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Report

State Highway 1 Revocation Mackays to Peka Peka Contract Number 820PN – Paraparaumu Town Centre Traffic Modelling

Prepared for NZ Transport Agency

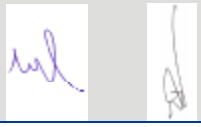
Prepared by (Beca)

19 October 2016

Revision History

Revision Nº	Prepared By	Description	Date
Revision A	Andrew Liu/John Row	Draft Issue covering the Paraparaumu Traffic Modelling Work	04 October 2016
Revision B	Andrew Liu	Issue covering the Paraparaumu Traffic Modelling Work	20 October 2016

Document Acceptance

Action	Name	Signed	Date
Prepared by	Andrew Liu/John Row		19 October
Reviewed by	James Ellison		19 October
Approved by	Stephen Hewett		19 October
on behalf of			

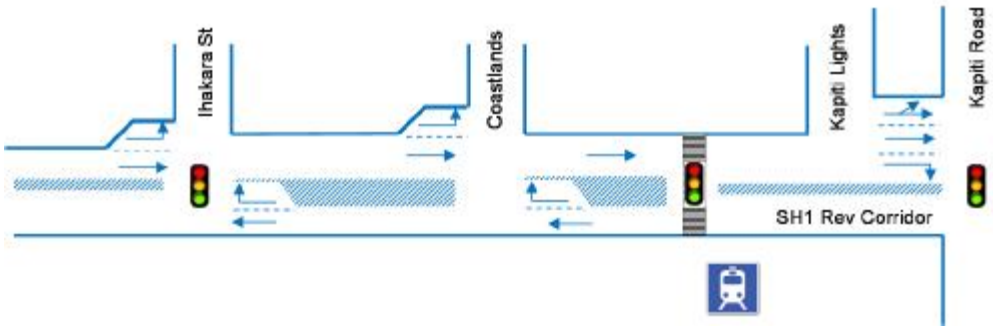
Executive Summary

This report documents the traffic modelling and analysis undertaken and presents the results of the proposed road layout options tested along the SH1 Revocation Corridor through the Paraparaumu town centre.

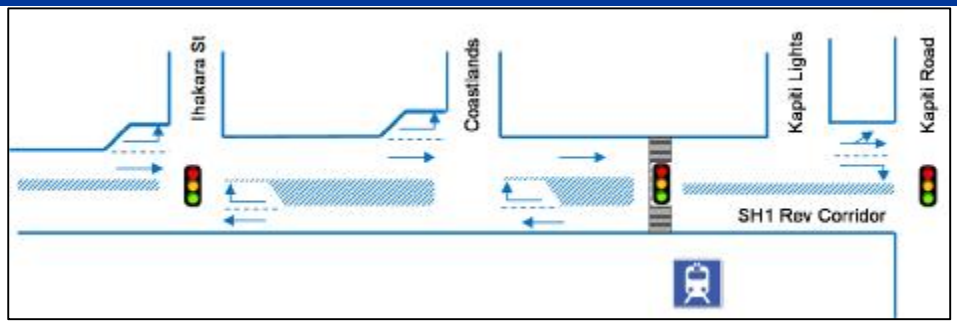
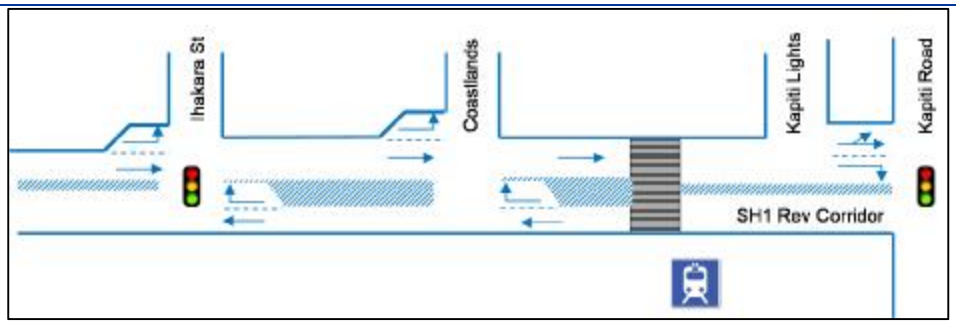
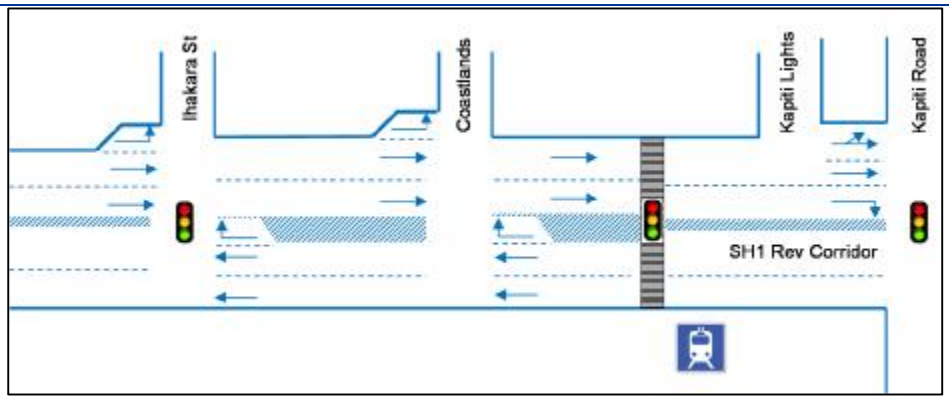
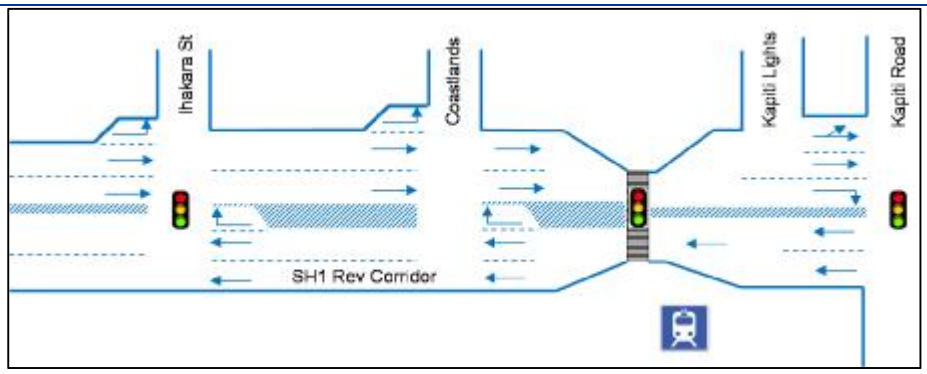
The methodology used was developed and agreed between the NZ Transport Agency, Kapiti Coast District Council and Beca on 31 August 2016. This methodology uses a SATURN model (KTM3) to provide the strategic network effects and traffic demand options for design year 2021 and 2031, using the composite growth methodology with medium growth factors.

The KTM3 SATURN model was cordoned around the Paraparaumu town centre area to generate an initial 2021 and 2031 design year traffic flows for the AM and PM peaks for use in the VISSIM model. This cordoned network model included the Relief Road and greater zone definition with the Paraparaumu Town Centre to provide more detailed trip distribution. The cordoned KTM3 SATURN model provided inputs into the calibrated 2015 Paraparaumu Town Centre VISSIM Model (the PTCM).

The layout option evaluated for 2021 design year is shown below. The model for this option does not include the Relief Road in the network but including doubled train frequency.

Road Layout Options	
2021 Option - Single lane plus at grade signalised crossing	

The layout of the four options evaluated for 2031 design year are shown below. These models included the Relief Road in the network and the double train frequencies.

Road Layout Options	
Option 1 - Single lane plus at grade signalised crossing	
Option 2 - Single lane plus at grade raised table crossing	
Option 3 - Double lane plus at grade signalised crossing	
Option 4 - Double lane with single lane at signalized crossing (hybrid design)	

Traffic Volume Comparison

Traffic volumes on each of the main roads through Paraparaumu town centre area have been extracted to show the comparisons between the base year and future design years (2021 and 2031). This includes traffic volumes on Rimu Road, Ihakara Street, SH1 Revocation Corridor and Kapiti Road.

Table 1 - Traffic Volume Comparison

Roads	Directions	AM Peak			PM Peak		
		2015	2021	2031	2015	2021	2031
Rimu road from Coastlands to Kapiti Road (at Kapiti)	Towards Kapiti Rd	327	518	273	769	1112	604
	Towards Ihakara Street	632	755	431	584	952	500
SH1 from Coastlands to Kapiti Road (at Kapiti)	Towards Kapiti Rd	859	543	489	1461	881	733
	Towards Ihakara Street	1330	720	576	1133	664	553
SH1 from Ihakara St to Coastlands (at Ihakara)	Towards Kapiti Rd	850	522	571	1189	626	657
	Towards Ihakara Street	1191	567	496	949	497	582
Ihakara Street (at SH1)	Towards SH1	229	196	320	316	382	636
	Towards Rimu Road	284	192	310	375	253	776
Kapiti Road from Hinemoa St to SH1 (at SH1)	Towards Hinemoa	432	367	445	455	426	529
	Towards SH1	486	359	447	451	371	425
Kapiti Road from SH1 to Rimu Road (at SH1)	Towards Rimu Road	620	514	596	588	665	481
	Towards SH1	596	358	314	721	524	533
Kapiti Road from Rimu Road to Arawhata (at Arawhata)	Towards SH1	1087	1027	665	885	1079	867
	Towards M2PP	844	914	778	1021	1349	932

For design year 2021, it can be seen from **Table 1** that the traffic volume on Rimu Road will increase significantly in year 2021 during both AM and PM peak hours as compared to 2015 base. It is expected that this demand will reach or exceed the capacity of Rimu Road during PM peak hours. The traffic volume on Kapiti Road between Rimu Road and Arawhata Street will increase significantly during PM peak hours in year 2021 as more traffic is heading to or leaving the M2PP Expressway. However, a reduction of traffic is expected on SH1 Revocation Corridor and Kapiti Road between Rimu Road and SH1 Revocation Corridor and this will provide capacity to redistribute traffic from Rimu Road to reduce the queue and traffic delay.

If the Council considers to reduce the speed along Rimu Road in the vicinity of Coastlands Shopping Centre it could be expected that up to 300 vph during the PM peak could redistribute to the SH1 Revocation Corridor and Kapiti Road. This would increase SH1 Revocation Corridor flows between Ihakara Street and Kapiti Road from 881 vph in the 2021 PM peak to 1181vph. We consider such an increase would be difficult to accommodate through the SH1 Revocation Corridor under a one lane operation.

For design year 2031, it can be seen from **Table 1** that the overall traffic volumes will decrease in year 2031 on most roads investigated as compared to 2015 base and year 2021. This is understood to be the result of the M2PP Expressway and the Relief Road. Significant increase of traffic volumes is expected on Ihakara Street which could be due to more traffic from the South uses the road and the Relief Road to join the M2PP Expressway at Kapiti Road Interchange.

Travel Time Analysis

The results from the models used for the different options have been compared and analysed to allow a comparison between the road layout options.

The three travel time routes on the main links through the Paraparaumu Town Centre are illustrated on **Figure 1**. The travel time results for the three routes from the VISSIM models for each option are detailed in **Table 2 and 3.**

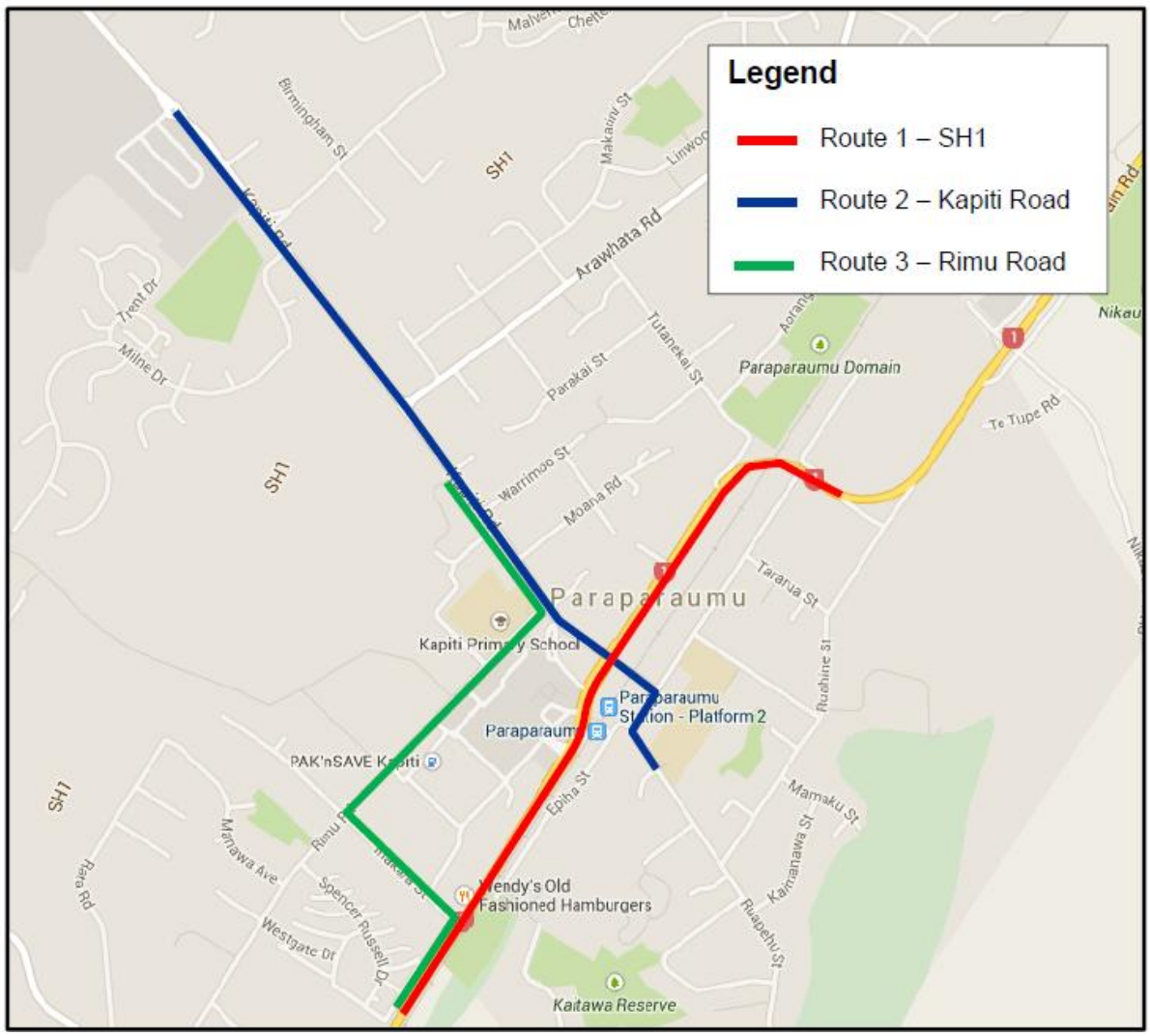


Figure 1 – Travel time routes

Table 2 - AM peak travel times (seconds)

AM Peak Journey Times		2015 Base	2021 Option	2031 Opti0n 1	2031 Option 2	2031 Option 3	2031 Option 4
SH1 Revocation Corridor	Towards Waikanae	167	237	245	244	239	237
	Towards Wellington	171	198	242	239	208	209
Kapiti Road	Towards Railway	280	391	374	377	375	385
	Towards Expressway	275	292	427	404	420	481
Rimu Road	Towards Kapiti Road	206	186	253	254	251	253
	Towards Ihakara St	188	280	225	227	219	219

Table 3 - PM Peak Travel Times (seconds)

PM Peak Journey Times		2015 Base	2021 Option	2031 Opti0n 1	2031 Option 2	2031 Option 3	2031 Option 4
SH1 Revocation Corridor	Towards Waikanae	269	251	295	284	282	242
	Towards Wellington	161	209	208	208	201	202
Kapiti Road	Towards Railway	280	398	503	496	497	531
	Towards Expressway	363	383	554	572	500	493
Rimu Road	Towards Kapiti Road	255	420	269	255	278	258
	Towards Ihakara St	220	336	279	276	276	275

For design year 2021 option without the Relief Road in the network, it can be seen from **Table 2** and **Table 3** that the journey times along SH1 Revocation Corridor will increase slightly in 2021 in most cases (apart from towards Waikanae during PM peak) as compared to 2015 base. This is understood to be the result of the speed limit and capacity reduction. The journey times along Kapiti Road will increase significantly during the PM peak period which could be due to the significant increase in traffic demands. Rimu Road journey times will also increase significantly in the peak direction during the morning and afternoon peaks. This is believed to be the result of additional demand from future development.

For design year 2031, it can be seen from **Table 2** and **Table 3** that the journey times along SH1 Revocation Corridor and Rimu Road will increase slightly in 2031 in most cases as compared to 2015 base. The journey times along Kapiti Road will increase significantly in 2031. This is understood to be the result of additional demand from future development. The journey times along the three measured routes in 2031 are similar across all the four options tested for both AM and PM peak hours. This indicates that the proposed layout options along the SH1 Revocation Corridor do not significantly affect the traffic performance on the wider network within the Paraparaumu town centre area.

Queue Length Comparison

Queue lengths have been plotted to show the VISSIM results on each of the main links through the Paraparaumu town centre area. This includes queue lengths at intersections at Kapiti Road/Rimu Road, Kapiti Road/SH1, SH1 at the proposed pedestrian crossing and Ihakara Street/ SH1.

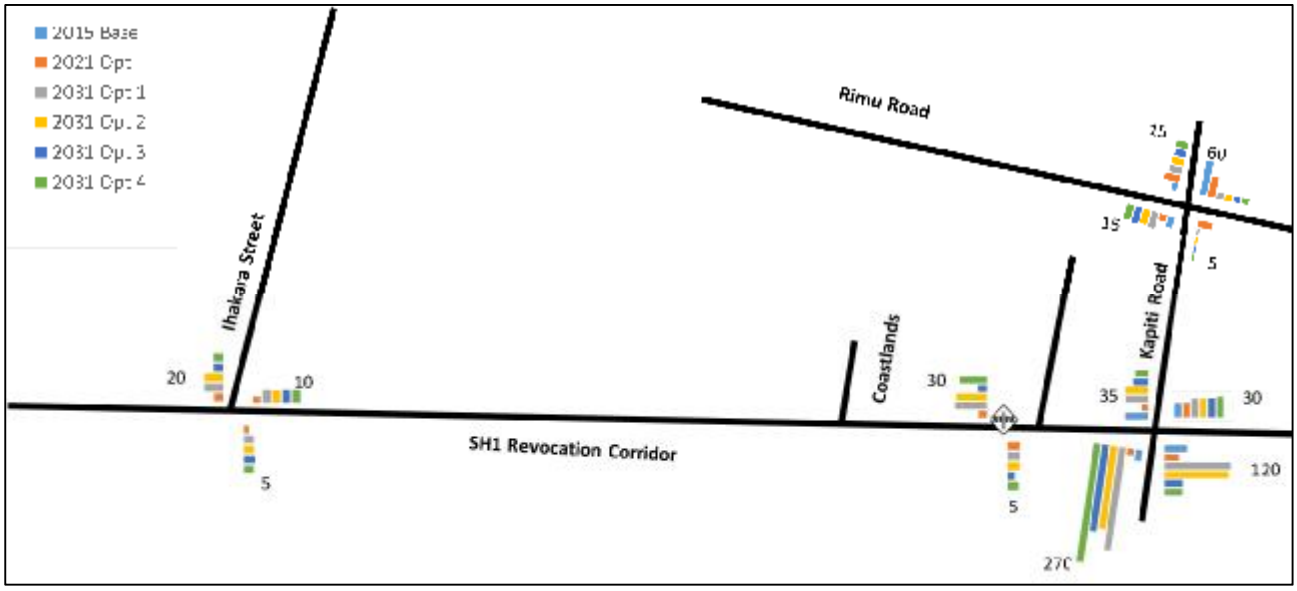


Figure 2 – Average Queue Length (AM peak hour)

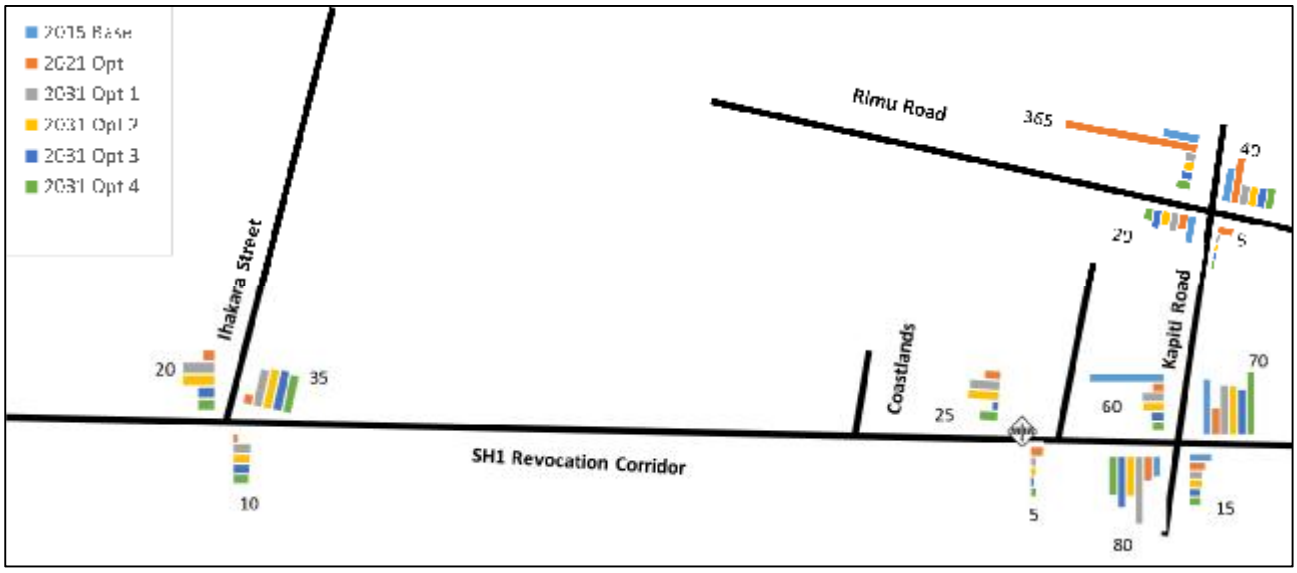


Figure 3 – Average Queue Length (PM peak hour)

For design year 2021 option, the overall queue length during the AM peak will increase slightly as compared to the 2015 base, however, all the intersections will still perform at an acceptable level (Level of Service D). Rimu Road at its intersection with Kapiti Road will be significantly worse during the PM peak hours in year 2021 as compared to the 2015 base, with average queue length over 350 meters. Based on the 2021 PM peak modelling, there would be capacity on the SH1 Revocation Corridor and Kapiti Road to redistribute traffic from Rimu Road to reduce this queue and delay.

For design year 2031, it can be seen from **Figure 2** and **Figure 3** that the queue length differences between 2031 and 2015 vary on different approaches at the investigated intersections. For example, a significant increase of queue length is observed on Kapiti Road towards M2PP Expressway at its intersection with SH1 Revocation Corridor during the AM peak hours which is a result of a significant increase of projected traffic demand in the future year. However, a reduction of queue length is also observed on Rimu Road towards Kapiti Road at its intersection with Kapiti Road during PM peak hours which is the effect of the Relief Road which provides alternatives to traffic to head towards west of Kapiti Road.

Options 3 and 4 present similar queue lengths as do Options 1 and 2 along the SH1 Revocation Corridor at its intersections with Kapiti Road, Ihakara Street for both AM and PM peak hours. The queue lengths of Options 3 and 4 are shorter than Options 1 and 2 which could be due to the extra capacity and queuing space the double lane layout options offers.

Option 3 provides shorter queue lengths along SH1 Revocation Corridor at the proposed pedestrian crossing due to the double lane configuration while the other three options present similar length queues. These queues are all within 50 meters of the crossing so are considered to have minimum impact to the adjacent junctions.

The queue lengths at the other intersections do not vary much across all the options tested for the PM peak hour. This indicates that the road layout options proposed along the SH1 Revocation Corridor have minimum impact to the network traffic performance within the Paraparaumu town centre area.

Extensive queues were observed on the Kapiti Road east approach at the intersection Kapiti Road/SH1 Revocation Corridor during AM peak hours. This is due to the significant projected traffic growth from this area and the impact from the doubled train frequency.

Level of Service

The levels of service for the three main intersections affected by the SH1 Revocation have also been analysed for the 2021 and 2031 design year and are detailed in **Table 4**. **Table 5** confirms the level of service bands for ease of reference.

Table 4 - Intersection Levels of Service

Intersections	AM Peak						PM Peak					
	2015 Base	2021 Opt	2031 Opt 1	2031 Opt 2	2031 Opt 3	2031 Opt 4	2015 Base	2021 Opt	2031 Opt 1	2031 Opt 2	2031 Opt 3	2031 Opt 4
Ihakara Street												
SH1 towards Wellington	A	C	C	C	C	C	A	C	C	C	B	B
SH1 towards Waikanae	A	C	A	A	A	A	A	B	A	A	A	A
Ihakara Street towards SH1	A	C	D	D	D	D	A	C	D	D	D	D
SH1 at the pedestrian crossing												
SH1 towards Wellington	-	C	C	C	C	C	-	C	C	C	C	C
SH1 towards Waikanae	-	A	A	A	A	A	-	A	A	A	A	A
Kapiti Road												
SH1 towards Wellington	D	C	C	C	C	C	D	D	C	C	C	D
SH1 towards Waikanae	D	C	C	C	C	C	D	D	C	C	C	C
Kapiti Road towards M2PP	D	D	D	D	D	D	E	E	E	E	E	E
Kapiti Road towards Railway	D	D	D	D	D	E	E	E	D	D	D	D

Table 5 - Level of Service Bands

Level of Service	
Band	**Average Delay (sec/veh)**
A	0-10
B	10-20
C	20-35
D	35-55
E	55-80
F	80+

For design year 2021 option, a minor decrease of the overall level of service at the investigated intersections was noted when compared with 2015 base, however, all the investigated intersections will still perform at an acceptable level (Level of Service D).

For design year 2031, as can be seen from **Table 4**, the overall level of service at the investigated intersections will worsen slightly in design year 2031 as compared to 2015 base. However, all the road layout options present similar level of service at the investigated intersections. This reconfirms that all the proposed layout options of SH1 Revocation Corridor do not significantly affect the traffic performance on the network within the Paraparaumu town centre area.

Summary

The following conclusions were drawn from the KTM3 SATURN modelling work undertaken to assess the wider network effects in year 2031:

- Traffic is generally heavier in the network during PM peak hours as compared to AM peak hours,
- SH1 Revocation Corridor and Rimu Road are both heavily used for north-south traffic movements, with traffic volumes being similar on both;
- Kapiti Road carries high traffic volumes, with these volumes building up from the west, including through the Kapiti Road interchange. Traffic volumes fall off east of the Relief Road, and further reduce east of Rimu Road, as the Relief Road provides a bypass to the Paraparaumu Town Centre and Rimu Road provides the first connection into the central Paraparaumu area;
- Both Ihakara Street and Raumati Road have lower volumes travelling east-west compared to the north-south volumes on Rimu Road and SH1 Revocation Corridor; and
- The Ihakara Extension will lead to a decrease in traffic volumes on both Kapiti Road east of the airport access opposite Hurley Road and the roads following the coast to the west of the airport (Marine Parade/Wharemauku Road/Matatua Road). There will be an overall increase in traffic on Ihakara Street approaching the Rimu Road intersection. However, the Ihakara Extension will have no impact on traffic volumes on SH1 Revocation Corridor immediately south of Kapiti Road, and will only result in a small decrease on Rimu Road at its northern end, and a slight increase south of this.

The following conclusions were drawn from the VISSIM modelling work undertaken to test the 2021 option:

- The journey times along SH1 Revocation Corridor will increase slightly in 2021 in most cases (apart from towards Waikanae during PM peak). The journey times along Kapiti Road will increase significantly during the PM peak period and Rimu Road journey times will also increase significantly in the peak direction during the morning and afternoon peaks. This is understood to be the result of additional demand from future developments;

- The overall queue length during the AM peak will increase slightly in design year 2021 as compared to the 2015 base, however, all the intersections will still perform at an acceptable level (Level of Service D). Rimu Road at its intersection with Kapiti Road will be significantly worse during the PM peak hours in year 2021 as compared to the 2015 base, with average queue length over 350 meters; and
- The overall level of service at the investigated intersections will worsen slightly as compared to 2015 base, however, all the investigated intersections will still perform at an acceptable level (Level of Service D).

The following conclusions were drawn from the VISSIM modelling work undertaken to test the four road layout options for design year 2031:

- Observations show that in the 2031, the traffic does not vary significantly between the four proposed road layout options. Option 3, the double lane arrangement, does perform marginally better because of the extra capacity it provides;
- The journey times routes measured are similar across all the options tested for both AM and PM peak hours, indicating that the layout options for SH1 Revocation Corridor does not significantly affect the traffic performance on the network within the Paraparaumu town centre area;
- Options 1 and 2 present longer queue lengths along SH1 Revocation Corridor at its intersections with Kapiti Road and Ihakara Street than Options 3 and 4. This is because Option 1 and 2 have only one through approaching Kapiti Road from SH1 North and Ihakara Street from the SH South and a single lane in each direction;
- Option 3 results in shorter queue length along SH1 Revocation Corridor at the proposed pedestrian crossing while the other three options present similar queue length. However, these queues are all within 50 meters which is considered to have minimum impact to the adjacent junctions;
- The traffic modelling shows extensive queues for all options on Kapiti Road east approach with SH1 Revocation Corridor in the AM peak. This is due to the significant projected traffic growth from this area. Measures will be required to manage traffic at that intersection in the future to cater for this significant growth traffic;
- The Level of Service results re-confirm that the proposed four layout options along the SH1 Revocation Corridor does not significantly affect the traffic performance on the wider network within the Paraparaumu town centre area; and
- From a traffic modelling perspective, all the four options proposed would have minimum impact on the traffic performance of the wider network. Therefore, the decision on the on the final layout along the SH1 Revocation Corridor through the Paraparaumu town centre is likely to be influence by other factors such as the future town centre development plan, pedestrian movements and urban design requirements.

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1 Introduction

1.1 Background

The NZ Transport Agency (the Transport Agency) has commissioned Beca Ltd (Beca) to deliver the State Highway 1 (SH1) Revocation – Mackays to Peka Peka (M2PP) Project Contract Number 820PN (the Project). The purpose of this project is for the Agency to handover to Kapiti Coast District Council (the Council) the 14km section of what is currently SH1 from Poplar Avenue to Peka Peka Road. This handover is expected to be undertaken within 24 months after the completion of the M2PP Expressway. Before the Transport Agency undertake this handover, physical works need to be undertaken to transform the SH1 to the form and function of a local road, which will typically include (but not necessarily limited to) the following:

- The lowering of the speed limit,
- More connected walkways and cycleway opportunities including on-road cycle lanes, shared footpaths and safer pedestrian/cyclist crossings,
- Improving the layout and operation of the intersections to incorporate cycling, improve safety and enhance traffic flow through the urban and suburban areas,
- Enhancing the suburban and urban areas through more accessible parking, feature landscaping, tree planting and street furniture.

As part of this commission, the Transport Agency has instructed Beca to undertake further detailed traffic modelling work associated with the Waikanae and Paraparaumu town centres. The traffic modelling associated with the Waikanae town centres has already been undertaken and is documented in a separate report.

1.2 Report purpose

The purpose of this report is to outline the traffic modelling scope, methodology, assumptions, traffic analysis and results to inform the layout of the road, of what is currently known as SH1, through Paraparaumu town centre.

1.3 Report structure

The remainder of this report is structured as follows:

Chapter 2: Summarises previous modelling work (KTM3) which provides network and traffic demand options
Chapter 3: Summarises the detailed traffic modelling scopes
Chapter 4: Describes the methodology used in the analysis
Chapter 5: Describes wider network traffic effects in future year based on SATURN model analysis
Chapter 6: Summarizes the micro-simulation results to the layout of SH1 Revocation Corridor
Chapter 7: Concludes the report

2 Existing Traffic Modelling Background

2.1 Overview

The traffic modelling documented in this report builds on the findings and results from the traffic modelling review undertaken by Beca in June 2016 using the KTM 3 SATURN model.

The KTM3 SATURN model was used to undertake the macro traffic modelling analysis to:

- Review the performance of the14km section of what is currently SH1 from Poplar Avenue to Peka Peka Road once the Expressway is completed and the proposed transformation changes are implemented.
- Understand how the wider transport network is expected to perform once the Expressway is completed and the proposed transformation changes for the Project are implemented on the existing SH1.

2.2 Key Findings from the KTM3

The key points of the findings from the KTM3 SATURN Model are summarised as follows:

- Delays at Rimu Road/Ihakara Street show that signals will be necessary to manage traffic at that intersection in the future due to the unbalanced flows forecast. Signalization will also reduce the potential for queuing back towards the old SH1.
- Retaining the two lane approaches (plus left turn lane) to the Kapiti Road signals will reduce delays for the old SH1 traffic and also relieve some of the risks and pressures on the Expressway/Kapiti Road intersection. It will also reduce traffic reassignment along Ihakara Street/Rimu Road.
- Signalisation of existing SH1/Ihakara Street should be incorporated into detailed modelling.
- Two lane approaches in both directions at SH1/Kapiti Road should be tested in detail to reduce delay and prevent reassignment. The effects of the pedestrian crossing and raised table should be modelled to confirm their effect on intersection performance.
- Future design year 2031 should be used to predict the design traffic flows.

3 Detailed Traffic Modelling Scope

The layout options and the requirements associated with the detailed modelling work are outlined below.

3.1 Test Layout Options

In agreement with the Council, a VISSIM model was used to test the following layout options along the SH1 Revocation Corridor through the Paraparaumu town centre:

- The 2021 design year (without the Relief Road in the network) to SH1 Revocation Corridor single lane plus at grade signalised crossing
- The 2031 design year to SH1 Revocation Corridor single lane plus at grade signalised crossing
- The 2031 design year to SH1 Revocation Corridor single lane plus at grade raised table crossing
- The 2031 design year to SH1 Revocation Corridor double lane plus at grade signalised crossing
- The 2031 design year to SH1 Revocation Corridor double lane with single lane at signalized crossing (hybrid design)

3.2 Requirements

The following requirements were considered in the detailed modelling:

- Use the future design year 2031 to predict the design traffic flows
- Model the single lane, two lane or hybrid scenarios of SH1 Revocation Corridor to determine the delays for each, and when and what time those delays occur
- Model with Ihakara Link road in and out for assessment
- Model or consider route switching/balancing through local route choices
- Consider the travel routes times
- Select link analysis
- Identify the stop line assumptions
- Factor in bus routes
- Factor in saturation flows
- Clearly state assumptions

4 Methodology

4.1 Overview

The KTM3 SATURN model was used to provide the network and demand options to be tested in the VISSIM model. The KTM3 also included the potential changes to the network for year 2021 and year 2031. The KTM3 SATURN model is a local area model covering the road network in the Kapiti Coast District from Raumati in the south to Otaki in the north. The extents of the model are shown in **Figure 4.1.1**.This provides an overall view of how traffic will flow from the wider network perspective.

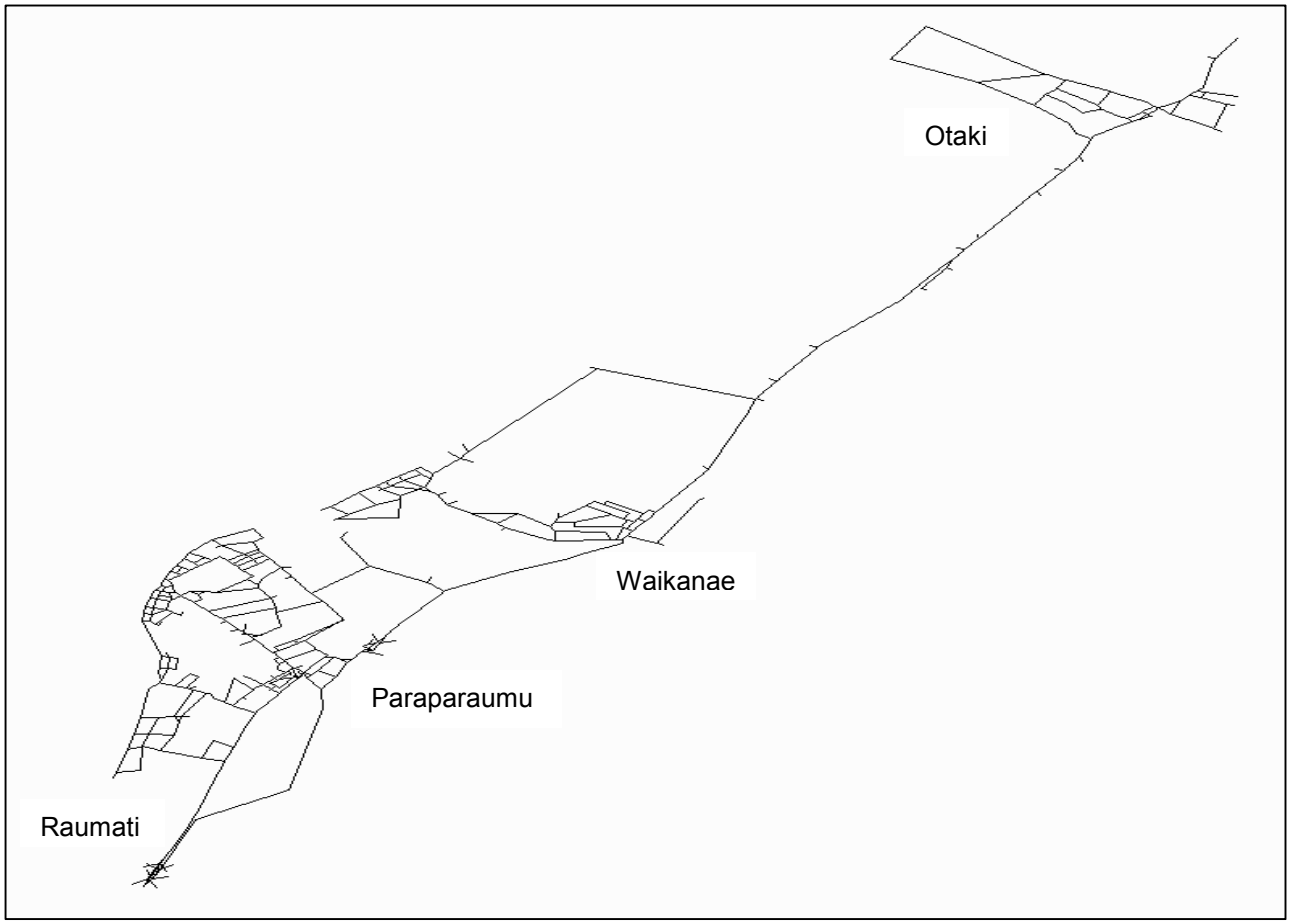

Figure 4.1.1 Extents of KTM3 SATURN model

A cordoned KTM3 SATURN model which zooms into the Paraparaumu town centre area was created to produce the initial 2021 and 2031 design year traffic flows for the AM and PM peaks for inclusion into the VISSIM model and is shown in **Figure 4.1.2**. This cordoned network model includes greater zone definition with the Paraparaumu Town Centre to provide more detailed trip distribution.

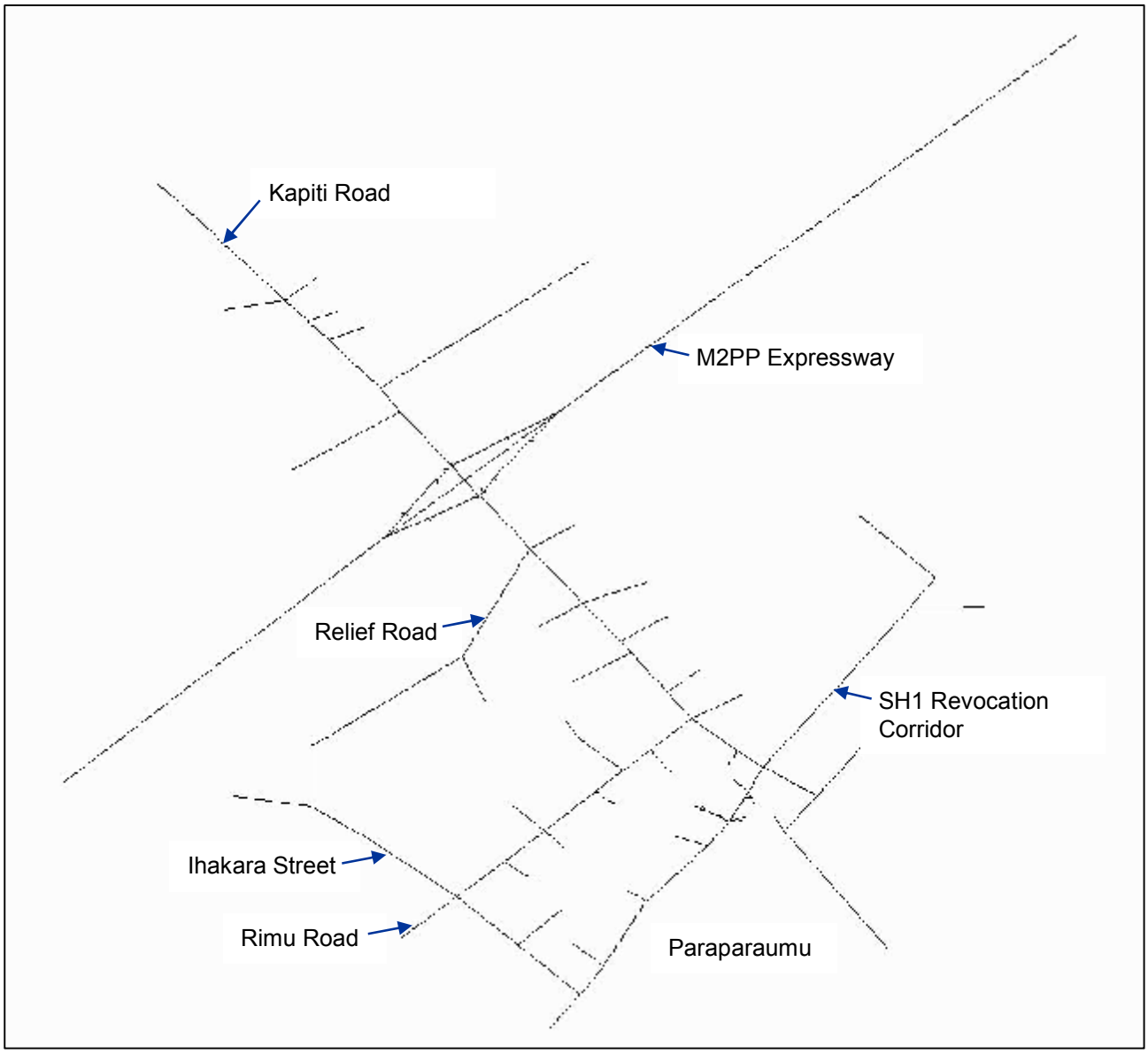

Figure 4.1.2 Extends of cordoned SATURN model (2031)

The VISSIM model was then updated to incorporate the flows from SATURN for the testing of different demand options.

4.2 KTM3 SATURN Model

The KTM3 model was used as it covers the wider area of influence associated with the M2PP Expressway and the impacts on old SH1. The latest update, which formed the starting point for this piece of work, was the refinement within the Paraparaumu Airport for the Kapiti Landing development, undertaken mid-2016.

The methodology used to provide traffic demands and routing for assignment in the VISSIM model is summarised below, with the following sections providing additional information around these steps:

- Review of Base 2015 year model network against existing network in SH1 and Rimu Road corridors
- Assignment of Base year traffic demands to Base year network
- Cordoning traffic demands out of the KTM3 SATURN model for VISSIM model equivalent network (i.e. the same network extents as the VISSIM model)
- Conversion of the cordoned demands from the KTM3 SATURN model to VISSIM model zoning systems
- Applying matrix estimation in the cordoned model (to better match observed traffic volumes) to determine adjustment factors to apply to future year matrices
- Refinement of future year model networks to include committed and planned schemes and developments within the KTM3 SATURN model extents (including the Town Centre Relief Route) and then incorporating the latest plans for the SH1 corridor between Mackays Crossing and Peka Peka
- Assignment of 2021 and 2031 future year traffic demands to future year KTM3 SATURN model networks
- Review and analysis in the wider KTM3 SATURN model network of traffic volumes and routing in the vicinity of “SH1”, Kapiti Road and Rimu Road, with comparisons between the Base and forecast years
- Cordoning 2021 and 2031 future year traffic demands out of KTM3 SATURN model for use in the VISSIM model
- Conversion of cordoned forecast year demands between the KTM3 SATURN model to VISSIM zoning systems; and
- Applying matrix estimation correction factors to forecast year traffic demands. This produces the 2021 and 2031 forecast year matrices for use in the VISSIM model

4.3 VISSIM Model

The methodology takes the calibrated 2015 Paraparaumu Town Centre VISSIM Model (the PTCM), which covers the extent of the Cordoned SATURN model as shown in **Figure** 4.1.2, as the network base. It updates the PTCM to include the 2021 and 2031 design year traffic flows obtained from the KTM3 SATURN model to test different layout options of SH1 Revocation Corridor.

The traffic signals for the at grade pedestrian crossing were incorporated into Kapiti Road/SH1 Revocation Corridor intersection and the pedestrian crossing green man will be introduced when the signals is green for Kapiti Road to minimize the traffic impact along SH1 Revocation Corridor.

4.4 Assumptions

The following traffic modelling assumptions were adopted:

- No Relief Road (Town Centre Link) as part of the road network in 2021
- Included Relief road as part of road network in 2031
  - One lane each direction
  - 50km/h speed limit
- Doubled train frequency
  - 10 minutes interval
- Signalized intersection
  - Ihakara Street/SH1 Revocation Corridor
- Standard KTM 3 SATURN traffic demands have been used, using the composite growth methodology with medium growth factors

- The free flow speeds assumed in the KTM3 SATURN model for SH1 Revocation Corridor and Rimu Road are shown in **Figure 4.4.1**.

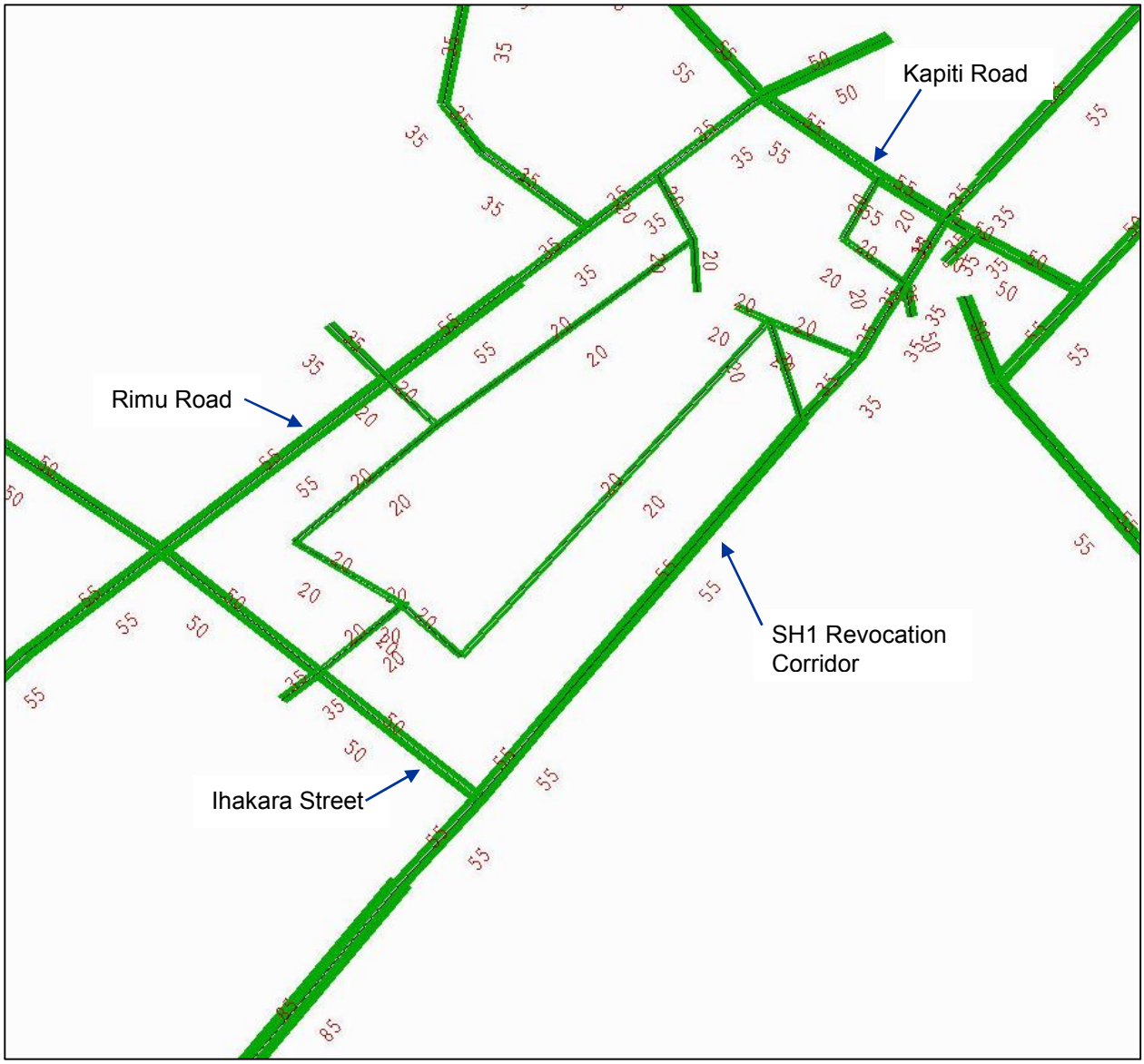

Figure 4.4.1: KTM3 free-flow speeds in vicinity of central Paraparaumu

5 Wider Network Effects

5.1 Overview

The KTM3 SATURN model has been used to model the future years for the AM and PM peak periods. This section reports on the traffic volumes and operations of the wider network beyond just the extents of the VISSIM micro-simulation model.

5.2 Networks Changes

The changes to the model networks to reflect the lower speed limits and capacities on SH1 Revocation Corridor and Rimu Road have been applied to the forecast years.

- The Relief Road has been added to the network for year 2031, connecting Ihakara Street to Kapiti Road at Arawhata Road.
- The Rimu Road/Ihakara Street intersection has been converted to a signalised intersection, as previous studies indicated that the existing single lane roundabout would become over-capacity with the additional traffic using the Relief Road.
- The Ihakara Street Extension has been included as a sensitivity test, linking the Kapiti Airport development directly to Ihakara Street around the southern edge of the runway.

5.3 Traffic Volume Comparison

Traffic volumes on each of the main roads through Paraparaumu town centre area have been extracted to show the comparisons between the base year and future design years (2021 and 2031). This includes traffic volumes on Rimu Road, Ihakara Street, SH1 Revocation Corridor and Kapiti Road.

Table 5.3.1 - Traffic Volume Comparison

Roads	Directions	AM Peak			PM Peak		
		2015	2021	2031	2015	2021	2031
Rimu road from Coastlands to Kapiti Road (at Kapiti)	Towards Kapiti Rd	327	518	273	769	1112	604
	Towards Ihakara Street	632	755	431	584	952	500
SH1 from Coastlands to Kapiti Road (at Kapiti)	Towards Kapiti Rd	859	543	489	1461	881	733
	Towards Ihakara Street	1330	720	576	1133	664	553
SH1 from Ihakara St to Coastlands (at Ihakara)	Towards Kapiti Rd	850	522	571	1189	626	657
	Towards Ihakara Street	1191	567	496	949	497	582
Ihakara Street (at SH1)	Towards SH1	229	196	320	316	382	636
	Towards Rimu Road	284	192	310	375	253	776
Kapiti Road from Hinemoa St to SH1 (at SH1)	Towards Hinemoa	432	367	445	455	426	529
	Towards SH1	486	359	447	451	371	425
Kapiti Road from SH1 to Rimu Road (at SH1)	Towards Rimu Road	620	514	596	588	665	481
	Towards SH1	596	358	314	721	524	533
Kapiti Road from Rimu Road to Arawhata (at Arawhata)	Towards SH1	1087	1027	665	885	1079	867
	Towards M2PP	844	914	778	1021	1349	932

2021 Design Year

It can be seen from **Table 5.3.1** that the traffic volume on Rimu Road will increase significantly in year 2021 during both AM and PM peak hours as compared to 2015 base. It is expected that this demand will reach or exceed the capacity of Rimu Road during PM peak hours. The traffic volume on Kapiti Road between Rimu Road and Arawhata Street will increase significantly during PM peak hours in year 2021 as more traffic is heading to or leaving the M2PP Expressway. However, a reduction of traffic is expected on SH1 Revocation Corridor and Kapiti Road between Rimu Road and SH1 Revocation Corridor and this shall provide capacity to redistribute traffic from Rimu Road to reduce the queue and traffic delay.

If the Council considers to reduce the speed along Rimu Road in the vicinity of Coastlands Shopping Centre it could be expected that up to 300 vph during the PM peak could redistribute to the SH1 Revocation Corridor and Kapiti Road. This would increase SH1 Revocation Corridor between Ihakara Street and Kapiti Road from 881 vph in the 2021 PM peak to 1181vph. We consider such an increase would be difficult to accommodate through the SH1 Revocation Corridor under a one lane operation.

2031 Design Year

It can be seen from **Table 5.3.1** that the overall traffic volumes will decrease in year 2031 on most roads investigated as compared to 2015 base and year 2021. This is understood to be the result of the M2PP Expressway and the Relief Road. Significant increase of traffic volumes is expected on Ihakara Street which could be due to more traffic from the South uses the road and the Relief Road to join the M2PP Expressway at Kapiti Road Interchange.

5.4 Traffic Effects

The demand matrices used for assessing the operation of the 2031 network (and providing the vehicle input and routing information to the VISSIM micro-simulation model) takes into consideration of the growth within the Kapiti area, including specific development such as Kapiti Landing at the Paraparaumu Airport, as well as a growth in through trips.

The network also includes the Relief Road, which provides an alternative route to travel between Kapiti Road and the central Paraparaumu area.

5.4.1 AM Peak Hour

The predicted traffic volumes on the roads represented in the network model for the AM peak hour are shown in **Figure 5.4.1**. The width of the green bars indicates the relative volume on each link, with the caption under the figure listing how much of the quantity being reported (traffic volumes in this case) are represented by each mm of bar width.

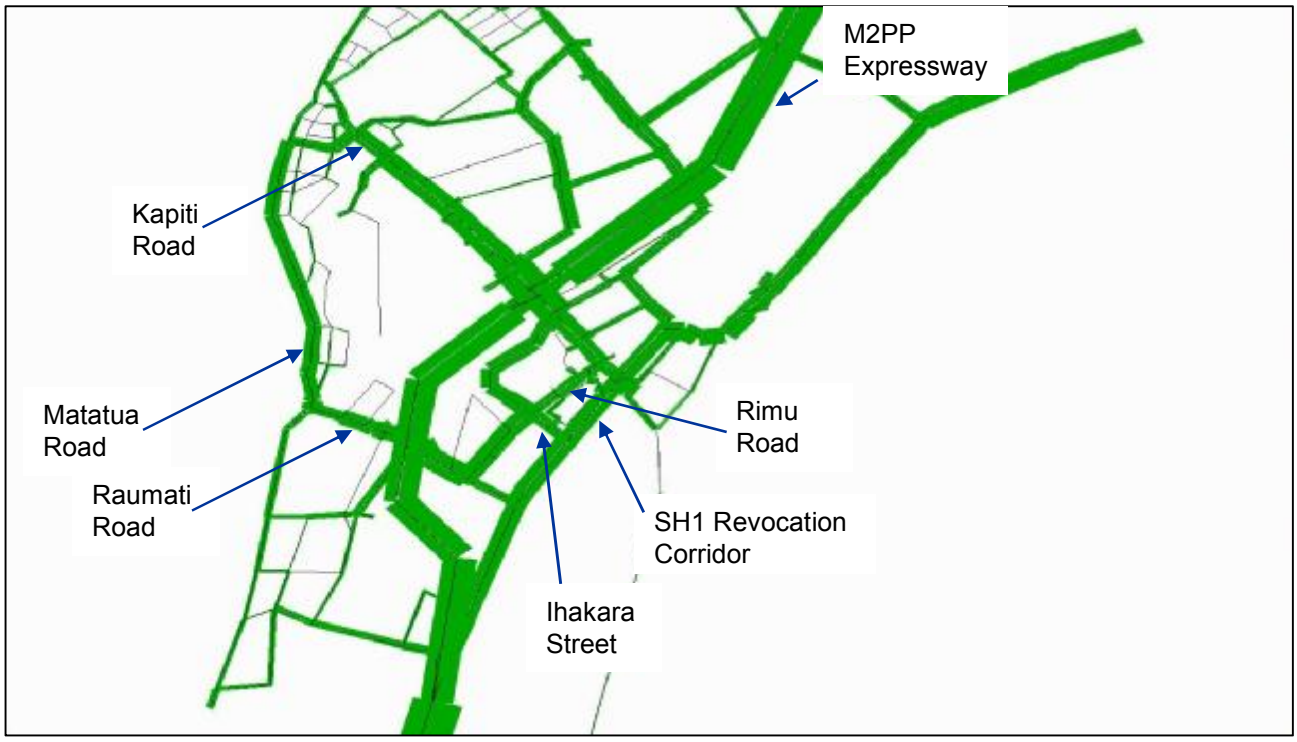

Figure 5.4.1: Actual traffic volume – 2031 AM peak hour (250 pcu/mm)

From **Figure 5.4.1** a number of points are apparent:

- The M2PP Expressway is the major route through and within the region, carrying the highest traffic volumes.
- SH1 Revocation Corridor and Rimu Road are both heavily used for north-south traffic movements, with traffic volumes being similar on both.
- Kapiti Road carries high traffic volumes, with these volumes building up from the west, including through the Kapiti Road interchange. There has been traffic volumes fall off east of Rimu Road, as Rimu Road provides the first connection into the central Paraparaumu area.
- Similar to what was seen with Kapiti Road between SH1 Revocation Corridor and Rimu Road, both Ihakara Street and Raumati Road have lower volumes travelling east-west compared to the north-south volumes on Rimu Road and SH1 Revocation Corridor.
- More Marine Parade/Wharemauku Road/Matatua Road is also heavily used for north-south traffic west of the airport, although traffic volumes are lower than on either SH1 Revocation Corridor or Rimu Road.

Figure 5.4.2 provides a closer view of the actual traffic volumes around the central Paraparaumu area.

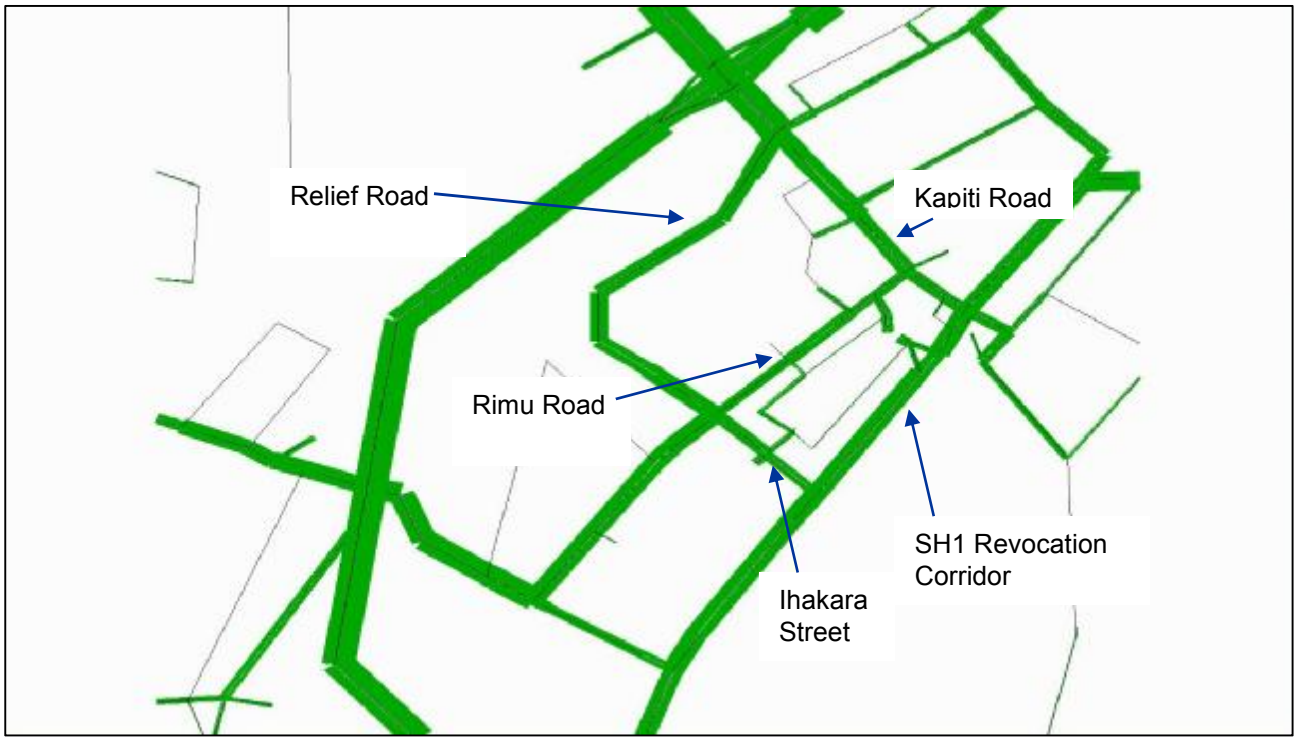

Figure 5.4.2: Actual traffic volume around central Paraparaumu area – 2031 AM peak hour (250 pcu/mm)

It can be seen that traffic volumes on SH1 Revocation Corridor are highest between Coastlands and Kapiti Road, which is the section subject to the lower speed limits and reduced capacity.

5.4.1.1 Select Link Analysis

Select link analysis has been undertaken in the 2031 network for the Relief Road.

a. Relief Road from Ihakara Road to Kapiti Road

Figure 5.4.3 shows the origins, destinations and routing of northbound traffic using the Relief Road to head towards Kapiti Road. All of these trips come from the eastern or southern side of the Rimu Road/Ihakara Street intersection – there are no trips from the northern end of Rimu Road, indicating that travelling directly to Kapiti Road is faster than backtracking to use the Relief Road.

The destinations for the majority of northbound traffic on the Relief Road is further west along Kapiti Road, with a small number continuing on Arawhata Road.

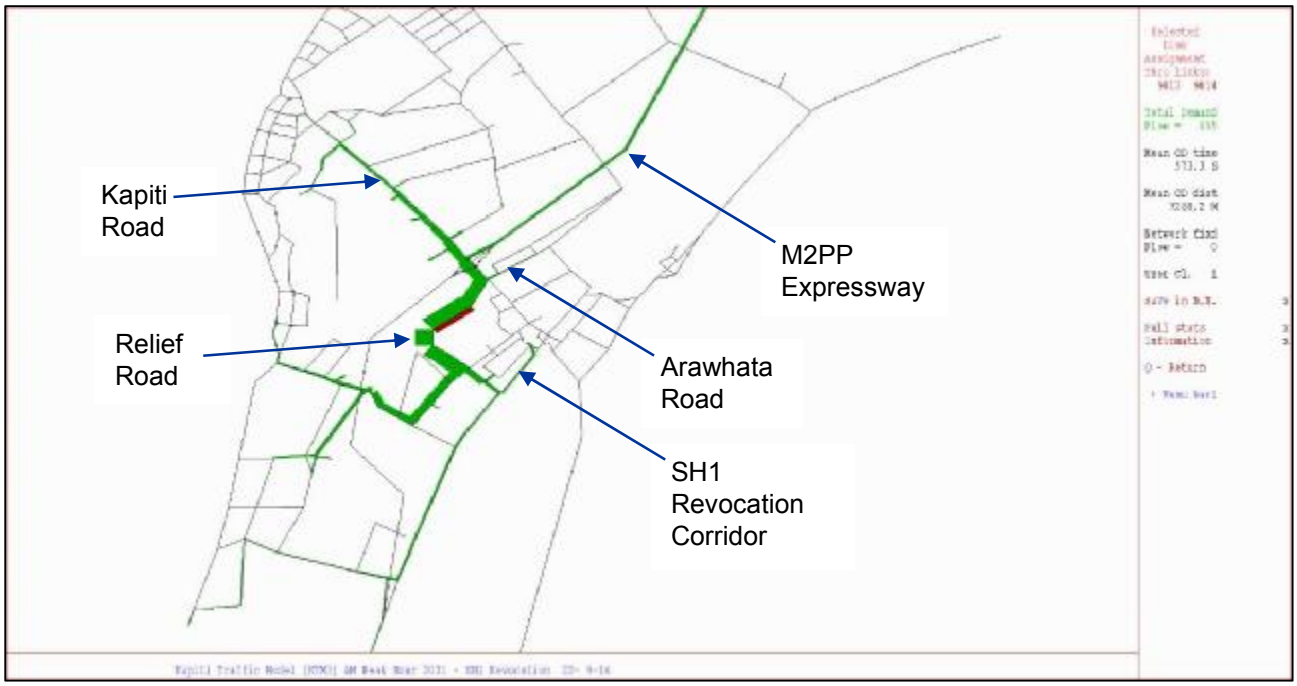

Figure 5.4.3 : Select link on Relief Road (from Ihakara Road heading towards Kapiti Road) – 2031 AM peak hour (100 pcu/mm)

b. Relief Road from Kapiti Road to Ihakara Road

Figure 5.4.4 shows the origins and destinations within the Paraparaumu area of vehicles using the Relief Road to travel southwards between Kapiti Road and Ihakara Road.

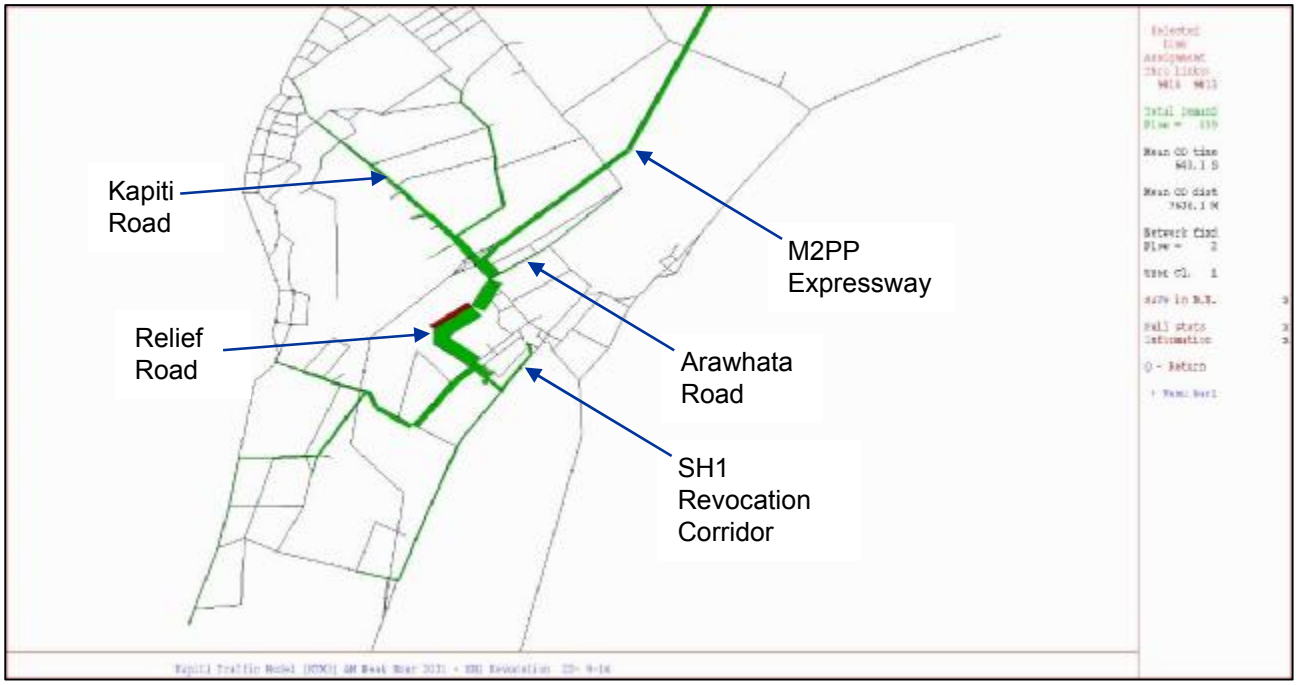

Figure 5.4.4 : Select link on Relief Road (from Kapiti Road heading towards Ihakara Road) – 2031 AM peak hour (100 pcu/mm)

All of these trips come from the western or northern side of the Relief Road/Kapiti Road intersection and there are no trips from the eastern side of Kapiti Road. The destinations for the southbound traffic on the Relief Road are splitted to further to the south along Rimu Road and east along Ihakara Street to head towards Coastlands or south of SH1. This indicates that travel south via the Relief Road is faster than via Rimu Road or SH1 Revocation corridor on which lower speed limits will be imposed for the design year.

5.4.2 PM Peak Hour

The predicted traffic volumes on the roads represented in the network model for the PM peak hour are shown in **Figure 5.4.5**.

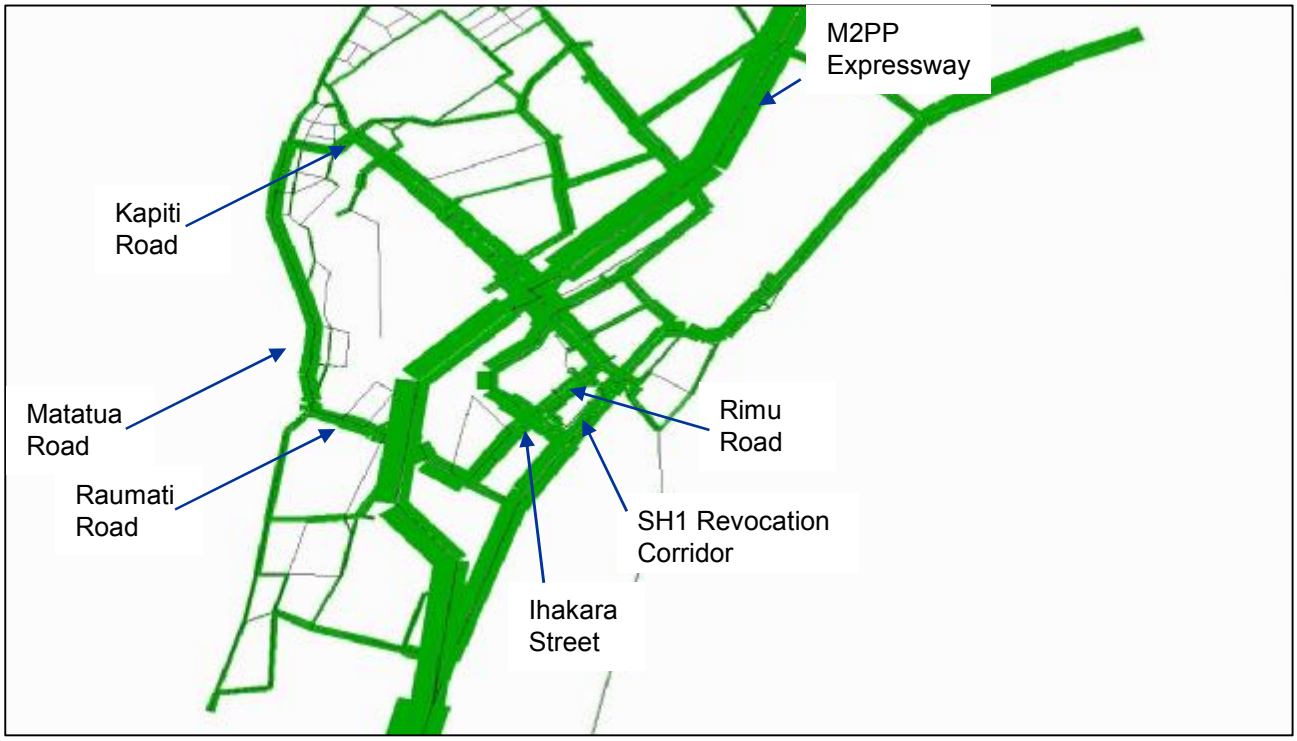

Figure 5.4.5: Actual traffic volume – 2031 PM peak hour (250 pcu/mm)

Commentary around what is shown in **Figure 5.4.5** is very similar to that for the AM peak hour, with the obvious exception that the peak direction has changed, with a net inflow into the Paraparaumu area.

Figure 5.4.6 shows the central Paraparaumu area in more detail, highlighting where the higher traffic volumes are. In particular, the section of SH1 Revocation Corridor north of the Coastlands entrance has higher volumes than on the northern end of Rimu Road (as the Relief Road provides an alternative to using this section of Rimu Road).

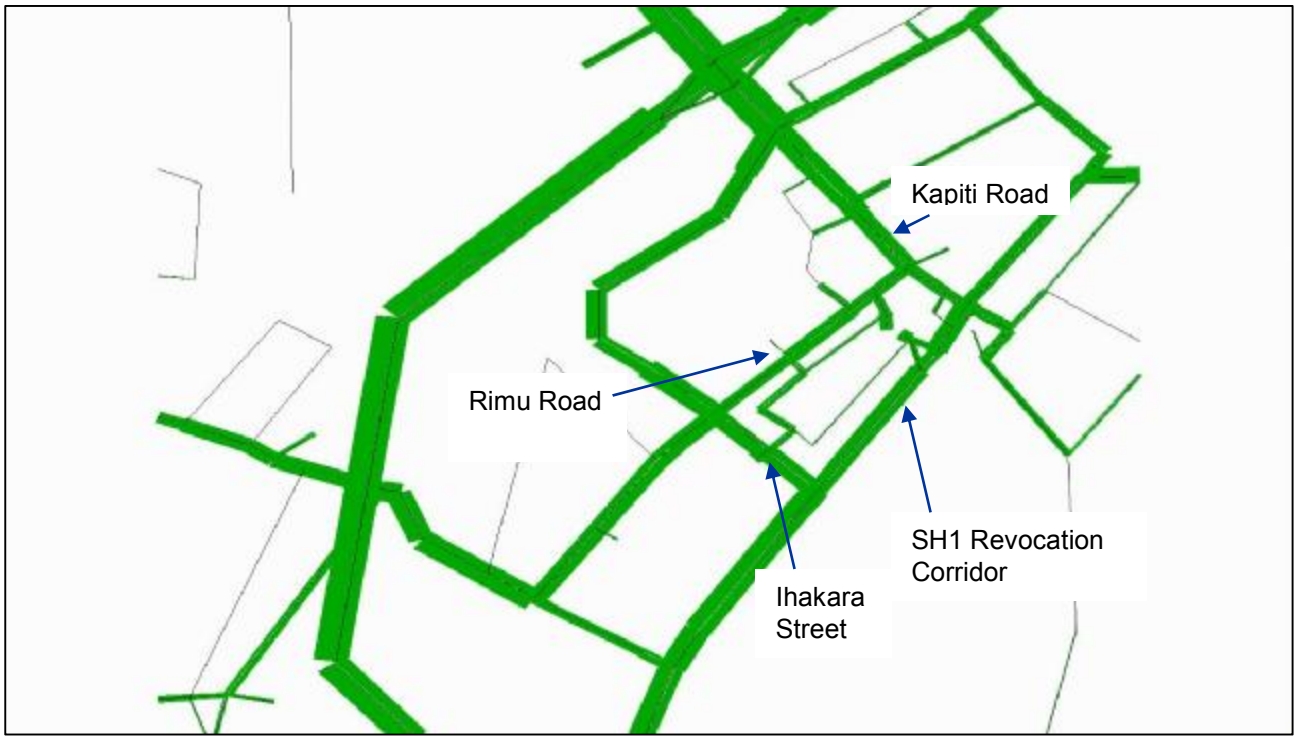

Figure 5.4.6: Actual traffic volume around central Paraparaumu area – 2031 PM peak hour (250 pcu/mm)

5.4.2.1 Select Link Analysis

a. Relief Road from Ihakara Road to Kapiti Road

Figure 5.4.7 shows the origins, destinations and routing of northbound traffic using the Relief Road to head towards Kapiti Road. Patterns are similar to the AM peak hour, but there is more traffic heading towards the Expressway and the more residential areas around Mazengarb Road. This is consistent with people heading home at the end of the day.

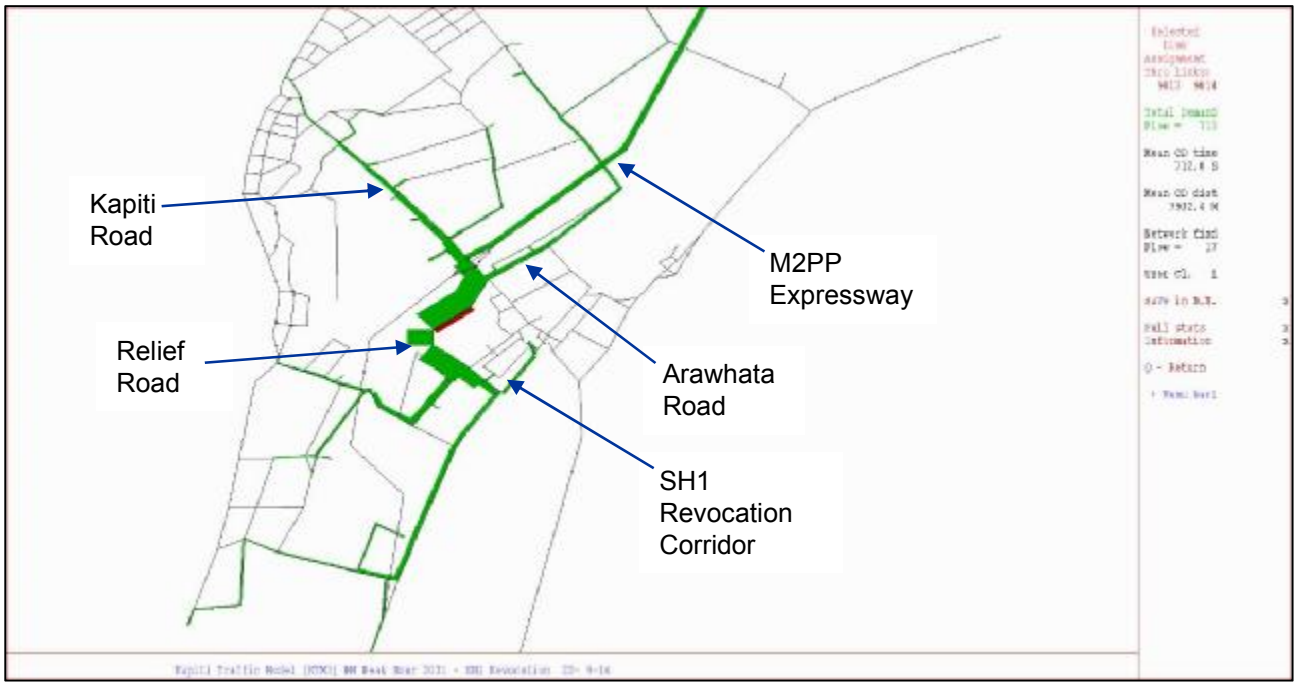

Figure 5.4.7: Select link on Relief Road (from Ihakara Road heading towards Kapiti Road) – 2031 PM peak hour (100 pcu/mm)

b. Relief Road from Kapiti Road to Ihakara Road

Figure 5.4.8 shows the origins and destinations within the Paraparaumu area of vehicles using the Relief Road to travel between Kapiti Road and Ihakara Road in the PM peak hour.

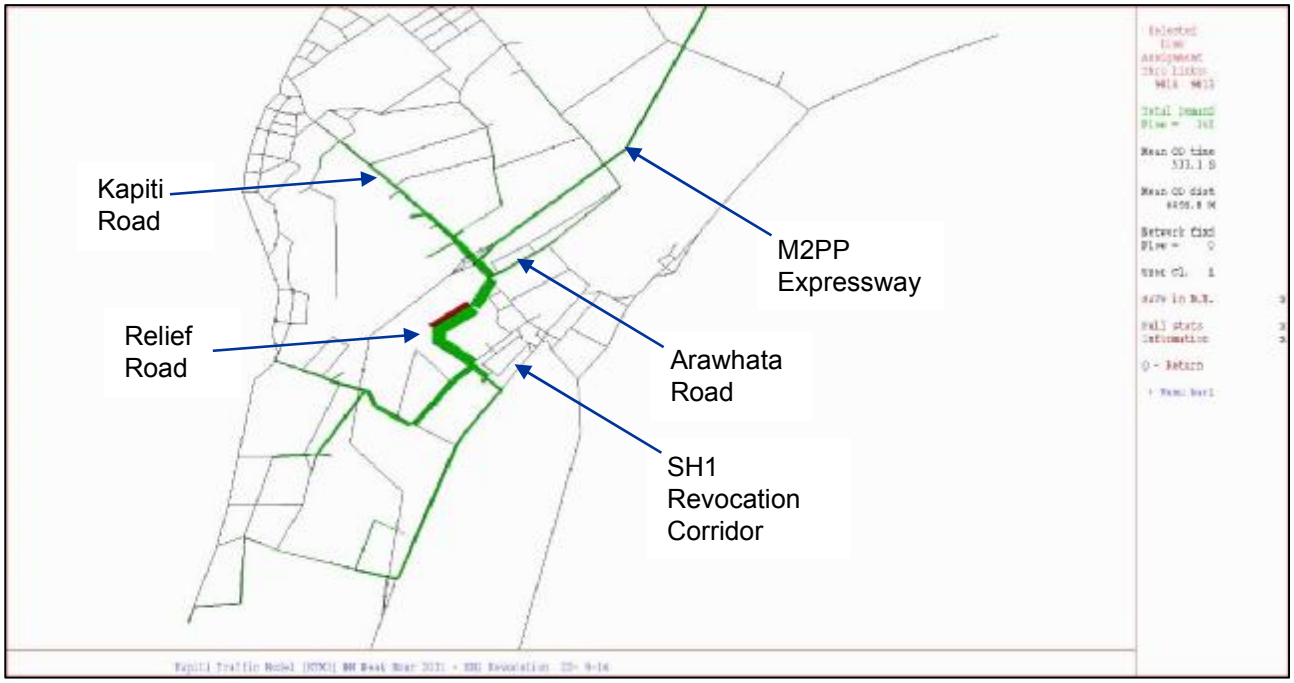

Figure 5.4.8: Select link on Relief Road (from Kapiti Road heading towards Ihakara Road) – 2031 AM peak hour (100 pcu/mm)

Unlike the AM peak hour, the destination for these vehicles is generally not within the central Paraparaumu area i.e. not heading to Coastlands, but the residential areas further south off Rimu Road or Raumati Road.

5.5 Ihakara Extension Sensitivity Test (2031)

The Ihakara Extension has been added to the 2031 network to test the effects of this link on the operation of the road network and impacts on the SH1 Revocation Corridor and the northern end of Rimu Road.

5.5.1 AM Peak Hour

With the Ihakara Extension in place, **Figure 5.5.1** shows the predicted traffic volumes on the roads represented in the network model.

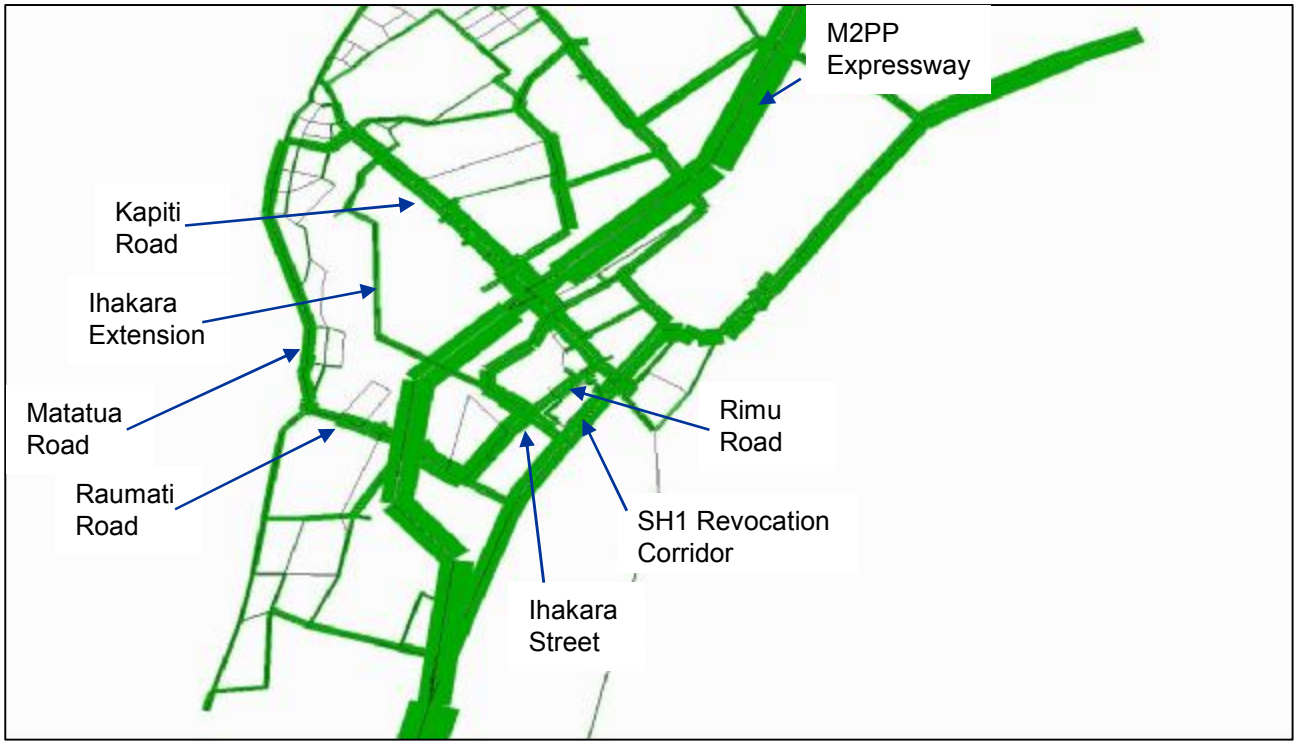

Figure 5.5.1: Actual traffic volume with Ihakara Extension – 2031 AM peak hour (250 pcu/mm)

This shows that the traffic volume on the Ihakara Extension in the AM peak hour is expected to be relatively low (a two way total of 260 pcu/hr).

5.5.1.1 Flow Differences

Figure 5.5.2 shows the difference in traffic volumes for the AM peak hour between the networks with and without the Ihakara Extension over the wider Paraparaumu area. Increases in traffic volumes with the Ihakara Extension are shown by **green bands**, with decreases shown by **blue bands**.

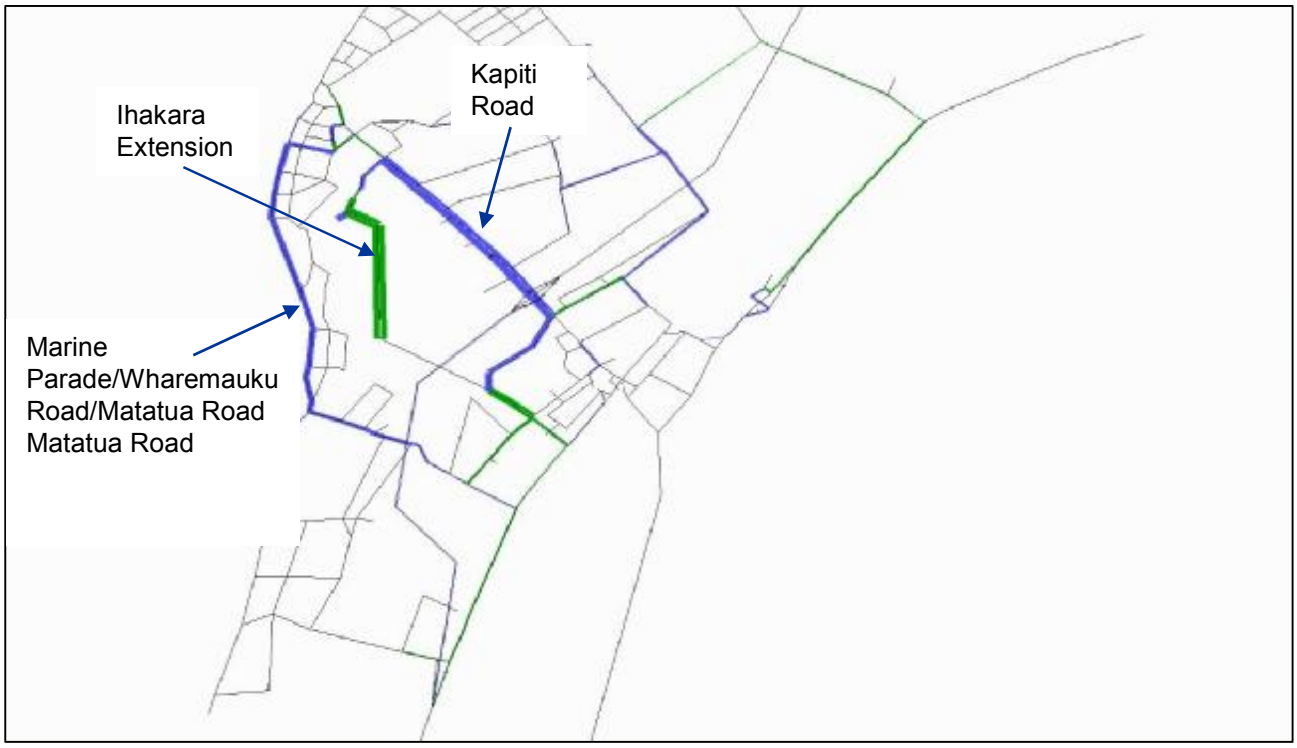

Figure 5.5.2: Actual traffic volume differences with and without Ihakara Extension – AM peak hour (100 pcu/mm)

The traffic volume differences shown in **Figure 5.5.2** show that the Ihakara Extension will lead to a decrease in traffic volumes on both Kapiti Road east of the airport access opposite Hurley Road and the roads following the coast to the west of the airport (Marine Parade/Wharemauku Road/Matatua Road). There will be an overall increase in traffic on Ihakara Street approaching the Rimu Road intersection.

It will have no impact on traffic volumes on SH1 Revocation Corridor immediately south of Kapiti Road, and will only result in a small decrease on Rimu Road at its northern end.

5.5.2 PM Peak Hour

Figure 5.5.3 shows the predicted traffic volumes with the Ihakara Extension in place on the roads represented in the network model.

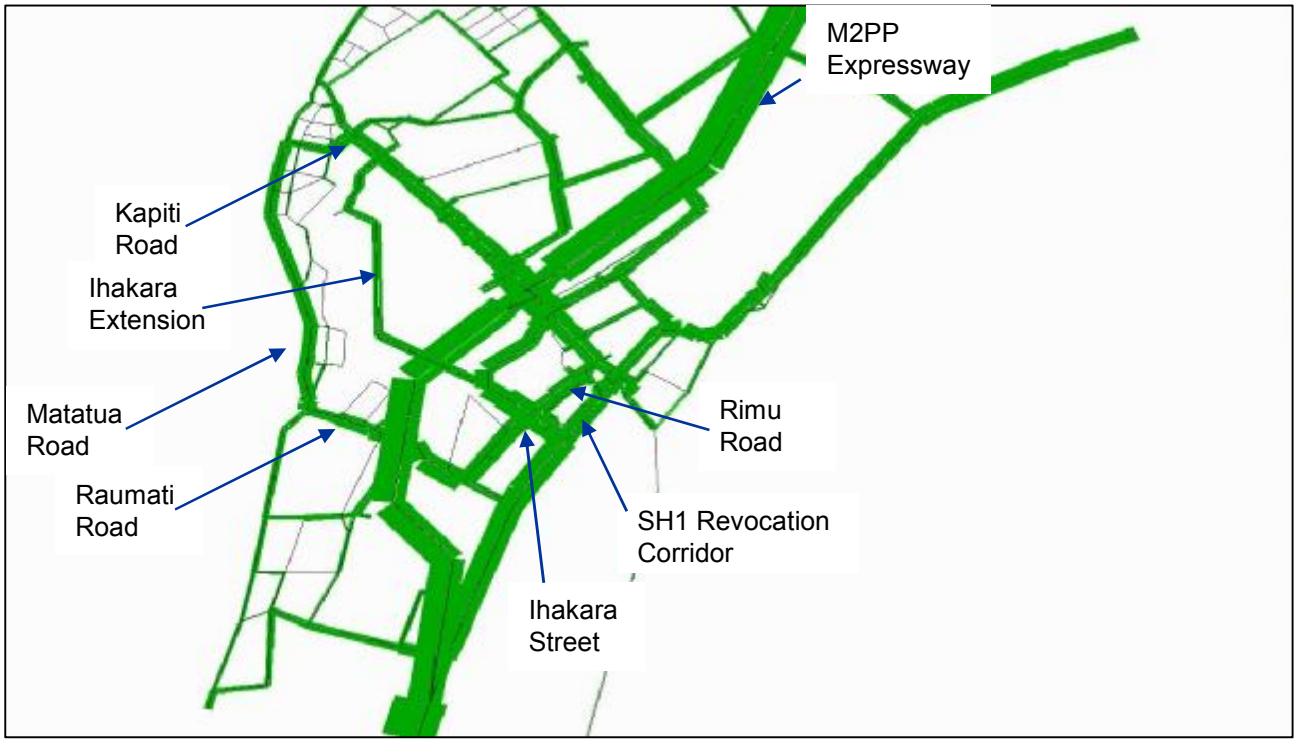

Figure5.5.3: Actual traffic volume with Ihakara Extension – 2031 PM peak hour (250 pcu/mm)

This shows that the traffic volume on the Ihakara Extension in the PM peak hour is higher than for the AM peak hour, with a two way total of 430 pcu/hr.

5.5.2.1 Flow Differences

Figure 5.5.4 shows the difference in traffic volumes for the PM peak hour between the networks with and without the Ihakara Extension over the wider Paraparaumu area.

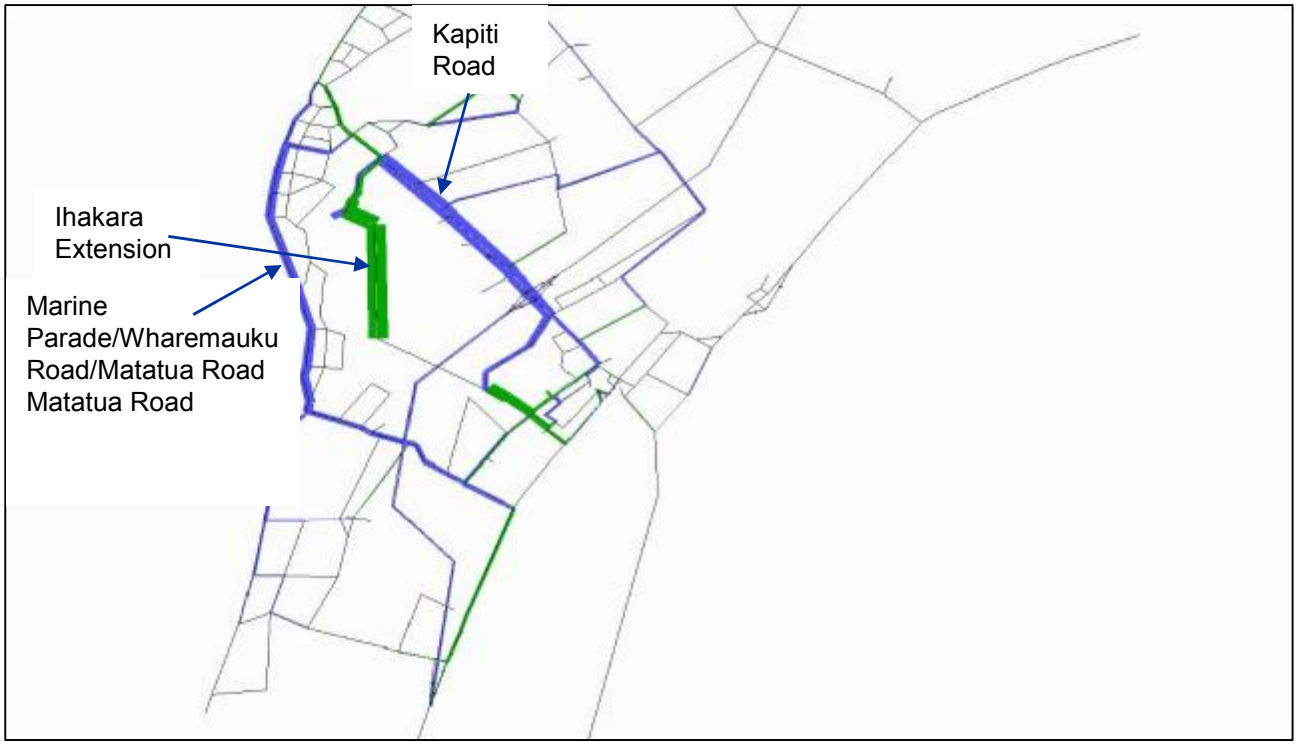

Figure 5.5.4 : Actual traffic volume differences with and without Ihakara Extension – PM peak hour (100 pcu/mm)

Similarly to the AM peak hour results, **Figure 5.5.4** shows that the Ihakara Extension will lead to a decrease in traffic volumes on both Kapiti Road east of the airport access at Hurley Road and the roads following the coast to the west of the airport (Marine Parade/Wharemauku Road/Matatua Road). Some of the traffic rerouted from Kapiti Road which would have joined the Expressway at the Kapiti Road interchange will now use the Ihakara Extension to travel southwards on SH1 Revocation Corridor from Rimu Road towards the Poplar Avenue southbound on-ramp.

Again there will be an overall increase in traffic on Ihakara Street approaching the Rimu Road intersection.

The Ihakara Extension will have no impact on traffic volumes on SH1 Revocation Corridor immediately south of Kapiti Road, and will only result in a small decrease on Rimu Road at its northern end, and a slight increase south of this.

5.6 Summary

This summarizes the analysis of KTM3 SATURN model for future years (2031) for the AM and PM peak periods. It reports on the traffic volumes and operations of the wider network beyond just the extents of the VISSIM micro-simulation model.

5.6.1 Wider Network Effects

The notable wider network effects are as follows:

- The M2PP Expressway is the major route through and within the region, carrying the highest traffic volumes for both AM and PM peak hours.
- SH1 Revocation Corridor and Rimu Road are both heavily used for north-south traffic movements, with traffic volumes being similar on both.
- Kapiti Road carries high traffic volumes, with these volumes building up from the west, including through the Kapiti Road interchange. Traffic volumes fall off east of Relief Road, and further reduce east of Rimu Road, as the Relief Road provides a bypass to the Paraparaumu Town Centre and Rimu Road provides the first connection into the central Paraparaumu area.
- Similar to what was seen with Kapiti Road between SH1 Revocation Corridor and Rimu Road, both Ihakara Street and Raumati Road have lower volumes travelling east-west compared to the north-south volumes on Rimu Road and SH1 Revocation Corridor.

5.6.2 Ihakara Extension Sensitivity Test

The Ihakara Extension has been added to the 2031 network to test the effects of this link on the operation of the road network and impacts on the SH1 Revocation Corridor and the northern end of Rimu Road. This includes upgrading the intersection of Rimu Road and Ihakara Road from a single lane roundabout to a signalised intersection.

The Ihakara Extension will lead to a decrease in traffic volumes on both Kapiti Road east of the airport access opposite Hurley Road and the roads following the coast to the west of the airport (Marine Parade/Wharemauku Road/Matatua Road). There will be an overall increase in traffic on Ihakara Street approaching the Rimu Road intersection.

However, the Ihakara Extension will have no impact on traffic volumes on SH1 Revocation Corridor immediately south of Kapiti Road, and will only result in a small decrease on Rimu Road at its northern end, and a slight increase south of this.

6 Traffic Simulation

6.1 Overview

This chapter describes the following road layout options tested in the VISSIM model along the SH1 Revocation Corridor through the Paraparaumu town centre for the design year 2021 and 2031:

- 2021 Option – Single lane plus at grade signalised crossing (without the Relief Road)
- Option 1 - Single lane plus at grade signalised crossing
- Option 2 - Single lane plus at grade raised table crossing
- Option 3 - Double lane plus at grade signalised crossing
- Option 4 - Double lane with single lane at signalized crossing (hybrid design)

This chapter also compares and analyses the simulation results from the VISSIM model for the road layout options.

6.2 Layout Options Tested

6.2.1 2021 Option – Single Lane Plus At Grade Signalised Crossing

A single lane through the existing SH1 Revocation corridor from Ihakara Street through to beyond the Kapiti Road intersection has been modelled. Two through lanes along SH1 Revocation Corridor were allowed at the intersection Kapiti Road/SH1 Revocation Corridor. Right turning lanes have been incorporated for the right turn movements from the existing SH1 into Ihakara Street and Coastlands respectively. On-street parking could be considered where is possible for civil design.

The Relief Road is not included in the network under this option.

At grade signalized pedestrian crossing has been proposed between Coastlands and the train station and the activation of the crossing is incorporated into the traffic light signal at Kapiti Road/SH1 intersection. It has also been allowed to run in each cycle to obtain a ‘worst case’ scenario expected.

A common cycle time has been used for all intersections and manually adjusted offsets have been used to co-ordinate all three sets of signals along the corridor.

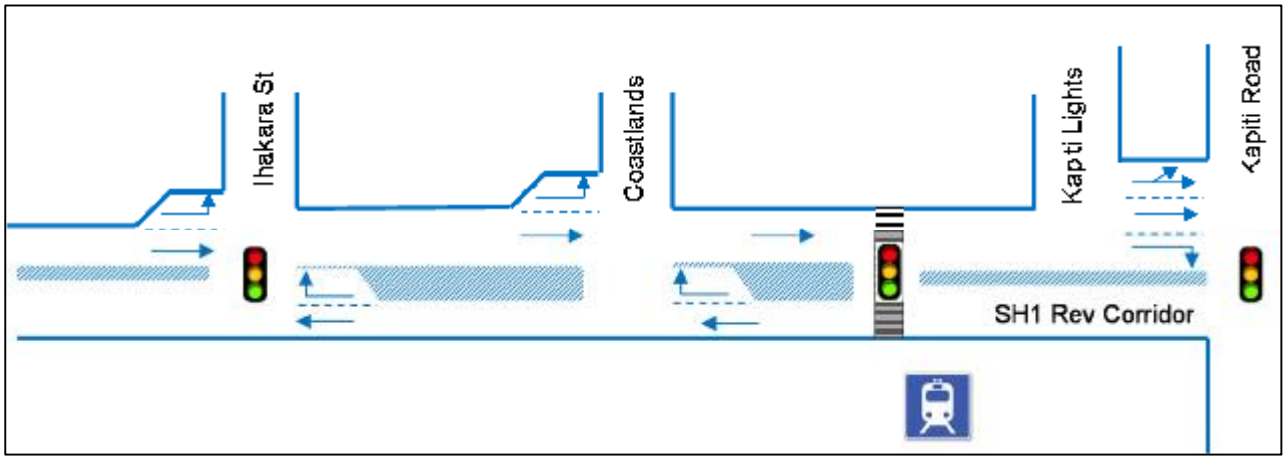

Figure 6.2.1 – 2021 Option Single Lane plus at grade signalized crossing

6.2.2 2031 Option 1 - Single Lane Plus At Grade Signalised Crossing

A single lane through the existing SH1 Revocation corridor from Ihakara Street through to beyond the Kapiti Road intersection has been modelled. Right turning lanes have been incorporated for the right turn movements from the existing SH1 into Ihakara Street and Coastlands respectively. On-street parking could be considered where is possible for civil design.

At grade signalized pedestrian crossing has been proposed between Coastlands and the train station and the activation of the crossing is incorporated into the traffic light signal at Kapiti Road/SH1 intersection. It has also been allowed to run in each cycle to obtain a 'worst case' scenario expected.

A common cycle time has been used for all intersections and manually adjusted offsets have been used to co-ordinate all three sets of signals along the corridor.

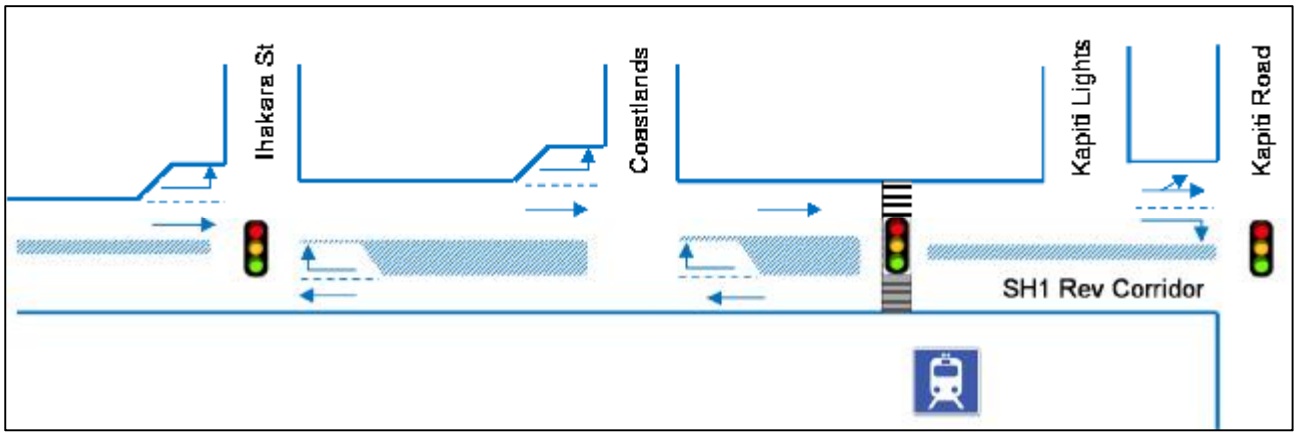

Figure 6.2.2 – Single Lane plus at grade signalized crossing

6.2.3 2031 Option 2 - Single Lane Plus At Grade Raised Table crossing

At grade raised table crossing between Coastlands and the train station was proposed and tested for this option. To model the operations of raised table crossing, two pedestrian crossing signals with 45 meters apart along the Revocation Corridor were coded in the network. These signals were incorporated into the traffic signal at the SH1 Revocation Corridor/Kapiti Road intersection and allowed to run in each cycle to obtain a 'worst case' scenario expected.

A common cycle time has been used for all intersections and manually adjusted offsets have been used to co-ordinate all three sets of signals along the corridor.

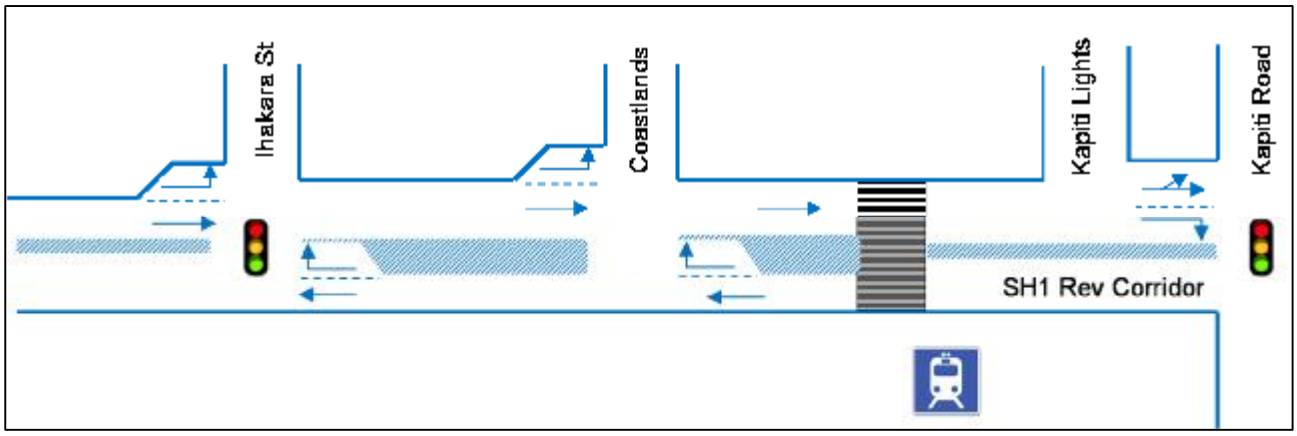

Figure 6.2.3 – Single Lane plus at grade raised table crossing

6.2.4 2031 Option 3 - Double Lane Plus at Grade Signalized Crossing

This allows for two through lanes to be provided on the northbound approach from Ihakara Street intersection to Kapiti Road intersection and to carry the two lanes through the town centre area to merge to one lane beyond the Kapiti Road intersection. A similar arrangement is provided for the southbound approach with two lanes formed on the approach to Kapiti Road which carries through to beyond the Ihakara intersection. Right turning lanes have also been incorporated for the right turn movements from the existing SH1 into Ihakara Street and Coastlands respectively.

An at grade signalized pedestrian crossing has been introduced between Coastlands and the train station and incorporated into the traffic light signal at Kapiti Road/SH1 intersection. It has also been allowed to run in each cycle to obtain a 'worst case' scenario expected.

A common cycle time has been used for all intersections and manually adjusted offsets have been used to co-ordinate all three sets of signals along the corridor.

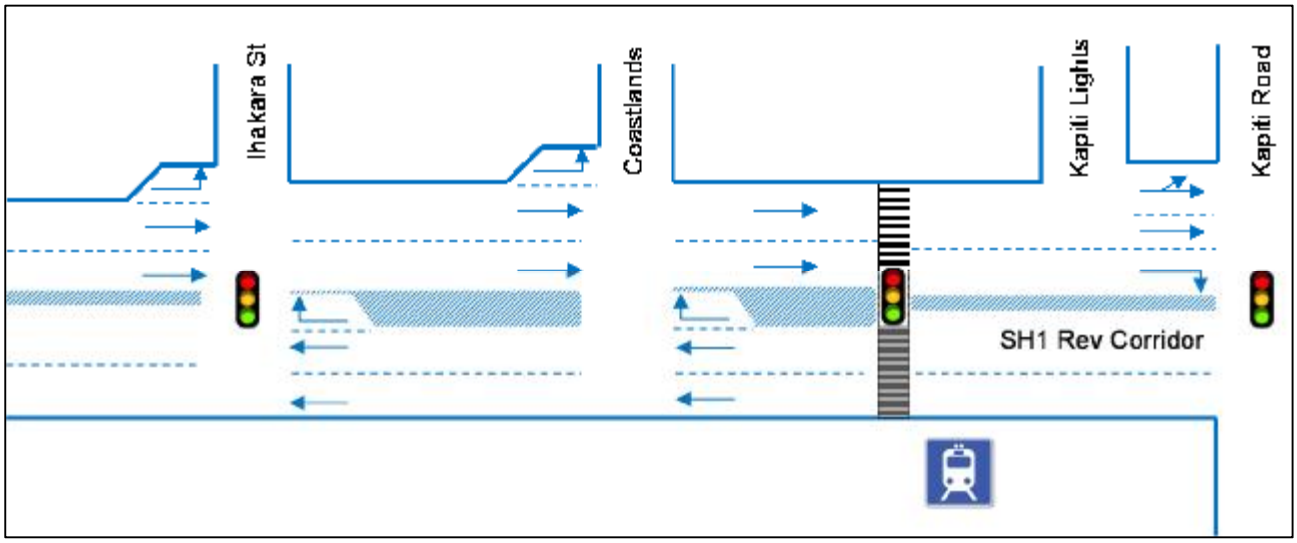

Figure 6.2.4 – Double Lane plus at grade signalized crossing

6.2.5 2031 Option 4 - Double Lane with Single Lane at the Pedestrian Crossing (Hybrid Design)

This allows for two through lanes to be provided on the northbound approach from Ihakara Street intersection to Kapiti Road intersection and to carry the two lanes through the town centre area to merge to one lane beyond the Kapiti Road intersection, with one lane arrangement at the proposed signalized crossing between Coastlands and the Paraparaumu train station. A similar arrangement is provided for the approach with two lanes formed on the approach to Kapiti Road which carries through to beyond the Ihakara intersection. Right turning lanes have also been incorporated for the right turn movements from the existing SH1 into Ihakara Street and Coastlands respectively.

The at grade signalized pedestrian crossing has been introduced between Coastlands and the train station and incorporated into the traffic light signal at Kapiti Road/SH1 intersection. It has also been allowed to run in each cycle to obtain a 'worst case' scenario expected.

A common cycle time has been used for all intersections and manually adjusted offsets have been used to co-ordinate all three sets of signals along the corridor.

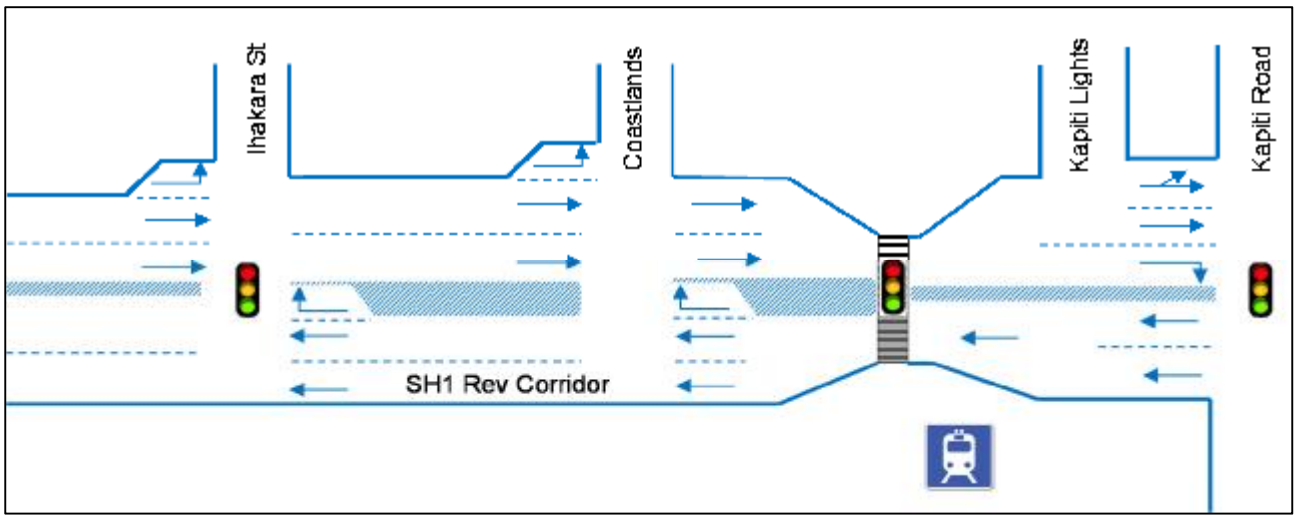

Figure 6.2.5 – Hybrid Lane Arrangement with at grade signalized crossing

6.3 VISSIM Model Results

The results from the VISSIM models have been compared and analysed to allow a comparison between the road layout options.

6.3.1 Travel Time Analysis

The three travel time routes on the main links through the Paraparaumu Town Centre are illustrated on **Figure 6.3.1**. The travel time results for the three routes from the VISSIM models are detailed in **Table 6.3.1 and 6.3.2.**

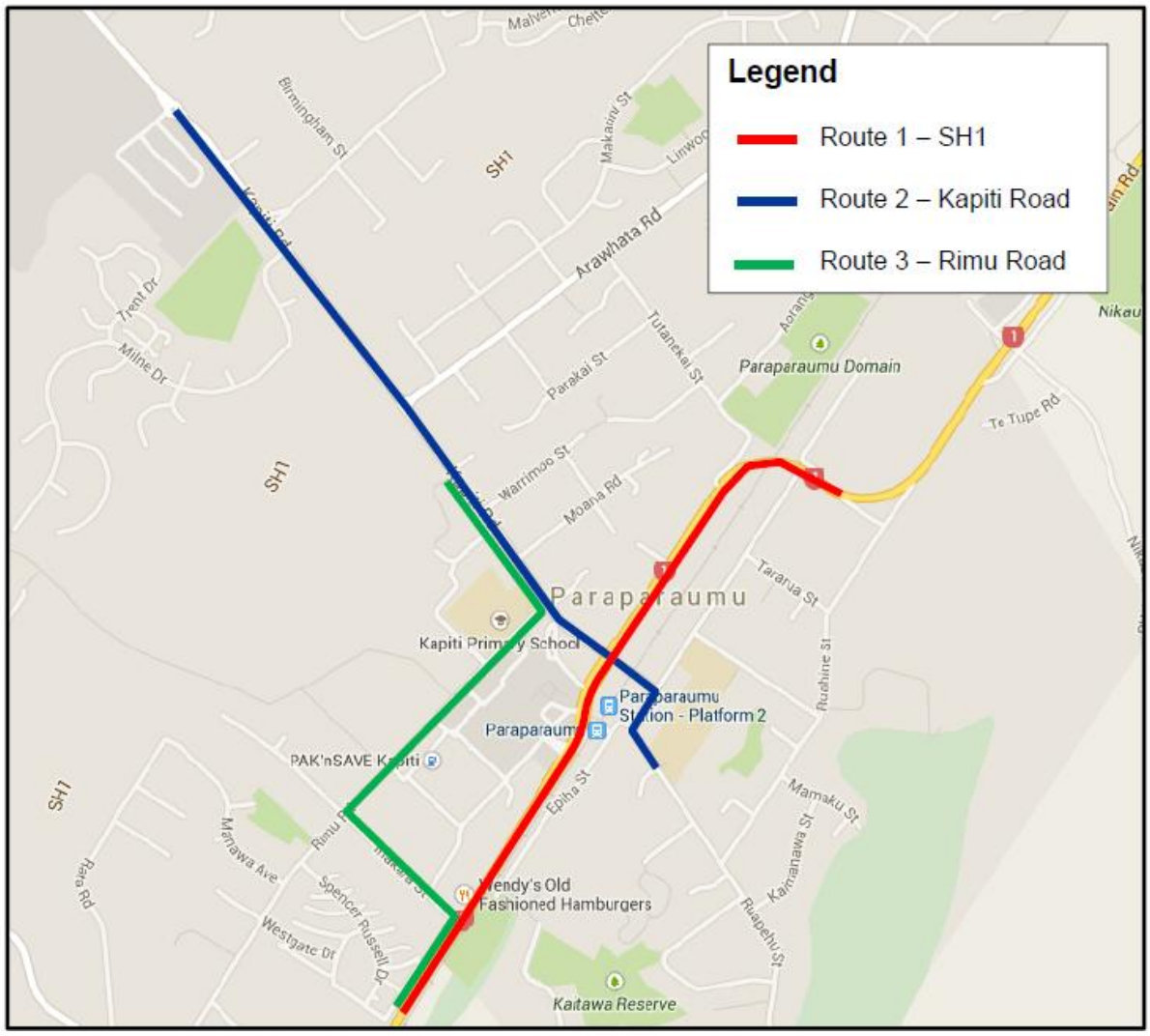

Figure 6.3.1 – Travel time routes

Table 6.3.1 – AM peak travel times

AM Peak Journey Times		2015 Base	2021 Option	2031 Option 1	2031 Option 2	2031 Option 3	2031 Option 4
SH1 Revocation Corridor	Towards Waikanae	167	237	245	244	239	237
	Towards Wellington	171	198	242	239	208	209
Kapiti Road	Towards Railway	280	391	374	377	375	385
	Towards Expressway	275	292	427	404	420	481
Rimu Road	Towards Kapiti Road	206	186	253	254	251	253
	Towards Ihakara St	188	280	225	227	219	219

Table 6.3.2 – PM peak travel times

PM Peak Journey Times		2015 Base	2021 Option	2031 Option 1	2031 Option 2	2031 Option 3	2031 Option 4
SH1 Revocation Corridor	Towards Waikanae	269	251	295	284	282	242
	Towards Wellington	161	209	208	208	201	202
Kapiti Road	Towards Railway	280	398	503	496	497	531
	Towards Expressway	363	383	554	572	500	493
Rimu Road	Towards Kapiti Road	255	420	269	255	278	258
	Towards Ihakara St	220	336	279	276	276	275

2021 Design Year

It can be seen from **Table 6.3.1** and **Table 6.3.2** that the journey times along SH1 Revocation Corridor will increase slightly in 2021 in most cases (apart from direction towards Waikanae during PM peak.) This is understood to be the result of the speed limit reduction and capacity reduction. The journey times along Kapiti Road will increase significantly during the PM peak period. This is because of the significant increase in traffic demands. Rimu Road journey times will also increase significantly in the peak direction during the morning and afternoon peaks. This is believed to be the result of additional demand from future development.

2031 Design Year

It can be seen from **Table 6.3.1** and **Table 6.3.2** that the journey times along SH1 Revocation Corridor and Rimu Road will increase slightly in 2031 in most cases as compared to 2015 base. The journey times along Kapiti Road will increase significantly in 2031. This is understood to be the result of additional demand from future development.

The journey times along the SH1 Revocation Corridor, Kapiti Road towards the Railway direction and Ihakara Street-Rimu Road are similar across all the options tested for both AM and PM peak hours. The differences are within 50 seconds which could be considered not be an issue as it is less than the 120 seconds cycle time at the intersections. This indicates that the proposed layout options along the SH1 Revocation Corridor do not significantly affect the traffic performance on the wider network within the Paraparaumu town centre area.

Between Option 2 and Option 4 for both the AM and PM peak hours, the journey time along Kapiti Road westbound increase by approximately 80 seconds. This increase in journey time could be the effect from the intersections along westbound Kapiti Road with Arawhata Road, Kapiti Interchange with M2PP expressway, and Te Roto Dr However, this is considered not be an issue because the cycle time at the intersections is 120 seconds.

6.3.2 Queue Length Comparison

Queue length have been plotted to show the VISSIM results on each of the main links through the Paraparaumu town centre area. This includes queue length at intersections Kapiti Road/Rimu Road, Kapiti Road/SH1, SH1 at the proposed pedestrian crossing and Ihakara Street/ SH1, as shown in **Figures 6.3.2** and **6.3.3** below.

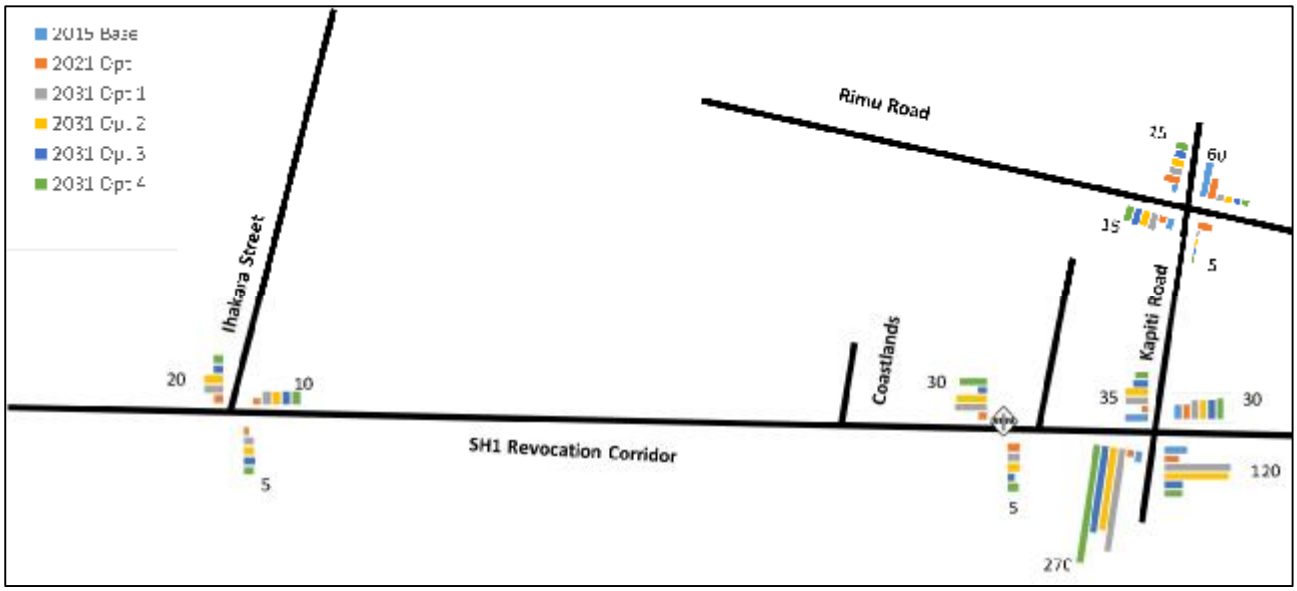

Figure 6.3.2 – Average Queue Length (AM peak hour)

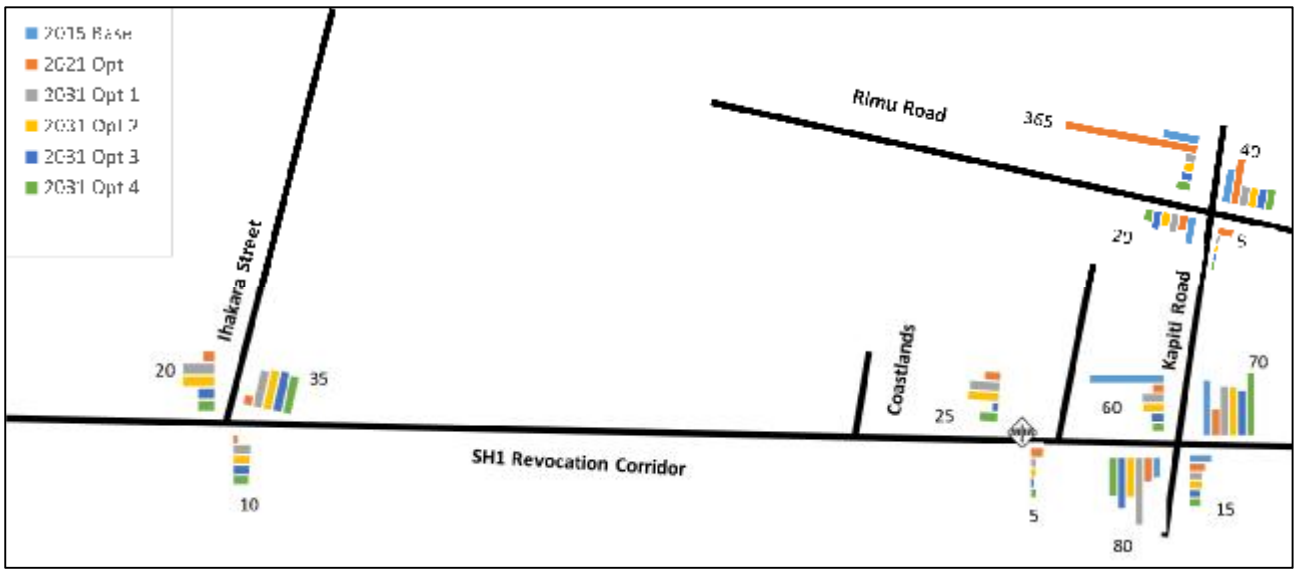

Figure 6.3.3 – Average Queue Length (PM peak hour)

2021 Design Year

For design year 2021 option, the overall queue length during the AM peak will increase slightly as compared to the 2015 base, however, all the intersections will still perform at an acceptable level (Level of Service D). Rimu Road at its intersection with Kapiti Road will be significantly worse during the PM peak hours in year 2021 as compared to the 2015 base, with average queue length over 350 meters. Based on the 2021 PM peak modelling, there would be capacity on the SH1 Revocation Corridor and Kapiti Road to redistribute traffic from Rimu Road to reduce this queue and delay.

2031 Design Year

It can be seen from **Figure 6.3.2** and **Figure 6.3.3** that the queue length differences between 2031 and 2015 vary on different approaches at the investigated intersections. For example, significant increase of queue length is observed on Kapiti Road towards M2PP Expressway at its intersection with SH1 Revocation Corridor during AM peak hours which is a result of significant increase of projected traffic demand and doubled train frequency in the future year; However, a reduction of queue length is also observed on Rimu Road towards Kapiti Road at its intersection with Kapiti Road during PM peak hours which is believed to be the effect of the Relief Road which provides alternatives to traffic to head towards west of Kapiti Road.

Options 3 and 4 present similar queue lengths and Options 1 and 2 present similar queue lengths along the SH1 Revocation Corridor at its intersections with Kapiti Road, Ihakara Street for both AM and PM peak hours. The queue lengths of Options 3 and 4 are shorter than Options 1 and 2 which could be due to the extra capacity and queuing space the double lane layout options offers.

Option 3 provides shorter queue length along SH1 Revocation Corridor at the proposed pedestrian crossing due to the double lane configuration while the other three options present similar length queues. These queues are all within 50 meters which is considered to have minimum impact to the adjacent junctions.

The queue lengths at the other intersections do not vary much across all the options tested for the PM peak hour. This indicates that the four road layout options proposed along the SH1 Revocation Corridor has minimum impact to the network traffic performance within the Paraparaumu town centre area.

Extensive queue were observed along westbound Kapiti Road at intersection Kapiti Road/SH1 Revocation Corridor during AM peak hours. This could be due to the high traffic demand from the residential area and the impact from the doubled train frequency.

6.3.3 Level of Service

The levels of service for the three intersections have also been analysed for the 2021 and 2031 design year and are detailed in **Table 6.3.3**. **Table 6.3.4** confirms the level of service bands for ease of reference.

Table 6.3.3 –Intersection Levels of Service

Intersections	AM Peak						PM Peak					
	2015 Base	2021 Opt	2031 Opt 1	2031 Opt 2	2031 Opt 3	2031 Opt 4	2015 Base	2021 Opt	2031 Opt 1	2031 Opt 2	2031 Opt 3	2031 Opt 4
Ihakara Street												
SH1 towards Wellington	A	C	C	C	C	C	A	C	C	C	B	B
SH1 towards Waikanae	A	C	A	A	A	A	A	B	A	A	A	A
Ihakara Street towards SH1	A	C	D	D	D	D	A	C	D	D	D	D
SH1 at the pedestrian crossing												
SH1 towards Wellington	-	C	C	C	C	C	-	C	C	C	C	C
SH1 towards Waikanae	-	A	A	A	A	A	-	A	A	A	A	A
Kapiti Road												
SH1 towards Wellington	D	C	C	C	C	C	D	D	C	C	C	D
SH1 towards Waikanae	D	C	C	C	C	C	D	D	C	C	C	C
Kapiti Road towards M2PP	D	D	D	D	D	D	E	E	E	E	E	E
Kapiti Road towards Railway	D	D	D	D	D	E	E	E	D	D	D	D

Table 6.3.4 - Level of Service Bands

Level of Service	
Band	**Average Delay (sec/veh)**
A	0-10
B	10-20
C	20-35
D	35-55
E	55-80
F	80+

2021 Design Year

For design year 2021 option, a minor decrease of the overall level of service at the investigated intersections was noted when compared with 2015 base, however, all the investigated intersections will still perform at an acceptable level (Level of Service D).

2031 Design Year

The overall level of service at the investigated intersections will worsen slightly in design year 2031 as compared to 2015 base.

As can be seen from **Table 6.3.3**, all the road layout options present similar level of service at the investigated intersections. This reconfirms that all the proposed layout options of SH1 Revocation Corridor does not significantly affect the traffic performance on the network within the Paraparaumu town centre area.

7 Conclusions

The following conclusions were drawn from the modelling work described in the previous sections. These are based on the following:

- The wider network traffic analysis in the KPT3 SATURN model
- The road layout options tested in the VISSIM model.

7.1 Wider Network Effects – KTM3 SATURN Model

The following conclusions were drawn from the KTM3 SATURN modelling work undertaken to assess the wider network effects:

- The M2PP Expressway is the major route through and within the region, carrying the highest traffic volumes for both AM and PM peak hours;
- Traffic is generally heavier in the network during PM peak hours as compared to AM peak hours;
- SH1 Revocation Corridor and Rimu Road are both heavily used for north-south traffic movements, with traffic volumes being similar on both;
- Kapiti Road carries high traffic volumes, with these volumes building up from the west, including through the Kapiti Road interchange. Traffic volumes fall off east of Relief Road, and further reduce east of Rimu Road, as the Relief Road provides a bypass to the Paraparaumu Town Centre and Rimu Road provides the first connection into the central Paraparaumu area;
- Similar to what was seen with Kapiti Road between SH1 Revocation Corridor and Rimu Road, both Ihakara Street and Raumati Road have lower volumes travelling east-west compared to the north-south volumes on Rimu Road and SH1 Revocation Corridor; and
- The Ihakara Extension will lead to a decrease in traffic volumes on both Kapiti Road east of the airport access opposite Hurley Road and the roads following the coast to the west of the airport (Marine Parade/Wharemauku Road/Matatua Road). There will be an overall increase in traffic on Ihakara Street approaching the Rimu Road intersection. However, the Ihakara Extension will have no impact on traffic volumes on SH1 Revocation Corridor immediately south of Kapiti Road, and will only result in a small decrease on Rimu Road at its northern end, and a slight increase south of this.

7.2 Traffic Simulation – VISSIM Model

The following conclusions were drawn from the VISSIM modelling work undertaken to test the 2021 option:

- The journey times along SH1 Revocation Corridor will increase slightly in 2021 in most cases (apart from towards Waikanae during PM peak). The journey times along Kapiti Road will increase significantly during the PM peak period and Rimu Road journey times will also increase significantly in the peak direction during the morning and afternoon peaks. This is understood to be the result of additional demand from future development;
- The overall queue length during the AM peak will increase slightly in design year 2021 as compared to the 2015 base, however, all the intersections will still perform at an acceptable level (Level of Service D). Rimu Road at its intersection with Kapiti Road will be significantly worse during the PM peak hours in year 2021 as compared to the 2015 base, with average queue length over 350 meters; and
- The overall level of service at the investigated intersections will worsen slightly as compared to 2015 base, however, all the investigated intersections will still perform at an acceptable level (Level of Service D).

The following conclusions were drawn from the VISSIM modelling work undertaken to test the four road layout options:

- Initial observations show that in the 2031, the traffic does not vary much for the four proposed road layout options. Option 3, the double lane arrangement, does perform marginally better because of the extra capacity it provides;
- The journey times routes measured are similar across all the options tested for both AM and PM peak hours, indicating that the layout options for SH1 Revocation Corridor does not significantly affect the traffic performance on the network within the Paraparaumu town centre area;
- Options 1 and 2 present longer queue lengths along SH1 Revocation Corridor at its intersections with Kapiti Road and Ihakara Street than Options 3 and 4. This is because Option 1 and 2 have only one through approaching Kapiti Road from SH1 North and Ihakara Street from the SH South and a single lane in each direction;
- Option 3 provides shorter queue length along SH1 Revocation Corridor at the proposed pedestrian crossing while the other three options present similar length of queue. However, these queues are all within 50 meters which is considered to have minimum impact to the adjacent junctions;
- The traffic modelling shows extensive queues for all options on Kapiti Road east approach with SH1 Revocation Corridor in the AM peak. This is due to the significant projected traffic growth from this area. Measures will be required to manage traffic at that intersection in the future to cater for this significant growth traffic;
- The Level of Service results re-confirms that the proposed four layout options along the SH1 Revocation Corridor does not significantly affect the traffic performance on the wider network within the Paraparaumu town centre area; and
- From a traffic modelling perspective, all the four options proposed would have minimum impact on the traffic performance of the wider network. Therefore, the decision on the on the final layout along the SH1 Revocation Corridor through the Paraparaumu town centre is likely to be influence by other factors such as the future town centre development plan, pedestrian movements and urban design requirements.