Project Number: 5-WT696.00

Marton Rail Hub

Comprehensive Development Plan
Traffic Impact Assessment

13 August 2021

CONFIDENTIAL

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Revision	Details
A	Draft for Review
B	Final for Issue
C	Final for Issue – Removal of minimum parking supply requirements
D	Final for Issue – Updated drawing amendments, modelling results and recommendations

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Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for Rangitikei District Council ('**Client**') in relation to the development of a Traffic Impact Assessment for the Marton Rail Hub Comprehensive Development Plan ('**Purpose**') and in accordance with the Conditions of Contact for Consultancy Services dated 7th December 2020.

The findings in this Report are based on and are subject to the assumptions specified in the Report and the scope of services outlined within the CCCS dated 7th December 2020. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

Executive Summary

Introduction

WSP have been commissioned by Rangitikei District Council (RDC) to develop a traffic impact assessment (TIA) in relation to the proposed Comprehensive Development Plan (CDP) for the Marton Rail Hub. The purpose of the traffic impact assessment is to assess the transportation effects of the proposed Marton Rail Hub with reference to the conceptual roading arrangements outlined within the CDP on the efficient and effective operation of the surrounding road network.

The Proposal

The CDP for Marton Rail Hub includes multiple industrial sites, a new rail siding, internal roads, and commercial premises. Access into the proposed industrial site is solely from Makirikiri Road via two new intersections. No direct vehicle accesses onto the State Highway network are proposed with all access facilitated through existing intersections.

The proposed activities on the site include:

- A weighbridge and security gate for access into the wider industrial zoned site
- Internal sealed roads for staff and transport trucks to access the sites
- Small business and service area
- Log yard and de-barker with pump station
- PLA and PHA plastics manufacturing plant (6 hectares / 60,000m2)
- Rail siding and container area
- Energy plant
- Food producer (20 hectares / 200,000m2).

The proposed layout of the CDP site including internal roads and site locations are provided in Figure 0-1.

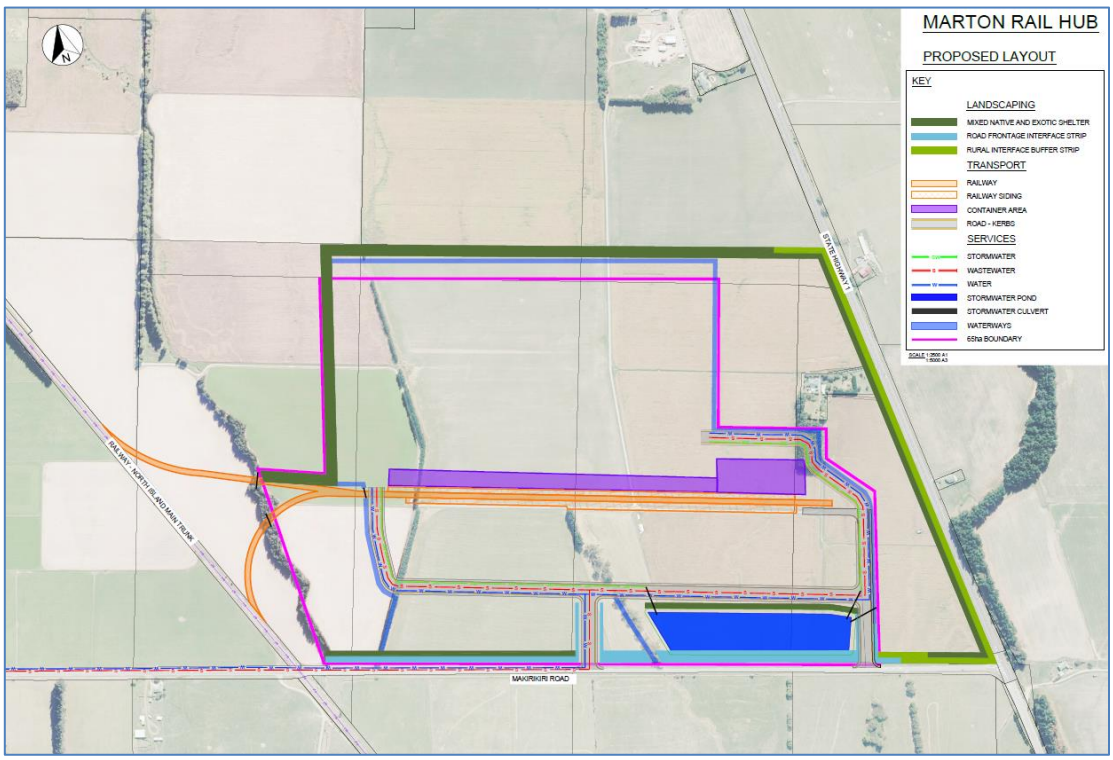


Figure 0-1: Comprehensive Development Plan - Concept Plan and Layout

Trip Generation and Distribution

The anticipated trip generation associated with the site has been developed on a "first principles" basis. Forecast trip generation rates for the proposed CDP area covering both peak hours and all-day traffic movements are summarised in Table 0-1.

Table 0-1: Forecast Trips Generated by the Marton Rail Hub CDP

PERIOD	MOVEMENT	STAFF TRIPS	COMMERCIAL TRIPS	TOTAL
AM Peak (7:30-8:30hrs)	Inward	155 vph	25 vph	**170 vph**
	Outward	40 vph	25 vph	**65 vph**
	Total	**195 vph**	**50 vph**	**245 vph**
PM Peak (16:30-17:30hrs)	Inward	40 vph	25 vph	**65 vph**
	Outward	155 vph	25 vph	**170 vph**
	Total	**195 vph**	**50 vph**	**235 vph**
All Day	Inward	235 vpd	137 vpd	**372 vpd**
	Outward	235 vpd	137 vpd	**372 vpd**
	Total	**470 vpd**	**274 vpd**	**744 vpd**

In the absence of a wider strategic model for the region, to establish future volumes at each intersection traffic generated during peak periods have been allocated to the network based on assumptions developed within the Plan Change Traffic Impact Assessment, and through discussions with potential site occupiers.

Intersection Performance

Based on existing turning count data and the forecast trip generating potential of the development, SIDRA (v9.0) was used to assess the current and future capacity of the key intersections on the strategic road network, during both AM and PM Peak periods. The performance of each of the intersections has been modelled for both the AM and PM peak periods under the following scenarios:

- Base Case (2019)
- Future modelling scenarios with background traffic growth only (2024 and 2034)
- Future modelling scenarios inclusive of traffic generated by the CPD site (2034 and 2034)

The results of the modelling process are summarised within Table 0-2.

The modelling results indicate the Makirikiri Road / SH1 will operate within generally accepted levels of performance levels up to 2034, it is likely that upgrades will need to be considered to support right-turning movements from Makirikiri Road soon after this. This is expected to require a more significant change of form to improve the Level of Service (LoS), such as a seagull type treatment, roundabout, or signals.

The modelling results indicate all other intersections are expected to perform within acceptable levels of capacity and delay with the inclusion of traffic generated by the proposed development.

Table 0-2: Summary of SIDRA Modelling Analysis of Key Intersections

INTERSECTION MODELLED	SCENARIO TESTED					COMMENT
	BASE CASE	NO DEVELOPMENT		WITH DEVELOPMENT		
	2019	2024	2034	2024	2034	
Makirikiri Road / SH1	✓	✓	✓	✓	✓	Intersection is expected to operate within acceptable parameters within all scenarios; however, right turning traffic from Makirikiri Road is approaching capacity within the 2034 with development scenario.
Wings Line / SH1	✓	✓	✓	✓	✓	Intersection is expected to operate within acceptable parameters under all scenarios.
Makirikiri Road / SH3	✓	✓	✓	✓	✓	Intersection is expected to operate within acceptable parameters under all scenarios.
Pukepapa Road / SH3	✓	✓	✓	✓	✓	Intersection is expected to operate within acceptable parameters under all scenarios.

Access Arrangements

All vehicles will access the CDP site will be enabled through two new intersections onto Makirikiri Road between SH1 and the North Island Main Trunk railway crossing. The proposed locations of the vehicle accesses as indicated within the CDP site layout plan are:

- **Western Access**: Located at Makirikiri Road RP 0.750.
- **Eastern Access**: Located at Makirikiri Road RP 0.250.

The suitability of the proposed access locations has been assessed against the requirements of the RDC District Plan (Section B9) in relation to access separation distances, sightline requirements and turning bay requirements (see Table 0-3).

Table 0-3: Intersection Spacing and Sight Distance Assessment Criteria

DESIGN CONSIDERATION	POSTED SPEED	MINIMUM REQ.	WESTERN ACCESS (RP 0.750)	EASTERN ACCESS (RP 0.250)
Intersection Separation Distances	70km/hr	220m	**Complies**	**Complies**
	100km/hr	800m	**Does not comply** The Eastern Access is located 460m to the east, less than the requirement minimum distance.	**Does not comply** SH1 is located 240m to the east and the Western Access is located approximately 510m to the west.
Sightlines for Road Intersections	70km/hr	130m	**Complies**	**Complies**
	100km/hr	250m	**Complies**	**Does not Comply** Minimum sight distances are achieved to the east; however, sightlines to the west are restricted by sag curves
Turning Bay Requirements	Assessed with 70km/hr or Below Posted Speed		**No** Recommended access is designed to comply with Waka Kotahi's Access Diagram E	**Yes** A channelised right turn bay (short) is warranted to support AM Peak period access demand.

The assessment indicates at the existing posted speed limit (100km/hr) the proposed access arrangements would fail to meet the sightline and intersection separation distances stipulated within the District Plan; however, at a reduced speed limit of 70km/hr or below, the minimum desired distances for both criteria could be achieved.

An assessment of turning bay requirements based on forecast traffic volumes indicate a right-turn bay would be warranted for vehicles accessing the Eastern Access.

Safety Assessment

A high-level crash risk assessment based on the NZ Transport Agency's Crash Estimation Compendium (CEC)[1] has been undertaken to compare the existing injury crash rate at the intersection, prior to the development of the site, and the predicted injury crash rate (A^T) when the development is completed. The suitability of the existing intersections in terms of minimum sight distances have also been assessed.

The results of the assessment are outlined within Table 0-4

Table 0-4: Summary of Predicted Injury Crash Rates at Key Intersections

INTERSECTION	A^T EXISTING	A^T EXISTING BASED ON CEC	A^T – CEC INCLUDING DEVELOPMENT	SIGHTLINES ACHIEVED
Makirikiri Road / SH1	0.40 per year	0.21 per year	0.28 per year	Yes
Wings Line / SH1	0.0 per year	0.12 per year	0.13 per year	Yes
Pukepapa Road / SH3	0.33 per year	0.27 per year	0.28 per year	Yes
Makirikiri Road / SH3	0.20 per year	0.08 per year	0.10 per year	No (Eastward)
Makirikiri Rd/Wellington Rd	0.50 per year	0.21 per year	0.23 per year	No (Makirikiri Road Eastern Approach)

The expected traffic generated by the site is expected to have a minor impact on crash risk at most key intersections within the vicinity of the development. The greatest increase in crash risk is expected on Makirikiri Road / SH1 as a result of increased right-turning movements into and from Makirikiri Road. A channelised right-turn bay on SH1 is recommended to support safety.

The assessment indicates the Wellington Road / Makirikiri Road intersection currently has a higher than predicted volumes of injury crashes. It is recommended that potential safety improvements to the intersection are explored, which may include enhancing sightlines, implementing electronic warning signs, speed reduction measures and/or changes to posted speeds at the intersection.

Makirikiri Road Rail Crossing

The Makirikiri Road railway crossing is located at KM178.24 of the North Island Main Trunk Line and approximately 1.3 kilometres west of the intersection of SH1 and Makirikiri Road. The crossing controls were upgraded from Flashing Lights and Bells to include Half Arm Barriers in 2015.

A Level Crossing Safety Impact Assessment (LCSIA) was undertaken in 2019, which outlined several recommendations to improve safety including installing crossing approach warning signs, no passing markings and yellow hatching through the crossing and localised widening of the road on the approach to the railway crossing.

Subject to the implementation of these recommendations, LCSIA indicates the additional traffic generated by the proposed development is not expected to warrant a fundamental change in rail crossing provisions at this location.

Recommendations

Table 0-5 summarises the recommended transport mitigation measures to support the safe and efficient operation of the wider transportation network.

[1] According to crash prediction method in the Crash Estimation Compendium section 7.5 High-speed priority T-junctions ≥ 80 km/h

Table 0-5: Summary of Recommended Mitigation Measures

Timeline	Proposed Mitigation
Pre-Development	**SH1 / Makirikiri Road Intersection** • A right-turn bay is provided on State Highway 1 at the intersection with Makirikiri Road prior to completion of the development to safely support increased traffic turning demands generated by the site. **Makirikiri Road (General)** • The posted speed limit on Makirikiri Road within the vicinity of the CDP site is reduced to 70km/hr or below prior to occupancy of the site, to adhere with the minimum intersection spacing requirements outlined within the District Plan. • Improvements to the vertical road alignment are considered between RP 0.340 and RP0.510 to maximise sightlines to the west from the proposed Eastern Access road. • A right-turn bay is provided from Makirikiri Road into the Eastern Access, and the Western Access is designed to comply with Waka Kotahi's Accessway Standards Diagram E to support heavy vehicle access into the site. **Makirikiri Road / Wellington Road Intersection** • RDC investigates safety improvements such as enhanced sightlines, implementing electronic warning signs, speed reduction measures and/or changes to posted speeds at the intersection at the Wellington Road / Makirikiri Road crossroads intersection in response to the current higher than expected volume of injury crashes. **Makirikiri Road Railway Crossing** • Installation of crossing approach warning signs, no passing markings and yellow hatching through the Makirikiri Road rail crossing to comply with the requirements of Traffic Control Devices Manual Part 9 (Level Crossings), and localised widening of the road on the approach to the railway crossing. **General Recommendation** • Construction Traffic Management Plans are developed by prospective developers and approved prior to commencing work on the site.
Post-Development	• In collaboration with Waka Kotahi, investigate options to upgrade the Makirikiri Road/State Highway 1 intersection in response to expected longer-term (post-2034) capacity issues at the intersection. • RDC undertakes regular monitoring of the safety performance of key intersections and roads surrounding the site to determine if and when any improvements are required in response to emerging crash trends.

Conclusions

Subject to the recommended mitigation measures outlined above, it is concluded that the proposed CDP will operate safely and efficiently, and that traffic generated by the proposed activities on the site can be accommodated with a less than minor impact on the surrounding transport network. Therefore, it is considered that there is no traffic planning or traffic engineering reason to preclude the implementation of the development as intended.

1 Introduction

WSP has been appointed to provide transport consultancy services to assist with input into a Comprehensive Development Plan (CDP) for a proposed the industrial zone in Marton, Rangitikei.

This proposed Plan Change (1165, 1151 and 1091 State Highway 1) to enable an industrial zone to be developed was released for public consultation in June 2019. The decision on the Plan Change was made in August 2020 which rezoned approximately 40ha of land adjoining the North Island Main Trunk Railway with access off Makirikiri Road, from Rural to Industrial, overlain with an 'Industrial Development Area' notation. This Plan Change is currently under appeal.

In addition to the current District Plan provisions that apply to the Industrial Zone, the plan change introduced a set of provisions that specifically apply to the subdivision, development and use of the Industrial Development Area overlay. Specifically, the subdivision requires a Resource Consent, to approve a CDP along with any industrial activities within the 'Industrial Development Area' as a discretionary activity. The rezoned site which requires the CDP is termed the Marton Rail Hub ("the proposal") within this report.

As part of the CDP, WSP has been commissioned by Rangitikei District Council (RDC) to undertake a traffic impact assessment (TIA) to assess the transport impacts of additional traffic generated by the proposed Marton Rail Hub on the surrounding road network, and the suitability of the transport provisions outlined within the CDP.

Subject to the recommended mitigation measures outlined within Section 5 of the report, the assessment concludes that the proposed CDP will operate safely and efficiently, and that traffic generated by the proposed activities on the site can be accommodated with a less than minor impact on the surrounding transport network. Therefore, it is considered that there is no traffic planning or traffic engineering reason to preclude the implementation of the development as intended.

1.1 Project Scope

The purpose of the TIA is to assess the potential impacts (and proposed mitigation where applicable) of the Proposal on the safe and efficient operation of the transport network, with consideration given to:

- The expected trip generation and site operations,
- The suitability of proposed site access arrangements,
- The suitability of on-site provisions, such as on-site circulation,
- The impacts of the proposed development on the local and regional road network, and
- Compliance of the proposed development with the transport related requirements of the Rangitikei District Council (RDC) District Plan.

1.2 Relevant Information

In developing this TIA, the following sources of information have been used and appropriately referenced throughout the report:

- MobileRoad (www.mobileroad.org)
- Waka Kotahi – NZ Transport Agency's One Network Road Classification (ONRC)
- Waka Kotahi – Appendix 5B Accessway Standards and Guidelines (2007)
- Austroads Guide to Traffic Management: Part 3 (2020)
- Austroads Guide to Traffic Management: Part 6 (2020)
- RDC District Plan – Part B Section 9: Transport (2018)

- RDC Road Assessment and Maintenance Management (RAMM) Database
- RDC Land Development and Subdivision Infrastructure, Addendum to NZA 4404:2010 (2017)
- Trip Generation Manual, 9th Edition – Institute of Highway Engineers (ITE)
- Guide to Traffic Generating Developments (2002) – Road and Traffic Authority, NSW
- New Zealand Trips and Parking Database (2017)
- Trips and Parking Related to Land Use – Research Report 453, Waka Kotahi, 2011

1.3 Report Structure

This remainder of the report has been structured as follows:

- ***Section 2*** – Provides a summary of the existing road network and local transportation conditions, including traffic volumes and local crash history;
- ***Section 3*** – Provides an outline of the anticipated CDP development staging and associated trip generation rates, including assumed trip distribution across the transport network;
- ***Section 4*** – Provides an outline of the findings of the assessment of effects, including traffic modelling findings, a safety performance assessment of key intersections, and suitability of the proposed site access arrangements; and
- ***Section 5*** – Provides a summary of the key study findings and general recommendations relating to infrastructure and operational improvements on the road network to support the CDP development.

2 Existing Conditions

This section of the report provides a description of the existing site and local transport network operations, as well as a description of the existing road network, intersection arrangements and road safety record within the sites of interest.

2.1 Site Location

The location of the proposed Marton Rail Hub in relation Marton township and the wider regional context (including the transport network) is shown in Figure 2-1 below. The site is located approximately 3.5km south-east of Marton town centre.

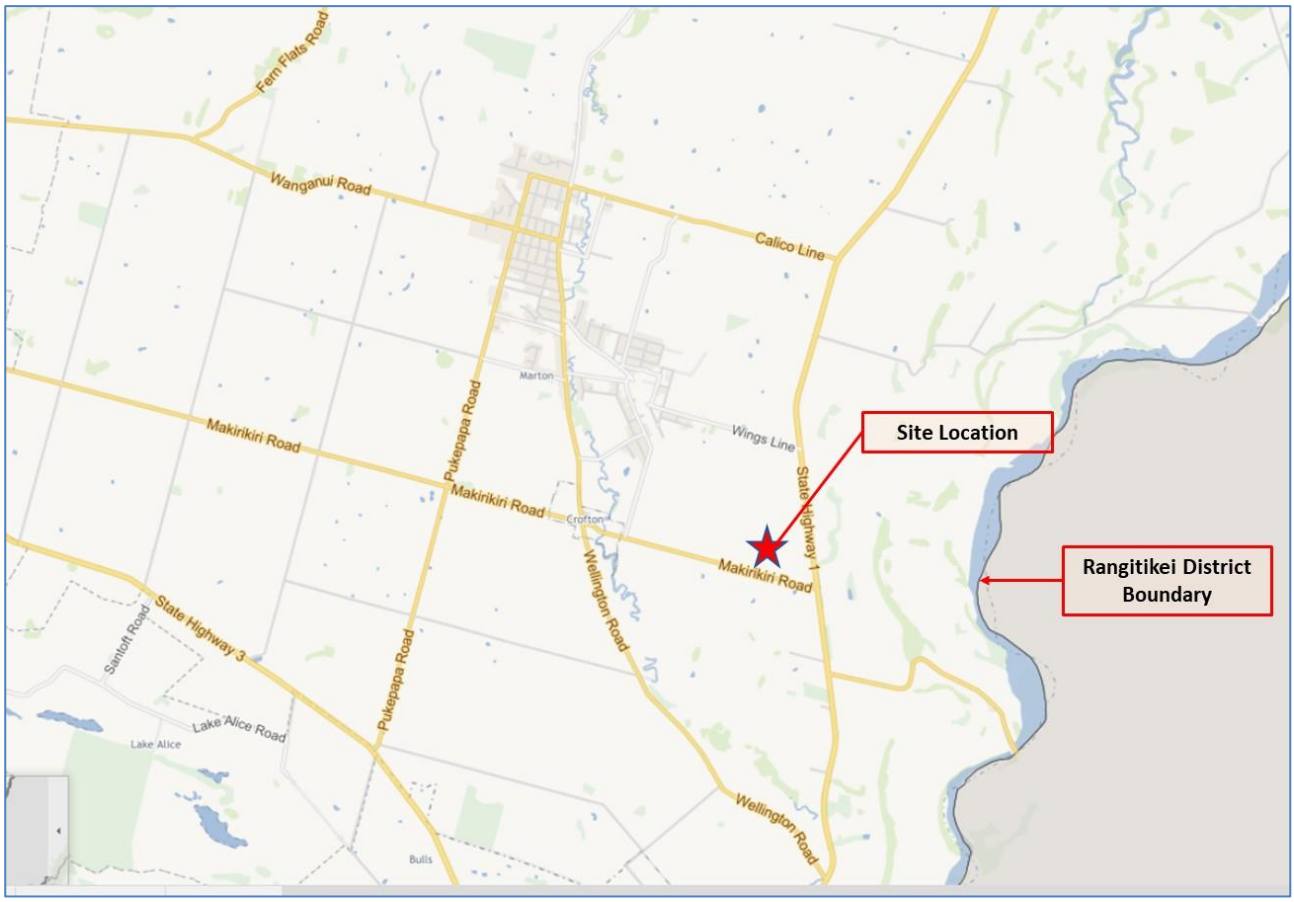


Figure 2-1: Site Context (Source: Rangitikei District Council GIS Maps)

The site is bounded to the south by Makirikiri Road, a primary collector and key route between State Highway 1 (SH1) and Wellington Road (primary collector) which connects through the rural community of Crofton directly to the Marton town centre. The site is bounded to the west by the Marton-New Plymouth Line (MNPL), a freight only rail line and a secondary main line branching from the North Island Main Trunk Railway (NIMT). To the northwest lies industrial and rural uses.

The site is bounded to the east by SH1, with the Makirikiri Road intersection, forming the primary connections onto the State Highway network from the site.

2.2 Existing Land-Use Zoning

The indicative area for the Marton Rail Hub area is currently zoned rural within the Rangitikei District Council's District Plan (see Figure 2-2). The site is surrounded by a combination of rural and industrial zoned land, with residential land uses also nearby. Very few community facilities are in the area as the site is located on the periphery of Marton. A racecourse is located across Wings Line from the site.

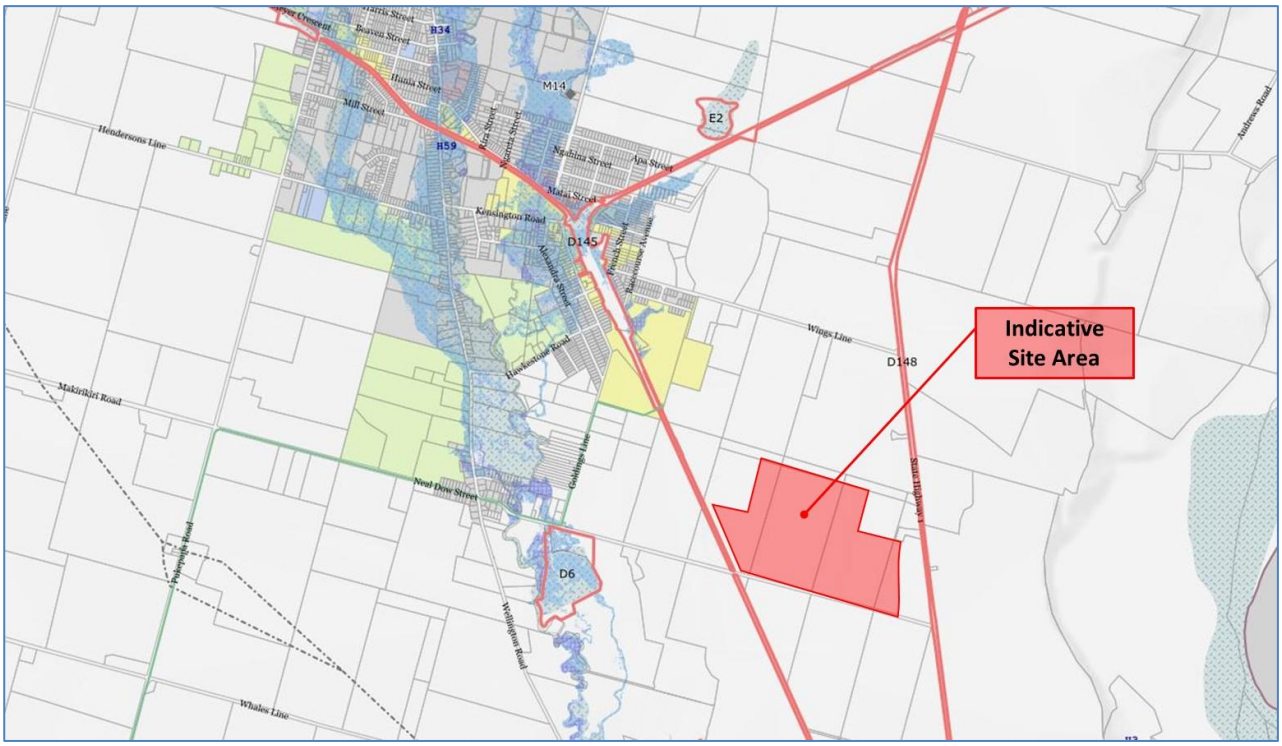


Figure 2-2: RDC District Plan Zone Maps (Source: Rangitikei District Council GIS Maps)

2.3 Transport Network

A summary of the key characteristics of each of the roads of interest within the study area is provided within Table 2-1 below. It is noted that Makirikiri Road as the primary access route to the proposed development has an average daily traffic (ADT) volume of approximately 1,900 vehicles per day within the vicinity of the site, reducing to less than 1,000 vehicles per day on sections to the west of the Wellington Road intersection. Heavy vehicles form a large percentage of travel demands on the surrounding roads, ranging between 15-20% of recorded traffic movements.

Table 2-1: Road Network Summary within Study Area

Road Name	ONRC Road Hierarchy	Lanes	ADT (%HV)	Speed Limit
Makirikiri Road (SH1 to Goldings Line)	Primary Collector	Two Lanes	1,860 (16%)	100 Km/hr
Makirikiri Road (Goldings Line to Wellington Rd)	Primary Collector	Two Lanes	1,320 (17%)	100 Km/hr
State Highway 1 (Wings Line to Makirikiri Road)	National (State Highway)	Two Lanes	6,120 (15%)	100 Km/hr
Wings Line	Secondary Collector	Two Lanes	550 (15%)	100 Km/hr

A brief description of each road is outlined in further detail below.

2.3.1 Makirikiri Road

Makirikiri Road is identified as a "Primary Collector" within Waka Kotahi's One Network Road Classification (ONRC). The road provides connections from State Highway 1 on its eastern extent to State Highway 3 on its western extent. The road intersects with several other local roads along the route including Goldings Line, Wellington Road, Pukepapa Road and Williamsons Line.

Within the vicinity of the site, the road carriageway is 7.4m wide and is formed of two general traffic lanes with narrow shoulder widths on both sides. The road has an estimated ADT of approximately 1,900 vehicles per day (vpd) with heavy vehicles comprising 16% of traffic (see Traffic Flow profile in Figure 2-3). The road has a posted speed limit of 100km/hr along most of its extent, with a reduced posted speed limit (70km/hr) currently operational through the township of Crofton.

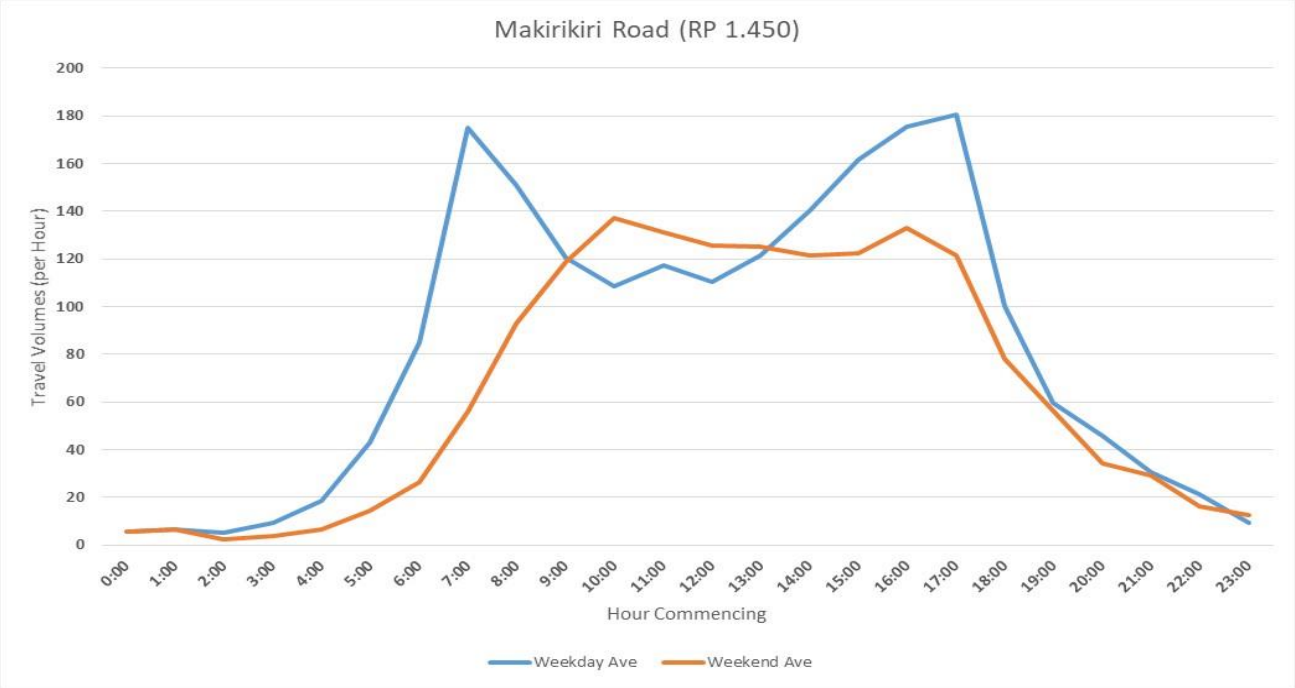


Figure 2-3: Traffic Flow Profile on Makirikiri Road (RP 1.450)(November 2020)

2.3.2 Wings Line

Wings Line is identified as a "Secondary Collector" within the ONRC. The road provides connections from State Highway 1 on its eastern extent to Marton township on its western extent. The road is recognised as the bypass route for large vehicles to avoid the overhead restrictions at the railway overbridge on SH1.

Within the vicinity of the site, the road carriageway is 6.3m wide and is formed of two general traffic lanes with narrow shoulder widths on both sides. The road has a posted speed limit of 100km/hr along the majority of its extent, reducing to 50km/hr on entry to residential areas. The road has an estimated ADT of 550 vehicles per day (vpd) with heavy vehicles comprising 15% of traffic (see Traffic Flow profile in Figure 2-4).

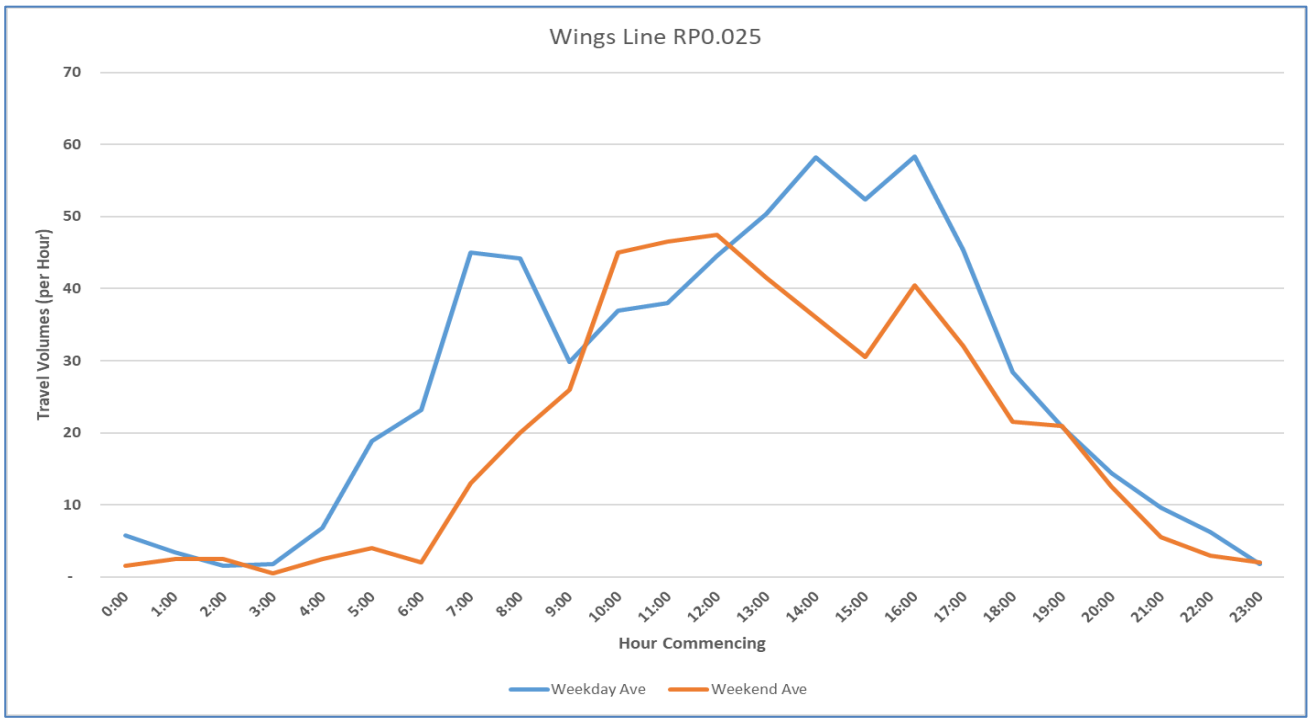


Figure 2-4: Traffic Flow Profile on Wings Line (RP 0.025)(June 2020)

2.3.3 State Highway 1

State Highway 1 (SH1) is identified as a "National (State Highway)" route within the ONRC. The road is the longest and most significant road within the NZ road network, running the length of both the North and South Island.

At a regional level, the route provides connections to State Highway 3 (SH3) in Bulls approximately 9.5km south Makirikiri Road. SH3 provides regional connectivity to the west, including key destinations such as Whanganui and New Plymouth. The SH1 corridor continues southwards through to Wellington via Levin and Porirua. To the north, the route provides regional connectivity to a number of key regional destinations in the upper north island, including Taupo, Hamilton and Auckland.

Within the vicinity of the site, the road carriageway is approximately 9m wide and is formed of two general traffic lanes with shoulders of varying widths on both sides. The road has an estimated ADT of approximately 6,875 vehicles per day (vpd) with heavy vehicles comprising 16% of traffic (Count Id 01N00916, Location: 1N-914-2.49)(see Traffic Flow profile in Figure 2-5). The road has a posted speed limit of 100km/hr within the vicinity of the site.

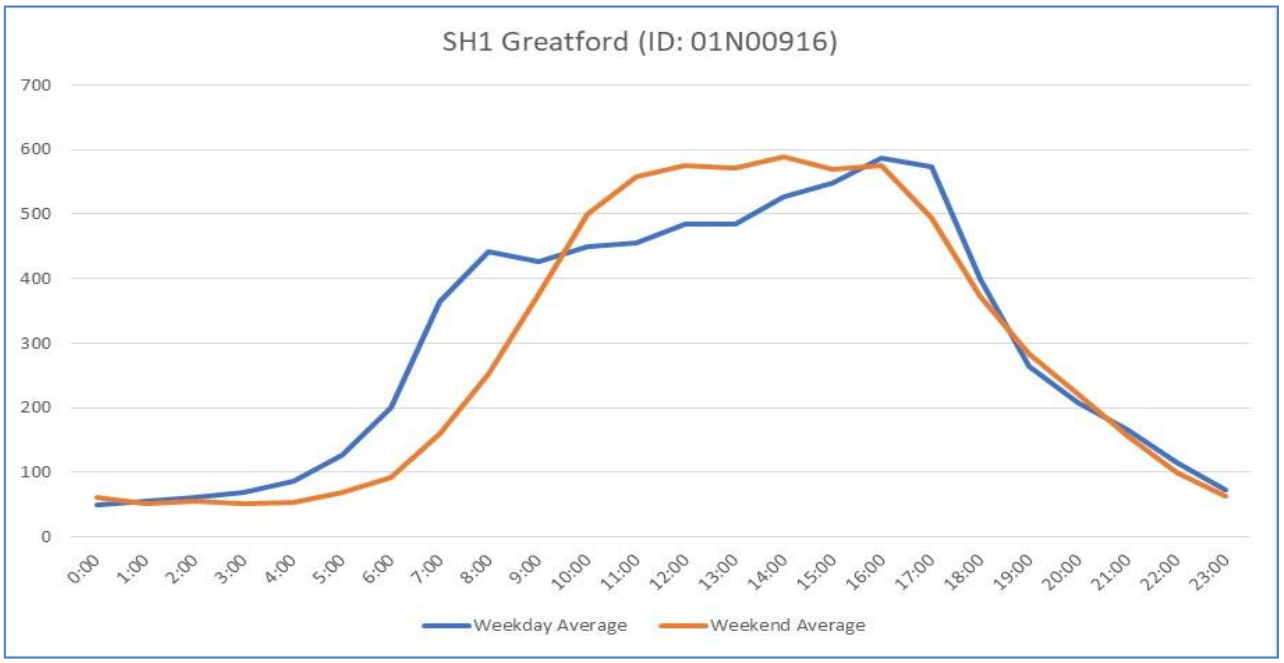


Figure 2-5: Traffic Flow Profile on State Highway 1 at Greatford – Site ID: 01N00916)(2019)

2.3.4 Pedestrian and Cycling Network

Since the area surrounding the site is rural in nature, there are no footpaths along Wings Line or Makirikiri Rd within the vicinity of the site. The closest footpath runs along the south side of Wings Line up to the entrance of Malteurop. Closer to Marton town centre there are footpaths along at least one side of the road and on many streets they are on both sides, particularly in closer proximity to the town centre.

There is currently limited dedicated cycling infrastructure within Marton or surrounding residential streets; however, at a regional level there are two segments of the Country Road Cycle Trail that connect in Marton (see Figure 2-6 overleaf). These cycle trails run on sealed and unsealed roads. The Mt. Curl cycle route from Hunterville to Marton (34km) and the Tangimoana cycle route which runs along the site boundary on Makirikiri Rd, from Marton to Tangimoana (55km)[2].

The RDC Roading 2018-21 Programme Business Case & 2018-48 Activity Management Plan (AMP) outlines Council's strategic goal to encourage the uptake of walking and cycling as transport modes and for recreation. Improvements identified in the plan include cycle lane markings radiating from

[2] The Country Road Cycle Routes

schools on Hereford Street and Bredins Line. Other roads to be marked include; Wellington Rd High Street to the Rail underpass, Broadway from Follett Street to Bond Street, and High Street. The objective is to provide a safe lane to encourage cycling[3]. The Horizons Regional Council (HRC) Regional Land Transport Plan (RLTP) has also prioritised walking and cycling facilities.

Section 2.10.3.1 of the AMP also states that "council will ensure land use planning recognises potential impacts on the existing transport system by ensuring new land use development includes provision for walking, cycling and public transport services consistent with relevant best practice guidance". It is also noted that encouraging walking and cycling provides positive health benefits and efficient use of the transportation system.

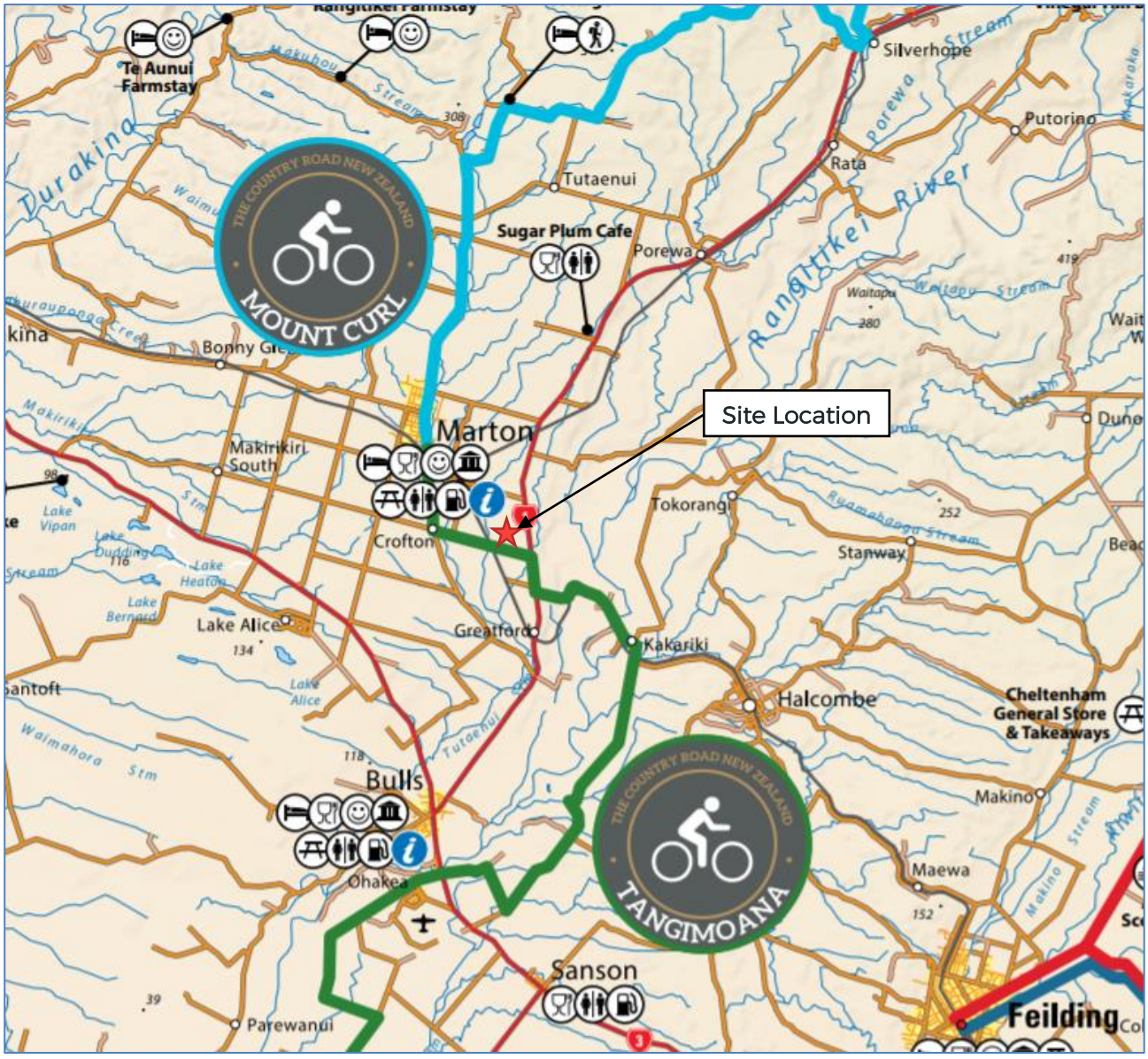


Figure 2-6: The Country Road Cycle Trail through Marton

2.3.5 Public Transport Network

Horizons Regional Council (HRC) currently operates a limited bus service to/from the Marton area to regional centres as follows:

- The Taihape/Wanganui service picks up in Marton at 10am and arrives in Wanganui at 10:45am. The return trip departs Wanganui at 3:30pm and arrives in Marton at 4:15pm. This service runs the first Thursday of the month.

[3] RDC Roading 2018-21 Programme Business Case & 2018-48 Activity Management Plan

- The Marton/Palmerston North Commuter service picks up in Marton at 7am and arrives in Palmerston North at 7:40am.
- The Palmerston North/Marton Commuter picks up in Palmerston North at 5:10pm and arrives in Marton at 5:50pm. Service runs Monday through Friday with no service on public holidays.

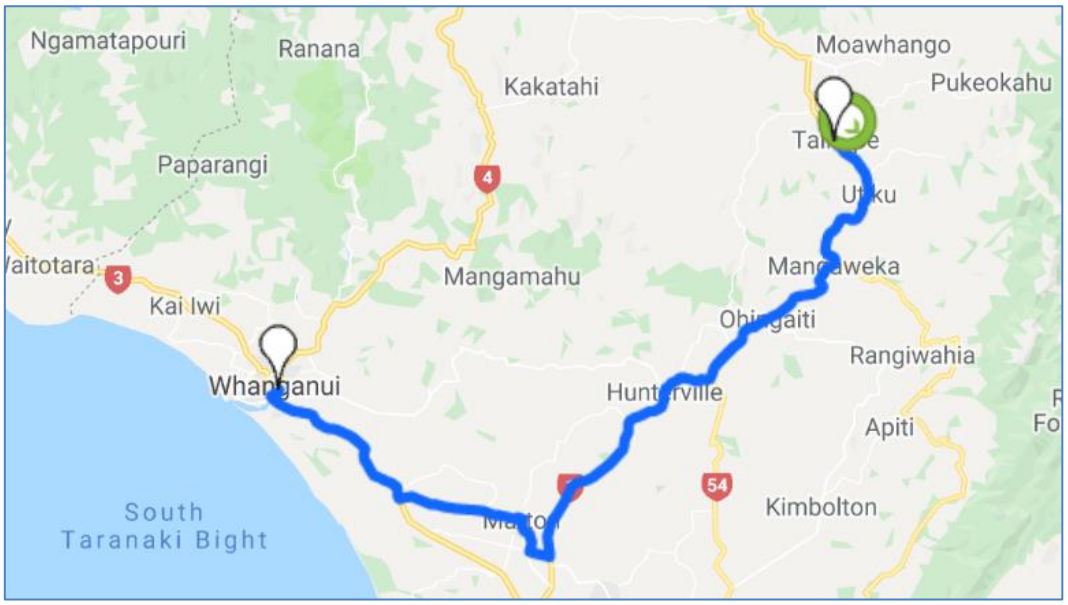


Figure 2-7: HRC Bus Transport Past the Site to Wanganui

2.4 Safety Record

A review of the Waka Kotahi - NZ Transport Agency Crash Analysis System (CAS) database has been undertaken to identify all reported crashes on State Highway 1, Makirikiri Road and Wings Line, and key local intersections between them, within the vicinity of the site between 2011 and 2020.

A total of 32 crashes have been recorded within the study area over the past ten years. of which 5 resulted in severe outcomes. No fatalities have been recorded within the study area over this period. The location of all recorded crashes within the study area is summarised within Table 2-2 and shown graphically within Figure 2-8. As indicated within Figure 2-9, there does not appear to be a trend in crash frequency within the study area over this period.

Most of these recorded crashes occurred at intersections (20 crashes, or 63%), with half of these crashes occurring at the Makirikiri Road / Wellington Road intersection. A detailed assessment of crash history at the intersections is outlined further within Section 4.5 of the report.

Table 2-2 Summary of Recorded Crash History (2011-2020)

LOCATION	TOTAL CRASHES	TOTAL CASUALTIES			
		DEATH	SERIOUS	MINOR	TOTAL
Midblock Sections					
State Highway 1 Midblock	7	0	0	3	3
Makirikiri Road Midblock	2	0	3	4	7
Wings Line Midblock	3	0	1	0	1
Intersections					
Makirikiri Road / SH1 Intersection	6	0	1	7	8
Makirikiri Road / Wellington Rd Intersection	10	0	1	5	6
Makirikiri Road / Goldings Line Intersection	3	0	0	1	1
Wings Line / SH1 Intersection	1	0	0	0	0
Wings Line / French St Intersection	1	0	0	0	0

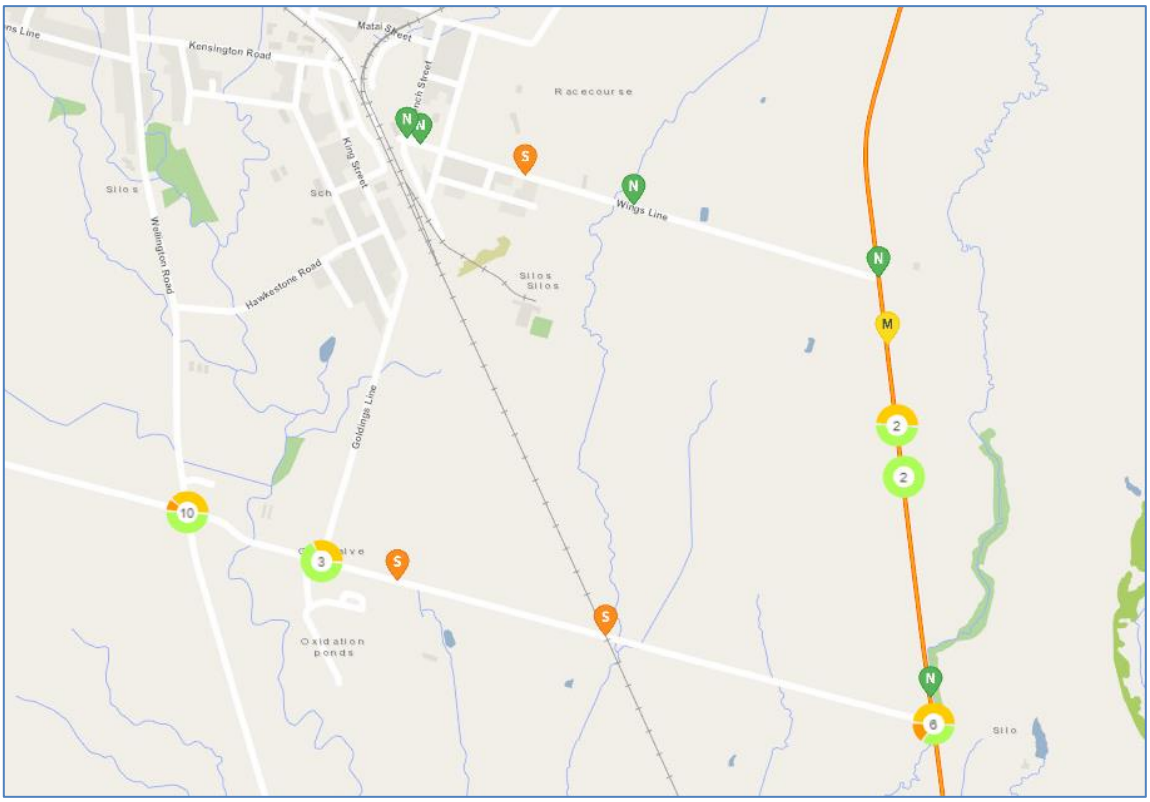


Figure 2-8: Location and Severity of Recorded Crashes on SH1, Wings Line and Makirikiri Road 2011-2020 (Source: Waka Kotahi CAS)

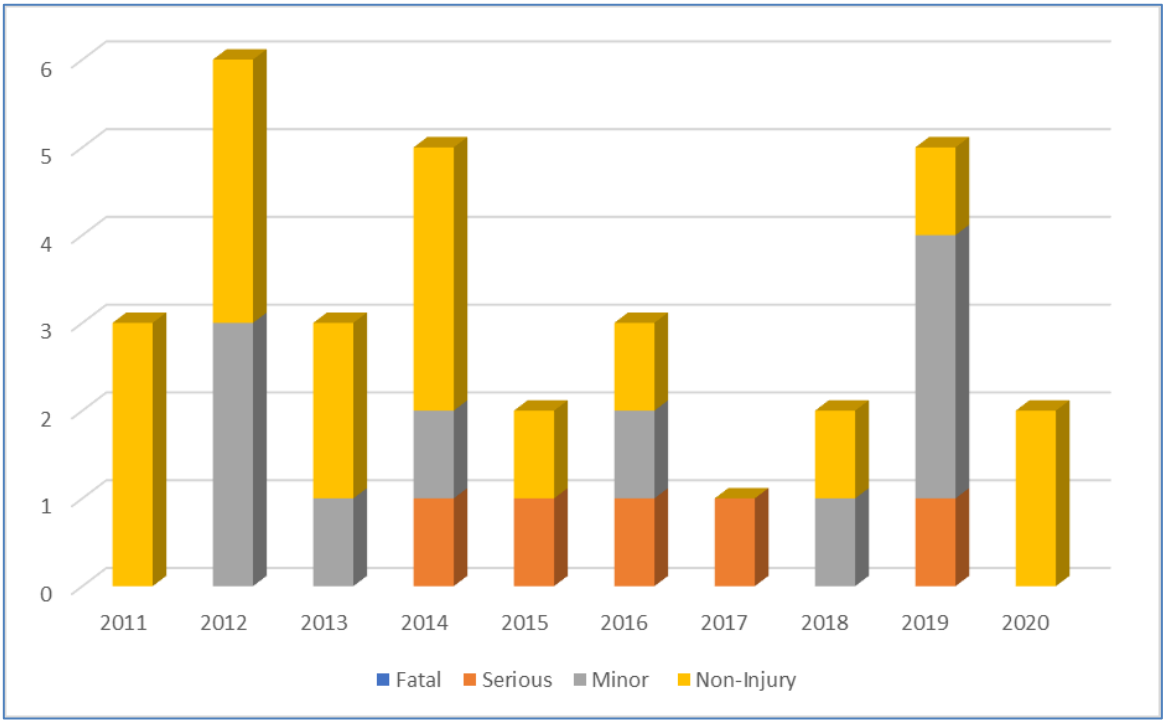


Figure 2-9: Total Recorded Crashes Per Year by Severity - 2011-2020 (Source: Waka Kotahi CAS)

2.5 Existing Turning Traffic Data

In 2019, traffic turning count surveys were undertaken at key intersections with the State Highway network as follows:

- Makirikiri Rd / SH1
- Wings Line / SH1
- Makirikiri Road / SH3
- Pukepapa Road / SH3

The turning movement survey was completed on 19th September 2019, which was considered a fair representation of a typical day as it was during school period with fine weather. The survey was undertaken between 6:30hrs and 18:15hrs and included classified turning counts and recorded general traffic, heavy vehicles, buses and cyclists.

Based on the survey, it is found that generally, the AM peak hours are 7:30– 8:30 at both Makirikiri Road and Pukepapa intersections and 8:30 – 9:30 at the Wings Line intersection. PM peak times on all intersections in the area was generally 16:30 – 17:30.

For the purposes of the assessment, the peak hours have been assumed to be 7:30-8:30hrs and 16:30-17:30hrs. This reflects the general operational hours of anticipated activities within the CDP site (see Section 3.1 of the report) and aligns with the record peak hour at the Makirikiri Road / SH1 intersection which is the intersection most likely to be impacted by additional traffic.

The following tables summarise the traffic survey results in vehicles per hour (vpd) for each of the key intersections during these AM and PM peak hours. This data has been used as a basis for the traffic modelling exercises (see Section 4 of the report). No cyclists were recorded at any of the intersections during the periods summarised in the tables below.

Table 2-3 Traffic survey results for Makirikiri Road / SH1 intersection (vehicles per hour)

INTERSECTION APPROACH	MOVEMENT	AM PEAK (07:30-08:30HRS)			PM PEAK (16:30-17:30HRS)		
		Light	Heavy	Total	Light	Heavy	Total
MAKIRIKIRI ROAD	Left	2	0	**2**	2	0	**2**
	Right	60	15	**75**	107	8	**115**
SH1 SOUTH	Left	77	16	**93**	73	9	**82**
	Through	162	41	**203**	188	42	**225**
SH1 NORTH	Through	92	36	**128**	152	32	**184**
	Right	2	2	**4**	0	1	**1**

Table 2-4 Traffic survey results for Wings Line / SH1 intersection (vehicles per hour)

INTERSECTION APPROACH	MOVEMENT	AM PEAK (07:30-08:30HRS)			PM PEAK (16:30-17:30HRS)		
		Light	Heavy	Total	Light	Heavy	Total
WINGS LINE	Left	3	1	**4**	2	1	**3**
	Right	13	2	**15**	13	5	**18**
SH1 SOUTH	Left	12	4	**16**	22	0	**22**
	Through	144	40	**184**	176	44	**220**
SH1 NORTH	Through	79	36	**115**	143	26	**169**
	Right	3	1	**4**	1	2	**3**

Table 2-5 Traffic survey results for Makirikiri Road / SH3 intersection (vehicles per hour)

INTERSECTION APPROACH	MOVEMENT	AM PEAK (07:30-08:30HRS)			PM PEAK (16:30-17:30HRS)		
		Light	Heavy	Total	Light	Heavy	Total
SH3 (WEST)	Left	14	4	**18**	23	2	**25**
	Through	219	31	**250**	259	50	**309**
MAKIRIKIRI ROAD	Left	1	0	**1**	0	0	**0**
	Right	24	2	**26**	15	2	**17**
SH3 (EAST)	Through	192	36	**228**	242	29	**271**
	Right	0	0	**0**	1	0	**1**

Table 2-6 Traffic survey results for Pukepapa Road / SH3 intersection (vehicles per hour)

INTERSECTION APPROACH	MOVEMENT	AM PEAK (07:30-08:30HRS)			PM PEAK (16:30-17:30HRS)		
		Light	Heavy	Total	Light	Heavy	Total
SH3 (WEST)	Left	6	1	**7**	2	1	**3**
	Through	231	26	**257**	260	47	**307**
PUKEPAPA ROAD	Left	69	9	**78**	69	7	**76**
	Right	0	1	**1**	2	2	**4**
SH3 (EAST)	Through	196	43	**239**	233	31	**264**
	Right	46	9	**55**	111	5	**116**

2.6 Background Traffic Growth

Both the future tested scenarios (with and without development) have assumed background traffic growth independent of the development of the site. This needs to be factored into future traffic estimates, as future traffic volumes on the State Highway network will not purely increase based on traffic generated by the proposed development.

From the most recent data extracted from the Waka Kotahi SH records, over the past five years, SH1 and SH3 have had an approximate baseline growth rate of 3% per annum (see Table 2-7).

Table 2-7: Historic Growth Rates – SH1 and SH3 (2015 to 2019)

SITE		HISTORIC VOLUMES					% HEAVY	ANNUAL GROWTH RATE
		2015	2016	2017	2018	2019		
STATE HIGHWAY 1	Mangaraupi	4,695	4,831	5,112	5,368	5,259	19.7	3.0%
	Greatford	6,049	6,344	6,678	6,830	6,875	16	3.0%
	Nth of Bulls	5,456	5,627	5,883	6,099	6,120	14.7	2.8%
STATE HIGHWAY 3	Makirikiri	6,094	6,486	6,615	6,502	6,698	10.8	1.8%
	Tutaenui Stream	7,186	7,283	7,617	7,826	8,041	9.2	2.7%

3 Proposed Development

The CDP for Marton Rail Hub includes multiple industrial sites, a new rail siding, internal roads, and commercial premises. Access into the proposed industrial site is solely from Makirikiri Road via two new intersections. No direct vehicle accesses onto the State Highway network are proposed with all access facilitated through existing intersections. The proposed activities on the site include:

- A weighbridge and security gate for access into the wider industrial zoned site
- Internal sealed roads for staff and transport trucks to access the sites
- Small business and service area
- Log yard and de-barker with pump station
- PLA and PHA plastics manufacturing plant (6 hectares / 60,000m2)
- Rail siding and container area
- Energy plant
- Food producer (20 hectares / 200,000m2).

The proposed layout of the site including internal roads and site locations are provided in Figure 3-1.

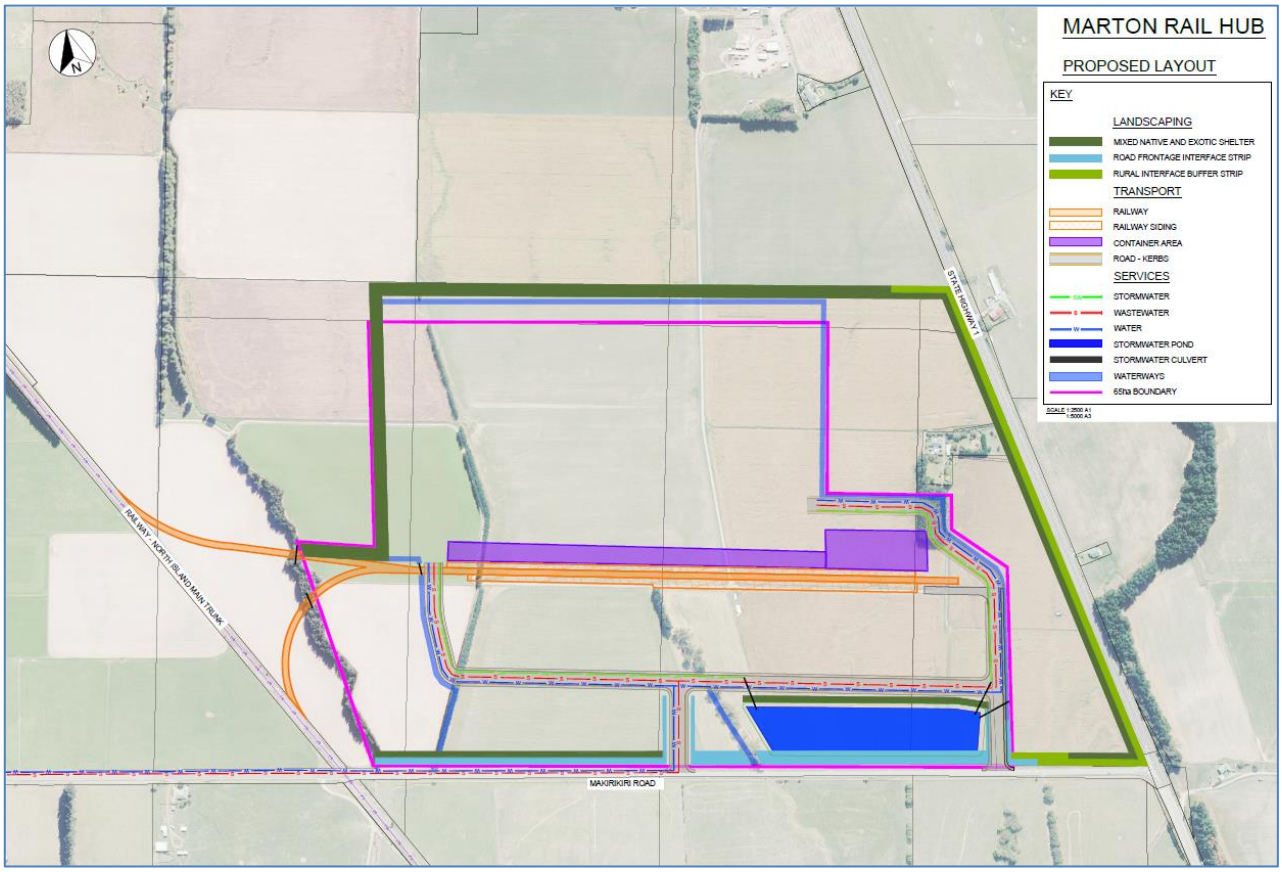


Figure 3-1: Comprehensive Development Plan - Concept Plan and Layout

The site and activities will operate 24 hours a day, 7 days a week.

The proposed activities and site layout are accurate at the time of this report. However, not all tenants within each site are confirmed. Therefore, the location of the proposed activities may change or the activities on site may change once tenants are signed up.

As outlined within the site layout plan for the CDP, as a basis for this TIA assessment the following transport infrastructure is expected:

- All vehicle access into the site will be enabled through two new connections to Makirikiri Road to the south;
- Connections to the railway line will be provided via rail sidings on the western extent of the site to support distribution of freight via the rail network; and
- Direct vehicle access from the proposed development onto the State Highway will not be provided, rather access between the site and the State Highway within the immediate vicinity of the proposed development will be maintained via the existing intersection at Makirikiri Road.

3.1 Trip Generation

The TIA developed to support the Industrial Plan Change (November 2019) provides an outline of the potential trip generation rates for a range of industrial land uses, based on several rates (employees, Gross Floor Area and Site Floor Area) from a range of different data sources[4].

As outlined above, the proposed CDP area comprises a mix of industrial activities based around the proposed Rail Hub, many of which are complementary to the log yard and associated debarking facility. The interdependence of activities within the hub means a higher than normal number of trips generated by land-uses are expected to be internal trips.

Given that these facilities are relatively unique land-uses and specific trip generation rates for sites of this nature are not provided within reference materials, the anticipated trip generation associated with the site has been developed on a "first principles" basis. The TIA has considered the trip generating potential of the proposed development on peak hour network operations, based on a combination of staff trips and commercial truck activities associated with the proposal.

3.1.1 Staff

Across the various activities within the CDP area, it is expected that the proposed facility will be staffed by 235 full time equivalent (FTE) staff on a typical weekday. The estimated staffing volumes and operating hours within each of the proposed activities is shown within Table 3-1. Although some activity is expected across the site during Saturdays, it is not anticipated that the site will be fully staffed during weekend periods.

Table 3-1: Estimated Staff Numbers within the Marton Rail Hub CDP

Site Component	Operating Hours	Staff	Shift Pattern
Food Producer	All Day - 7 Days a Week	200 FTE	Assumed three shifts across the day with 60% operating during the "Day Shift"
Log Yard	07:00hrs to 17:00hrs (6 days/week)	8 FTE Across Log Yard and De-barker Facility	Assume shift patterns as per operating hours
De-barker	07:00hrs to 17:00hrs (6 days/week)		
PHA Plastics Plant	All Day - 7 Days a Week	6 FTE Across PHA / PLA	Assumed full attendance during day shift
PLA and Plastics Manufacturing Plant	All Day - 7 Days a Week		
Biomass Energy Plant	All Day - 7 Days a Week	6 FTE	Assumed full attendance during day shift
Services Area[5]	7:00hrs to 18:00hrs – Monday to Saturday	10 FTE	Assume shift patterns as per operating hours
Container Area	7:00hrs to 18:00hrs (7 days/week)	5 FTE	Assume shift patterns as per operating hours
	Total Employees	**235 FTE**	-

[4] Including the NZ Trips and Parking Data Base (2016), the US ITE Trip Generation Manual (8th Edition) and the RTA Guide to Trip Generating Developments

[5] Activities within the services area include a refueling station, café/food, and diesel repair

As the site is located away from main urban areas alternative options for travel are limited (i.e. the site is not serviced by regular bus services), therefore this assessment has assumed that all staff will travel to the site by private vehicle. Using an estimated average of one vehicle per staff member, this translates to 470 vehicle movements a day for staff/employee movements (235 in, 235 out).

To establish a conservative estimate of staff traffic movements into and out of the site during the morning and evening peak hour, it has been assumed that the majority of staff arrival patterns will coincide with the AM peak hour, and the majority of staff depart during the PM peak hour. In reality, it is likely that some degree of "peak spreading" will occur, with staff travel to the site occurring outside of this timeframe. These the trip generation assumptions are particularly conservative given most staff within the site will operate in shifts.

As the largest employer within the CDP development area is expected to be the food producer area, with up to 200 FTE staff working on site once fully operational. This site is expected to operate 24 hours, 7 days a week; however, for the purposes of this assessment we have assumed the bulk of employees (60% or 120 FTE staff) work during the daytime shift. We have assumed that the "evening" and "night" shift staff will operate with 20% of the total staffing operation.

Due to the nature of the shift patterns within the site, some staff are expected to leave the facility at the end of the "night shift", whilst "day shift" employees are arriving during the morning peak hour. Conversely, during the PM peak hour, "evening shift" workers are expected to arrive whilst "day shift" workers are leaving the site.

Table 3-2: Assumed Peak Hour Staff Traffic Trip Generation within CDP Site

PEAK Period	AM Peak Hour	PM Peak Hour
Inward Trips	155 Trips	40 Trips
Outward Trips	40 Trips	155 Trips
Total Trip Generation	**195 Trips**	**195 Trips**

3.1.2 Commercial Activities

The anticipated volume of truck movements generated by the CDP has been determined from operational forecast provided by potential operators for various activities within the site. The proposed activities will generate commercial truck movements relating to both internal trips (i.e. between site activities) and external trips into or out of the CDP area, such as raw material inputs or products for transport to market.

The primary focus of the TIA relates to the wider network impacts of the proposed CDP development area; therefore, the trip generation rates used within this assessment outlines the anticipated external commercial vehicle trips generated into and out of the site. It should be noted that outward goods that are expected to travel to market by rail have not been included within the assessment, including:

- Raw log product for export;
- Processed / de-barked logs; and
- Refined plastic products developed from the PHA/PLA component of the CDA.

In addition to the above, the service area located within the site is expected to operate as an ancillary facility to the proposed activities within the CDA therefore is not expected to generate additional trips on the wider network.

Based on the above assumptions, the annual volume of inward and outward goods, and anticipated payloads of trucks delivering product to and from the CDA is outlined within Table 3-3. The analysis indicates the site will generate approximately 44,600 deliveries per annum.

Table 3-3: Estimated Commercial Good Trip Generation for Goods to Marton Rail Hub CDP by Activity

Activity	Delivery	Type	Annual Weight (Tonnes)	Days Per Year	Daily Volumes	Truck Capacity (Tonnes)	Daily Trips (Two-Way)	Assumed Daily Movements	
								Per Day	Peak Hour
Log Yard / Debarking Facility	Inward	Unprocessed Logs	522,000 Tonnes	290	1,800 Tonnes	28.5 Tonnes	65 Trips	130 vpd	20 vph
	Outward	N/A	-	-	-	-	-	-	-
Food Producer	Inward	Barley Waste	85,000 Tonnes	365	233 Tonnes	28.5 Tonnes	8 Trips	16 vpd	4 vph
		Wood Waste from Biomass	54,750 Tonnes	365	150 Tonnes	28.5 Tonnes	6 Trips	12 vpd	2 vph
	Outward	Waste to Landfill	160 Tonnes	365	0.5 Tonnes	28.5 Tonnes	< 1 Per Day	<1 Per Day	2 vph
		Produce	85,000 Tonnes	365	233 Tonnes	28.5 Tonnes	8 Trips	16 vpd	4 vph
Container Area	Inward	Malt Factory Containers	850 Containers	280	3 Containers	1 Container	4 Trips	8 vpd	2 vph
	Outward	N/A	-	-	-	-	-	-	
PHA/PLA Plastics	Inward	Dairy Waste Slurry	219,000 Tonnes	365	600 Tonnes	28.5 Tonnes	21 Trips	42 vpd	6 vph
	Outward	N/A	-	-	-	-	-	-	-
Biomass Energy Plant	Inward	Forestry Waste	8,760 Tonnes	24	24 Tonnes	3 Tonnes	8 Trips	16 vpd	4 vph
		Dairy Waste	18,250 Tonnes	50	50 Tonnes	3 Tonnes	17 Trips	34 vpd	6 vph
	Outward	N/A	-	-	-	-	-	-	
							Inward (50%)	137 vpd	25 vph
						TOTAL	Outward (50%)	137 vpd	25 vph
							Total	**274 vpd**	**50 vph**

On this basis, it is expected that a total of 137 trips, or 274 vehicle movements, could be generated by the proposed CDP per day, once the site is operational. In developing the estimated commercial peak hour trips movements based on all day truck movements, the following has been assumed:

- There is an even split between arrival and departure volumes patterns (50% in, 50% out) during both the peak period (AM and PM peak hour) and all-day arrival patterns; and
- A conservative estimate of 15% of all daily commercial vehicle trips generated by the CDP development occurs during the morning and evening peak periods.

Applying these ratios to the anticipated all day commercial truck traffic volumes, it is estimated that 50 truck movements (25 in, 25 out) could be generated by the CDP during the morning and evening peak periods during a typical weekday.

3.1.3 Total Trip Generation

From the trip generation rates provided above, it is estimated that a total of 50 truck movements (25 in, 25 out) could be generated during both peak hours, with a further 195 light vehicle movements during the AM peak (155 in, 40 out) and PM peak (40 in, 155 out) generated by staff operating within the site. A total of 274 truck movements (137 in, 137 out) and 470 light vehicle movements (235 in, 235 out) could be expected during a typical weekday. This would result in a total of 744 vehicle movements (372 in, 372 out) over the course of a typical weekday.

The forecast daily traffic volumes developed for the CDP area have been compared with daily trip generation rates outlined within various industry recognised sources (based on movements per employee). As shown within Table 3-4, the forecast daily trip generation rate of 744 vehicle movements aligns with the expected trip generation rates outlined within these recognised industry rates. It is therefore considered that the assumed trip generation rates from the CDP are appropriate for purposes of this assessment.

Table 3-4: Comparison of Trip Generation Rates

SOURCE	PER EMPLOYEE	BASIS	TOTAL TRIPS
ITE Trip Generation Handbook Version 8	3.34	Per Employee	785 Movements
RTA Guide to Traffic Generating Developments (2002)	2.30	Per Employee	540 Movements

3.2 Trip Distribution

In the absence of a wider strategic model for the region, to establish future volumes at each intersection traffic generated during peak periods have been allocated to the network based on assumptions developed within the Plan Change Traffic Impact Assessment, and through discussions with potential site occupiers. The traffic distribution to and from the CDP has been based on routes for light (staff) and heavy vehicles (commercial trucks) to access the site.

3.2.1 Staff trips

The Economic Impact Assessment (Visser, 2019) has been used as a basis for estimating trip distributions for employees generated by the site. This has been determined from existing working population within surrounding territorial local authorities (TLAs) adjusted to reflect more originating proportionately from Rangitikei.

A summary of the staff traffic distribution is provided in Table 3-5.

Table 3-5 Staff Traffic Distribution

STAFF ORIGIN (TLA)	DISTRIBUTION	DIRECTION	ROUTE CHOICE
Whanganui District	20%	North-West	• SH3 (West) and Makirikiri Road
Palmerston North City	37%	South-East	• SH1 (South) and Makirikiri Road
Manawatu District	11%	South-East	• SH1 (South) and Makirikiri Road
Rangitikei District	22%	South and North	• Makirikiri Road (West) – 50% or • SH1 (North) - 35% • SH1 (South) – 15%[6]
Horowhenua District	10%	South	• SH1 (South) and Makirikiri Road

3.2.2 Commercial Operational Trips

The trip origins and destinations for commercial traffic from the CDP area has been projected using forecast regional freight demands established through discussions with potential site operators. The resulting route choices for each activity within the development are presented within Table 3-6.

Table 3-6 Operational Traffic Distribution

ACTIVITY	DELIVERY	TYPE	SOURCE / DESTINATION	ROUTE CHOICE
Log Yard / Debarking Facility	Inward	Unprocessed Logs	Sourced from regional forests: Assumed 60% generated from Central Plateau and 40% Whanganui region	60% - SH1 North 40% - SH3/Makirikiri Road
Food Producer	Inward	Barley Waste	Sourced from the Malt Factory (Wings Line)	Wings Line -> SH1 North
		Wood Waste from Biomass	Sourced from regional forests: Assumed 60% generated from Central Plateau and 40% Whanganui region	60% - SH1 North 40% - SH3/Makirikiri Road
	Outward	Waste to Landfill	Assumed waste transported to landfill at Bonny Glen	To Makirikiri Road (west)
		Produce	Goods transported to markets within Palmerston North / Wellington	SH1 South
Container Area	Inward	Malt Factory Containers	Sourced from the Malt Factory (Wings Line)	Wings Line -> SH1 North
PHA/PLA Plastics	Inward	Dairy Waste Slurry	Sourced from regional dairy factories at Longburn Hawera, Pahiatua. Assumed 70% arrival from SH1 South, remainder Makirikiri Road (west).	70% - SH1 South 30% - Makirikiri Road (west)
Biomass Energy Plant	Inward	Forestry Waste	Sourced from regional forests: Assumed 60% generated from Central Plateau and 40% Whanganui region	60% - SH1 North 40% - SH3/Makirikiri Road
		Dairy Waste	Sourced from regional dairy factories at Longburn Hawera, Pahiatua. Assumed 70% arrival from SH1 South, remainder Makirikiri Road (west).	70% - SH1 South 30% - Makirikiri Road (west)

3.2.3 Trip Assignment

The resulting traffic flows based on the trip distribution outlined above were assigned to the network to provide future forecast turning demands at intersections for modelling purposes (see **Appendix B**). Two westbound scenarios have been tested: one with all westbound traffic using Makirikiri / SH3 intersection and one assuming all use the Pukepapa/SH3 intersection to travel between Whanganui and the site. The modelling results for these intersections will therefore present a "worst-case" scenario in terms of intersection performance for these sites.

[6] Based on distributional splits of population within the District

3.3 Intersection Modelling Scenarios

The traffic operation assessment considers the current and future capacity of the existing intersections with the strategic road network, taking into account the traffic distribution and development growth assumptions contained in the previous sections.

The intersections considered in the assessment include:

- Makirikiri Road / SH1
- Wings Line / SH1
- Pukepapa Road / SH3
- Makirikiri Road / SH3

The performance of each of the intersections has been modelled for both the AM and PM peak periods under the following scenarios:

Table 3-7: Traffic Modelling Scenarios Tested

SCENARIOS	DESCRIPTION	YEARS
Existing Scenario ("Base Case")	Assessment of intersection performance based historical turning count data with "no development" traffic generated from the CDP. Used as a base case for assessing future network operations under the "no development" and "with development" scenarios.	2019
Future Scenarios (No Development)	Assessment of future network performance, assuming no development has not taken place and therefore no development traffic is included. An underlying traffic growth of 3% p.a. on all intersection approaches is included based on SH1 traffic growth rates. The future modelling year scenarios were chosen as: • The 2024 scenario represents a timeframe within which the CDP site could be fully operational; and • The 2034 scenario provides a 10-year horizon on which to assess longer term intersection performance giving consideration to wider network growth.	2024, 2034
Future Scenarios (With Development)	Assessment of future network performance, assuming development as taken place. Includes development traffic and background traffic growth of 3% p.a. based on SH1 traffic growth rates.	2024, 2034

3.3.1 Forecast Intersection Volumes

Both the future scenarios with and without development have assumed background traffic growth independent of the site. This needs to be factored into future traffic estimates, as future traffic volumes will not purely increase based on traffic generated by the proposed development.

From the most recent data extracted from the Waka Kotahi State Highway records, (see Section 2.6), a 3% linear traffic growth per year has been assumed for all affected roads for future scenarios.

Based on the trip generation rates for the proposed CDP (outlined within Section 3.1) and the proposed trip distribution and assignment (outlined within Section 3.2), the forecast peak hour traffic turning volumes for development traffic for both peak hour periods are outlined in **Appendix B**. These future forecast traffic volumes have been used within the traffic modelling exercise to assess the performance of intersections under future network conditions (discussed in Section 4).

4 Assessment of Effects

This section of the report provides an outline of the assessment approach, the findings of the base modelling exercise and the expected performance of the network under future network conditions.

4.1 Intersection Assessment Approach

4.1.1 Modelling Tools

SIDRA v9.0 is an industry standard traffic modelling tool that is used to assess the performance of isolated intersections. Base traffic models (2019) for the AM peak and PM peak periods were developed using the recorded turning count data.

Future forecast traffic models were developed for each of the intersections using background traffic growth and proposed trip generation rates / distribution assumptions outlined within Section 3 of the report. The assumptions and observations used to develop the base model were applied within the future development scenarios to determine intersection performance under both weekday AM peak and PM peak conditions.

4.1.2 Modelling Assumptions

The following input assumptions have been made within the SIDRA model:

- **Peak Flow Factor**: Calibrated based on 2019 intersection turning count data;
- **Flow Scale (Constant)**: 100% on all models;
- **Lane Utilisation Factors**: Calculated by SIDRA;
- **Gap Acceptance**: As per SIDRA standard parameters for priority-controlled intersections;
- **Approach Speeds**: Approach and exit speeds based on existing posted speeds; and
- **Lane Widths**: Approach lane widths have been input as per existing arrangements.

4.1.3 Performance Criteria

The purpose of the modelling exercise is to identify the performance of intersections under future conditions, and identify if/where mitigation maybe required. The following performance criteria has been used to assess if/when network deficiencies may occur within the network:

- **Level of Service (LoS):** AUSTROADS Part 3 (Transport Studies and Analysis Methods) states "appropriate LoS for a particular jurisdiction will be determined in the context of the policies indicating what are regarded as acceptable levels". In lieu of specified LoS expectations for intersections within the Rangitikei District, generally recognized LoS performance in terms of delay have been adopted; these being where the average LoS (delay) on any approach arm is E or below, or an individual movement operates at a LoS F (see Table 4-1);

Table 4-1: Level of Service (LoS) Assessment Criteria – Average Delay (seconds)

LEVEL OF SERVICE	LOWER (SECS)	UPPER (SECS)
A	0	10
B	10.1	15
C	15.1	25
D	25.1	35
E	35.1	50
F	50.1+	

- **Degree of Saturation**[7]**:** Intersection reaches practical spare capacity (i.e. v/c ratio > 85%); and

[7] The degree of saturation is a ratio of traffic volume over capacity (v/c). It is measurement of the operating capacity of a roadway or intersection where the number of vehicles passing through is divided by the number of vehicles that could

- **Maximum Queue Lengths**: Queue lengths impede on the performance of other intersections.

A full set of modelling results is set out in **Appendix C** for all scenarios.

4.2 Modelling Results

4.2.1 Base Model Operations

Makirikiri Road / State Highway 1

The existing intersection layout modelled within SIDRA is shown within Figure 4-1. The model layout represents how traffic use the intersection, not necessarily lane marking. For example, Makirikiri Road at SH1 is wide and therefore traffic use it as a two-lane approach even though it is marked as a single lane approach. Due to limitations within the model, the left-turn movement from SH1 south has been modelled as a slip lane with a give-way function; however, the model priorities have been set so the movement opposes the right-turn movement from SH1 north, reflective of actual on-site operations.

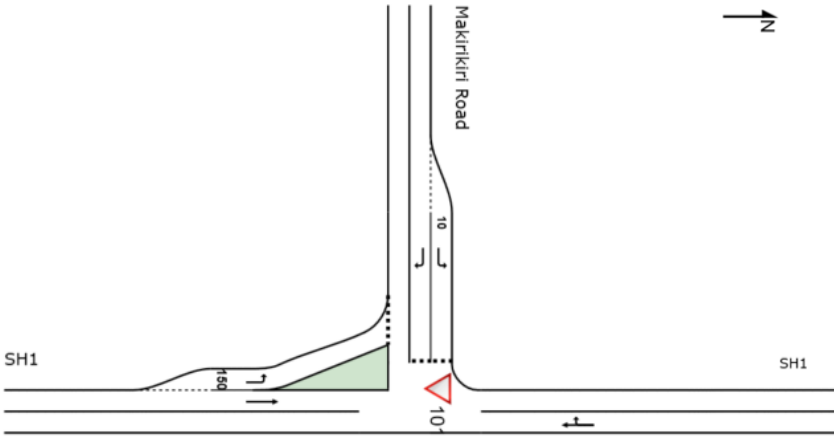


Figure 4-1: Makirikiri Road / SH1 SIDRA Intersection Layout

The results of the intersection performance under existing 2019 network conditions for both the AM and PM peak periods is shown within Table 4-2. The assessment indicates that the intersection operates well within practical spare capacity and with minor delay during both peak periods.

Table 4-2: Makirikiri Road / SH1– Base Model Intersection Performance (2019)

APPROACH		AM PEAK (07:30-08:30)				PM PEAK (16:30-17:30)			
		V/C	Average Delay (s)	Level of Service	Max Queue (m)	V/C	Average Delay (s)	Level of Service	Max Queue (m)
SH1 SOUTH	Left	0.059	8.8	LOS A	0.0	0.052	8.6	LOS A	0.0
	Through	0.124	0.0	LOS A	0.0	0.145	0.0	LOS A	0.0
	Approach	**0.124**	**2.8**	**LOS A**	**0.0**	**0.145**	**2.3**	**LOS A**	**0.0**
SH1 NORTH	Through	0.094	0.1	LOS A	0.6	0.122	0.1	LOS A	0.2
	Right	0.094	11.6	LOS B	0.6	0.122	14.9	LOS B	0.2
	Approach	**0.094**	**0.5**	**LOS A**	**0.6**	**0.122**	**0.1**	**LOS A**	**0.2**
MAKIRIKIRI ROAD	Left	0.002	8.5	LOS A	0.0	0.002	8.6	LOS A	0.0
	Right	0.113	10.3	LOS B	3.1	0.169	10.6	LOS B	4.3
	Approach	**0.113**	**10.3**	**LOS B**	**3.1**	**0.169**	**10.5**	**LOS B**	**4.3**

theoretically pass through when at capacity. If v/c is greater than 85%, it is considered that the approach is suffering from traffic congestion with queues of vehicles starting to form.

Wings Line / State Highway 1

The existing intersection layout modelled within SIDRA is shown within Figure 4-2. The model layout represents how traffic use the intersection, not necessarily lane marking. For example, Wings Line at SH1 is wide and therefore traffic use it as a two-lane approach even though it is marked as a single lane approach. Similar to the Makirikiri Road / SH1 model, the left-turn movement from SH1 south has been modelled as a slip lane with a give-way function; however, the model priorities have been set so the movement opposes the right-turn movement from SH1 north, reflective of actual on-site operations.

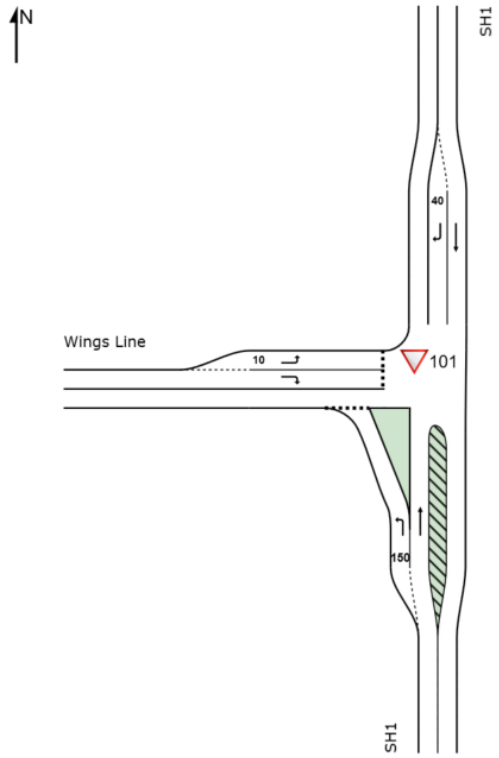


Figure 4-2: Wings Line / SH1 SIDRA Intersection Layout

The results of the intersection performance under existing 2019 network conditions for both the AM and PM peak periods is shown within Table 4-3. The assessment indicates that the intersection operates well within practical spare capacity and with minor delay during both peak periods.

Table 4-3: Wings Line / SH1– Base Model Intersection Performance (2019)

APPROACH		AM PEAK (07:30-08:30)				PM PEAK (16:30-17:30)			
		V/C	Average Delay (s)	Level of Service	Max Queue (m)	V/C	Average Delay (s)	Level of Service	Max Queue (m)
SH1 SOUTH	Left	0.011	8.9	LOS A	0.0	0.013	8.3	LOS A	0.0
	Through	0.121	0.0	LOS A	0.0	0.136	0.0	LOS A	0.0
	Approach	**0.121**	**0.7**	**LOS A**	**0.0**	**0.136**	**0.8**	**LOS A**	**0.0**
SH1 NORTH	Through	0.083	0.0	LOS A	0.0	0.108	0.0	LOS A	0.0
	Right	0.005	9.5	LOS A	0.2	0.005	11.4	LOS B	0.2
	Approach	**0.083**	**0.3**	**LOS A**	**0.2**	**0.108**	**0.2**	**LOS A**	**0.2**
WINGS LINE	Left	0.004	8.9	LOS A	0.1	0.003	9.2	LOS A	0.1
	Right	0.026	10.6	LOS B	0.7	0.035	12.1	LOS B	1.1
	Approach	**0.026**	**10.2**	**LOS B**	**0.7**	**0.035**	**11.7**	**LOS B**	**1.1**

Makirikiri Road / SH3

The existing intersection layout modelled within SIDRA is shown within Figure 4-3. The model layout represents how traffic use the intersection, not necessarily lane marking. For example, Makirikiri Road approach at SH3 is wide and therefore traffic use it as a two-lane approach even though it is marked as a single lane approach.

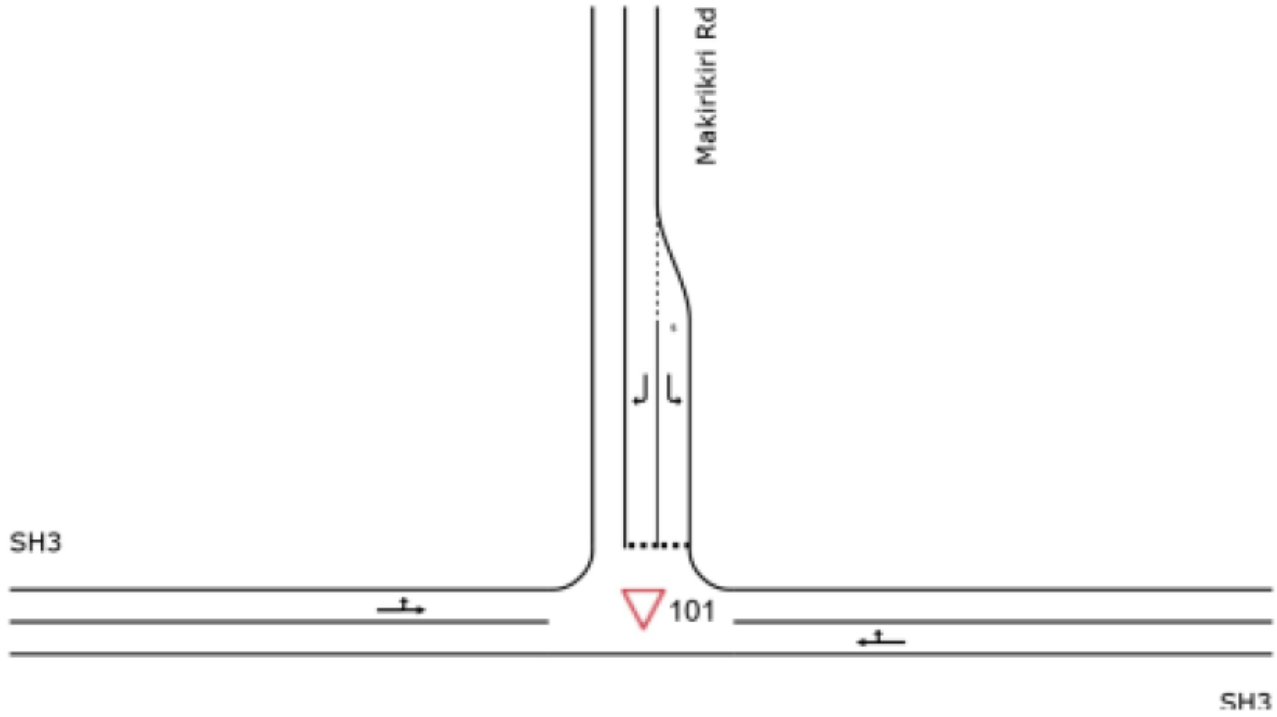


Figure 4-3: Makirikiri Road / SH3 SIDRA Intersection Layout

The results of the intersection performance under existing 2019 network conditions for both the AM and PM peak periods is shown within Table 4-4. The assessment indicates that the intersection operates well within practical spare capacity and with minor delay during both peak periods.

Table 4-4: Makirikiri Road / SH3– Base Model Intersection Performance (2019)

APPROACH		AM PEAK (07:30-08:30)				PM PEAK (16:30-17:30)			
		V/C	Average Delay (s)	Level of Service	Max Queue (m)	V/C	Average Delay (s)	Level of Service	Max Queue (m)
EAST SH3	Through	0.146	0.0	LOS A	0.2	0.156	0.0	LOS A	0.1
	Right	0.146	10.8	LOS B	0.2	0.156	9.3	LOS A	0.1
	Approach	**0.146**	**0.1**	**LOS A**	**0.2**	**0.156**	**0.0**	**LOS A**	**0.1**
MAKIRIKIRI RD	Left	0.001	8.6	LOS A	0.0	0.001	8.9	LOS A	0.0
	Right	0.041	10.3	LOS B	1.0	0.040	11.4	LOS B	1.0
	Approach	**0.041**	**10.2**	**LOS B**	**1.0**	**0.040**	**11.2**	**LOS B**	**1.0**
WEST SH3	Left	0.156	8.4	LOS A	0.0	0.204	8.1	LOS A	0.0
	Right	0.156	0.0	LOS A	0.0	0.204	0.0	LOS A	0.0
	Approach	**0.156**	**0.6**	**LOS A**	**0.0**	**0.204**	**0.6**	**LOS A**	**0.0**

Pukepapa Road / SH3

The existing intersection layout modelled within SIDRA is shown within Figure 4-4. The model layout represents how traffic use the intersection, not necessarily lane marking. For example, Pukepapa Road approach at SH3 is wide and therefore traffic use it as a two-lane approach even though it is marked as a single lane approach.

The results of the intersection performance under existing 2019 network conditions for both the AM and PM peak periods is shown within Table 4-5. The assessment indicates that the intersection operates well within practical spare capacity and with minor delay during both peak periods.

Table 4-5: Pukepapa Road / SH3– Base Model Intersection Performance (2019)

APPROACH		AM PEAK (07:30-08:30)				PM PEAK (16:30-17:30)			
		V/C	Average Delay (s)	Level of Service	Max Queue (m)	V/C	Average Delay (s)	Level of Service	Max Queue (m)
EAST SH3	Through	0.151	0.0	LOS A	0.0	0.162	0.0	LOS A	0.0
	Right	0.063	9.6	LOS A	2.0	0.135	9.7	LOS A	3.9
	Approach	**0.151**	**1.8**	**LOS A**	**2.0**	**0.162**	**3.0**	**LOS A**	**3.9**
PUKEPAPA RD	Left	0.104	9.6	LOS A	2.9	0.102	10.0	LOS B	2.8
	Right[8]	-	-	-	0.3	0.022	24.3	LOS C	0.7
	Approach	**0.104**	**9.8**	**LOS A**	**2.9**	**0.102**	**10.8**	**LOS B**	**2.8**
WEST SH3	Left	0.005	8.2	LOS A	0.0	0.002	8.7	LOS A	0.0
	Right	0.153	0.0	LOS A	0.0	0.194	0.0	LOS A	0.0
	Approach	**0.153**	**0.2**	**LOS A**	**0.0**	**0.194**	**0.1**	**LOS A**	**0.0**

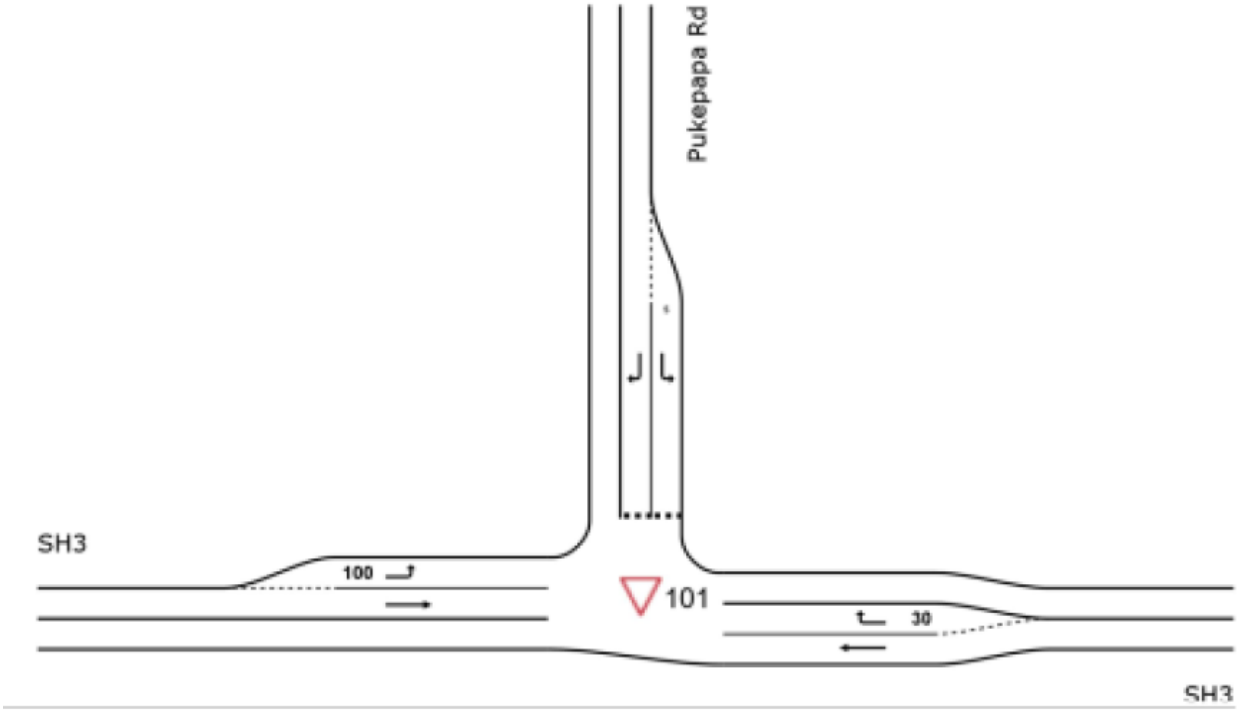


Figure 4-4: Pukepapa Road / SH3 SIDRA Intersection Layout

[8] **Note**: No right-turning movements were observed from Pukepapa Road in the AM peak hour

4.2.2 Future Modelling Scenarios

The capacity and performance of the key intersections surrounding the site has been modelled for the future scenarios as discussed in the previous section. The LoS predictions for each intersection established from the outcomes of the modelling under each scenario are summarised Table 4-6.

Table 4-6: Summary of Modelling Results for Key Intersections

Scenario	Base Case:		2024 Volume +		2024 Volume +		2034 Volume +		2034 Volume +	
	2019 - Existing		No Development		With CDP Development		No Development		With CDP Development	
	AM	PM	AM	PM	AM	AM	AM	PM	AM	PM
Makirikiri Road / SH1										
SH1 (North)	A	A	A	A	A	A	A	A	A	A
Makirikiri Road	B	B	B	B	B	C	B	B	C	D
SH1 (South)	A	A	A	A	A	A	A	A	A	A
Wings Line / SH1										
SH1 (North)	A	A	A	A	A	A	A	A	A	A
Wings Line	B	B	B	B	B	B	B	B	B	C
SH1 (South)	A	A	A	A	A	A	A	A	A	A
Makirikiri Road / SH3										
SH3 (East)	A	A	A	A	A	A	A	A	A	A
Makirikiri Road	B	B	B	B	B	B	B	B	B	C
SH3 (West)	A	A	A	A	A	A	A	A	A	A
Pukepapa Road / SH3										
SH3 (East)	A	A	A	A	A	A	A	A	A	A
Pukepapa Road	A	B	B	B	B	C	B	B	B	C
SH3 (West)	A	A	A	A	A	A	A	A	A	A

The following provides detail on the expected performance of each of the four intersections, under each development scenario.

Makirikiri Road / SH1

The modelling shows that the intersection operates well within acceptable operability in existing conditions within all "no development" modelling scenarios. Growth in general traffic volumes on the State Highway will slightly increase delay for right turning vehicles into and from Makirikiri Road; however, the long-term modelling scenario (2034 + no development traffic) indicates all approaches will operate with a minimum LoS B during both peak periods.

The "with development" model developed for the Makirikiri Road / SH1 intersection has been developed with a right-turn bay provided from SH1 (North) to support turning movements into Makirikiri Road. This is warranted to support safety at the intersection based on forecast turning movements within the future "with development" scenarios (discussed further in Section 4.5.1). The modelling layout used within the "with development" scenarios is shown Figure 4-5 overleaf.

With the inclusion of traffic from the CDP development, a growth in right-turning movements into and from Makirikiri Road is expected, in particular right-turning volumes from Makirikiri Road onto SH1. The model indicates under the long-term modelling scenario (2034 + development traffic) right-turning movements from Makirikiri Road would operate with a LoS D. The Makirikiri Road intersection approach is also expected to operate with a v/c ratio of 0.76.

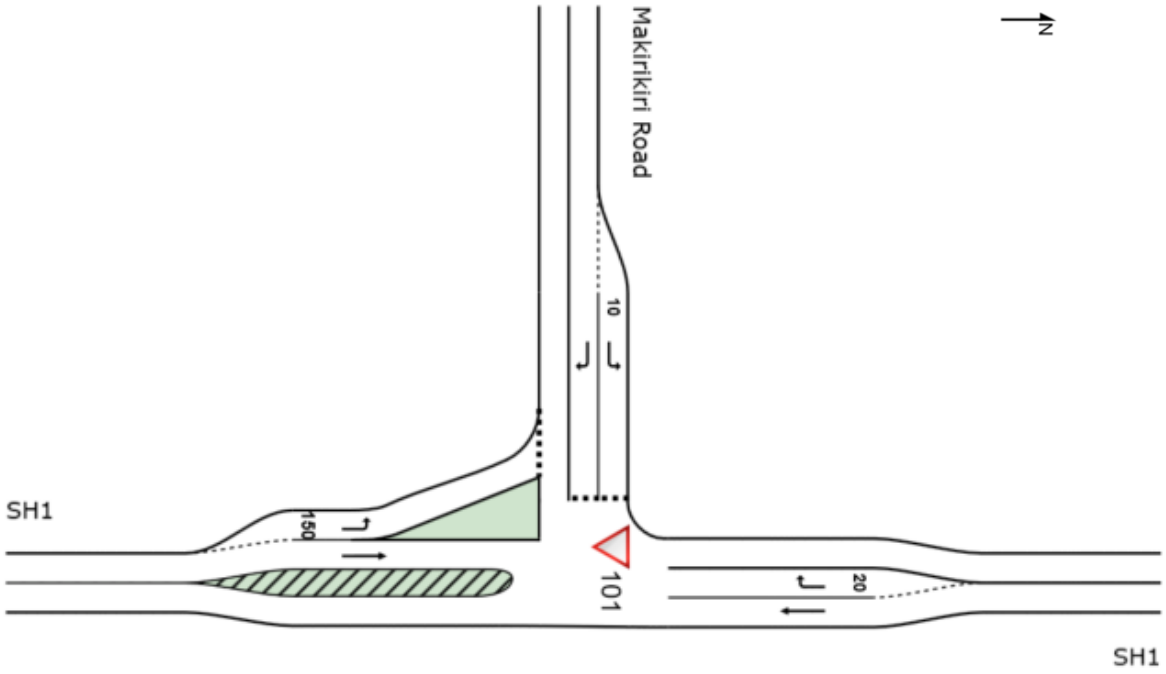


Figure 4-5: SH1 / Makirikiri Road Intersection Layout Modelled in "With Development" Scenarios

Whilst the results of the model indicate the intersection will operate within generally accepted levels of performance levels up to 2034, it is likely that upgrades will need to be considered to support right-turning movements from Makirikiri Road soon after this. This is expected to require a more significant change of form to improve the LoS, such as a seagull type treatment, roundabout, or signals.

Wings Line / SH1

The modelling shows that the intersection operates well within acceptable operability under existing conditions within all "no development" modelling scenarios. Some additional delay could be expected for right-turning traffic from Wings Line during the PM peak period as a result of background growth on SH1, with modelling indicating the movement would operate with a LoS C (average delay 15.6 seconds).

The traffic modelling indicates that within the long-term scenario (2034 + development traffic), some additional delay could be experienced for right-turn movements at the intersection (average delay 17.4 seconds during the PM peak period); however, the intersection is generally expected to operate well within capacity (v/c ratio of 0.185 and 0.210 during the AM and PM peak periods respectively). Therefore, the modelling indicates the intersection will operate within the performance criteria with anticipated traffic growth resulting from the CDP development.

Performance of SH3 Intersections

The likely route choices for westbound vehicles heading towards Whanganui have the option of travelling via the primary roads of Makirikiri Road or Pukepapa Road to access SH3. The likely split of traffic accessing SH3 via these intersections is unknown, therefore the TIA has conservatively assessed the potential impacts of traffic growth on these intersections. Therefore, for each of the intersections we have developed a "worst case" scenario where all SH3 bound traffic use Pukepapa Road or Makirikiri Road.

- *Makirikiri Road / SH3*

The modelling shows that the intersection operates well within acceptable levels of operability under existing conditions within all "no development" modelling scenarios. Makirikiri Road is the only approach that is not an A in the long-term modelling scenario (2034 + no development) operating with a LoS B during both peak periods.

With development traffic the intersection will operate with LOS C on Makirikiri Road during the PM peak period (with an average of 17.1 seconds delay). This is due to an increase in right-turning traffic turning out of Makirikiri Road and future growth on SH3 causing delays for this movement; however, this is only a slight increase on the 15 seconds delay for the same movement recorded within the "no development" scenario. Overall, the modelling indicates the intersection is expected to operate within acceptable levels of capacity and delay within all "with development" scenarios.

- *Pukepapa Road / SH3*

The modelling shows that the intersection operates within acceptable operability in existing conditions within all "no development" modelling scenarios. Pukepapa Road is the only approach that does not have a LoS A in the long-term modelling scenario (2034 + no development) operating with an overall LoS B.

It is also noted that the right-turn movements from Pukepapa Road are expected to operate at a LoS E during both periods. This is primarily due to the heavy left-turn demand present at the intersection, and the lack of a dedicated turning facility to enable these vehicles to bypass queued traffic. It is recognised that these movements form a relatively low proportion of intersection access demands, with less than 7 movements recorded in the PM peak hour.

If the development traffic is included, the overall level of service for the Pukepapa Road approach is expected to drop to LoS C in the PM peak period; however, the performance for criterial right-turning traffic from the Pukepapa Road approach is not expected to drop below E (average delay 46.8 seconds); however, the increased right turn traffic flows will increase the v/c from 0.186 to 0.519. This would still operate within acceptable levels of capacity (threshold of 0.850). Overall, the modelling indicates intersection is expected to operate within acceptable levels of capacity and delay within all "with development" scenarios.

4.3 Site Access

All vehicles will access the CDP site will be enabled through two new intersections onto Makirikiri Road between SH1 and the North Island Main Trunk railway crossing (as shown in Figure 4-6). Both accesses from the CDP will form the minor approach arms.

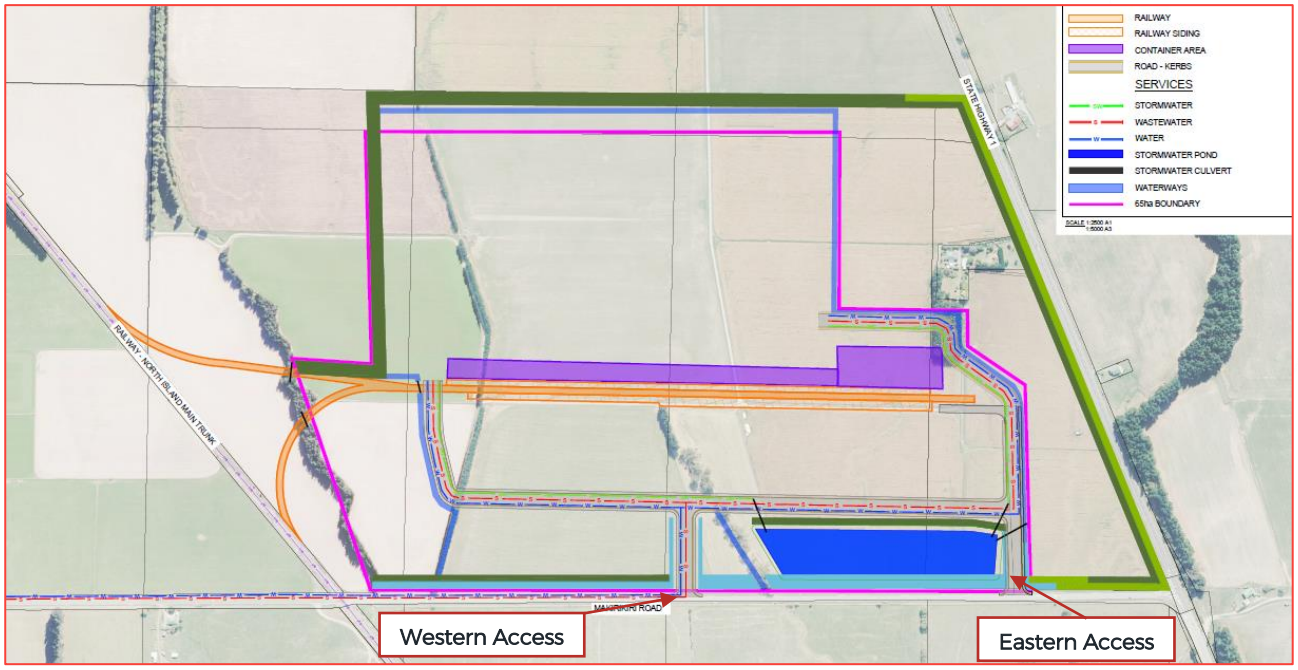


Figure 4-6: Proposed Site Access Locations onto Makirikiri Road

The proposed locations of the vehicle accesses as indicated within the CDP site layout plan are:

- **Western Access**: Located at Makirikiri Road RP 0.750.
- **Eastern Access**: Located at Makirikiri Road RP 0.250.

Both site accesses will support two-way traffic movements into and from the site; however, under the intended site arrangements are for the western access to primarily accommodate heavy vehicle movements, whilst the eastern access will support general site access. The western vehicle access will include a weighbridge to weigh commercial vehicles and their contents when entering and leaving the CDP area.

In considering vehicle access to a site, it is important that:

- Adequate sight distance and intersection spacing is provided; and
- The access is designed to ensure safe and efficient movement on the road network.

4.3.1 Sight Distance and Access Spacing

The Makirikiri Road alignment is generally straight and flat on the western extent of the site, with limited sightline constraints. On the eastern extent of the corridor, the existing vertical alignment of the road corridor has a series of crest and sag curves located between the two proposed vehicle accesses.

Within the vicinity of the Marton Rail Hub CDP, the nearest intersection to the east is SH1 (RP0.00 and Goldings Line (RP2.400) to the west. Goldings Line is sufficiently far to the west of the development to be a design constraint.

For the purposes of assessing the suitability of proposed access locations, the following reference documents have been used:

- Section B9 of the RDC District Plan (Transportation); and

- RDC Engineering Standards

Rule B9.4 Road Intersection states "road intersections must be designed in accordance with the standards set out in Tables B9.3 and B9.4, except for private farm and plantation forestry* roads^ which do not intersect with a public road." The requirements of Rule B9.4 at various posted speed limits are shown in Table 4-7 (note, no specific requirements are outlined for an 80km/hr posted speed). An assessment of the sight line distances from each of the accesses at various posted speed limits is also shown within Figure 4-7 to Figure 4-8.

Table 4-7: Intersection Spacing and Sight Distance Assessment Criteria

DESIGN CONSIDERATION	POSTED SPEED	MINIMUM REQ.	WESTERN ACCESS 1 (RP 0.750)	EASTERN ACCESS 2 (RP 0.250)
Intersection Separation Distances	70km/hr	220m	**Complies** Exceeds separation distances to the Eastern Access and Goldings Line intersections.	**Complies** Exceeds separation distances to the western access and SH1 intersections.
	100km/hr	800m	**Does not comply** The Eastern Access is located 460m to the east, less than the requirement minimum distance.	**Does not comply** SH1 is located 240m to the east and the Western Access is located approximately 510m to the west.
Sightlines for Road Intersections	70km/hr	130m	**Complies** Minimum sight distances are achieved in both directions	**Complies** Minimum sight distances are achieved in both directions
	100km/hr	250m	**Complies** Minimum sight distances are achieved in both directions	**Does not Comply** Minimum sight distances are achieved to the east; however, sightlines to the west are restricted by sag curves

Based on a posted speed limit of 100km/hr, the proposed arrangement would fail to meet the intersection separation distances; however, the proposed arrangement would adhere to the desired minimum intersection separation requirements at a posted speed limit of 70km/hr or less.

As shown in Figure 4-7, the Western Access would meet the desired sight line distances in both directions at 100km/hr; however, the Eastern Access would also fail to meet the minimum sightline requirements to the west at a 100km/hr speed limit due to the presence of a sag curve on the vertical alignment of the road between RP. 0.340 and RP 0 .510 (see Figure 4-8).

At a reduced speed limit of 70km/hr or below, the proposed intersection arrangement would achieve the minimum intersection spacing and sightline requirements.

To support adequate sightlines and intersection separation distances for proposed accesses into the CDP, it is recommended that:

- The posted speed limit on Makirikiri Road is reduced to 70km/hr or lower; and
- Improvements to the vertical road alignment are considered between RP 0.340 and RP0.510 to maximise sightlines to the west from the proposed Eastern Access road.

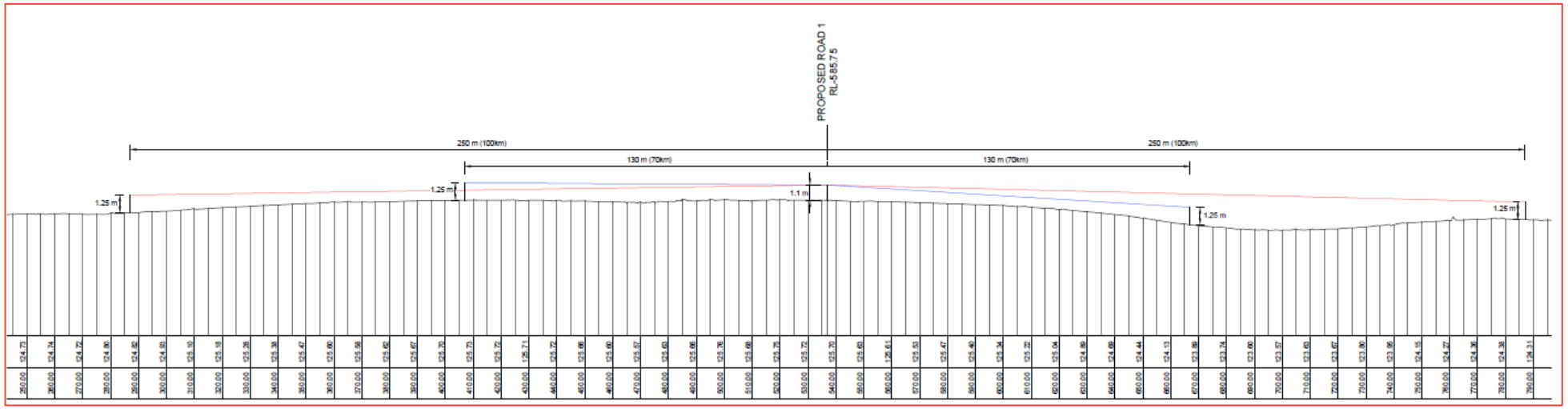


Figure 4-7: Western Access - Assessment of Sightlines at Various Posted Speed Limits

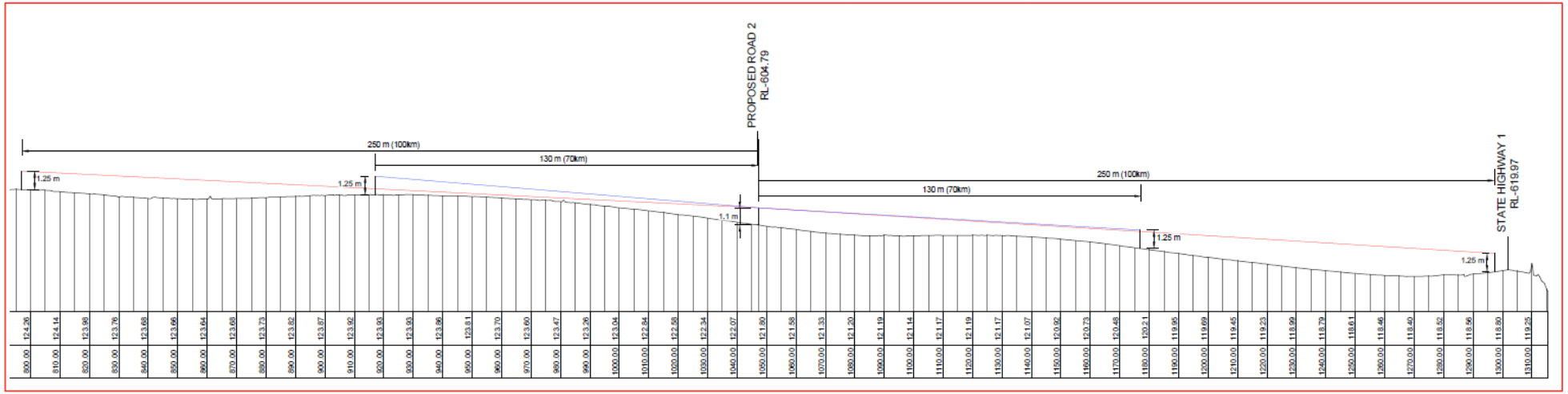


Figure 4-8: Eastern Access - Assessment of Sightlines at Various Posted Speed Limits

4.3.2 Turning Bay Requirements

Austroads Guide to Traffic Management: Part 6 (2020)[9] provides guidance on the warrant process for turning bays at intersections. The warrants are also dependent on traffic volumes and posted speed limits. At present the posted speed limit is 100km/hr; however, as recommended above, a reduction in speed limit to 70km/hr or below would be required to support proposed intersection locations and spacings. A reduction in the posted speed limit would increase the thresholds required for turning bay provisions at the intersections (i.e. a higher right turning demands would be required before a turning bay is needed).

The indicative volumes (Q^L and Q^R) (as shown in Figure 4-10) for turn treatment requirements were obtained forecast access demands, and the Major Road traffic volume parameters (Q^M,) is extracted from the survey data. Based on these parameters, the turning facility requirements from Austroads (as indicated in Figure 4-9) was used to assess the need for turning bays at each of the accesses. The outcome of the turning bay warrants is shown within Table 4-8.

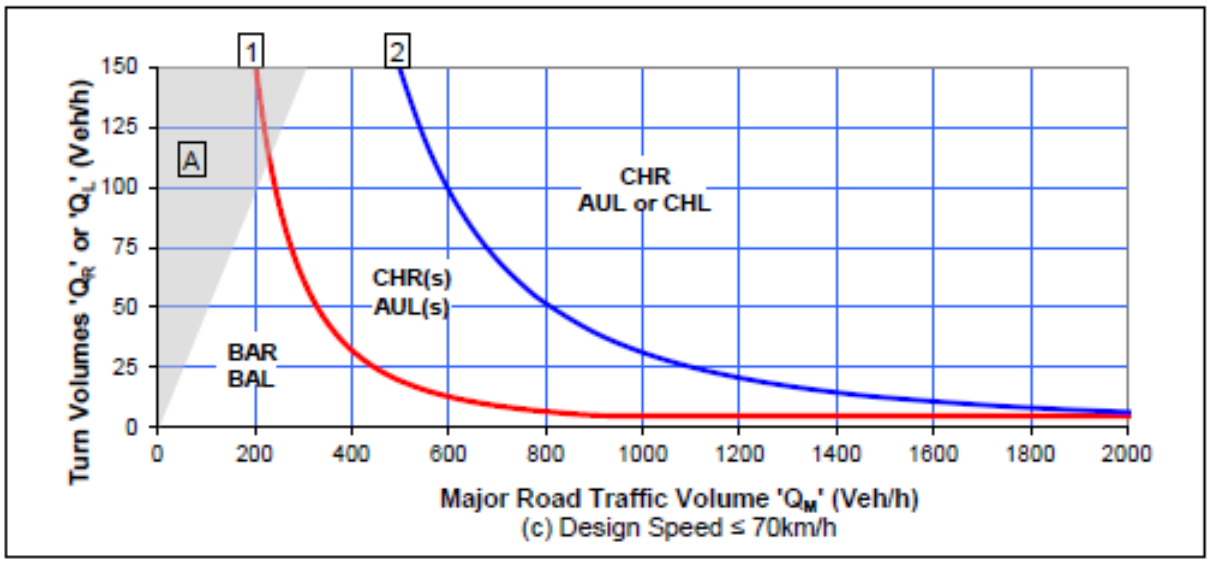
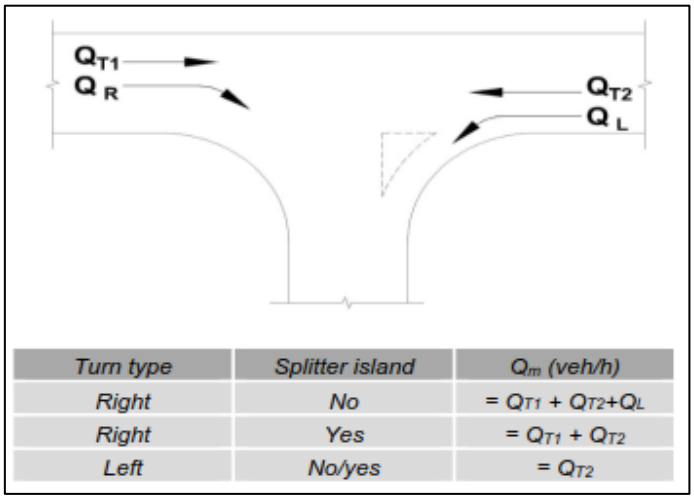


Figure 4-9. Warrants for Turn Treatments on the Major Road at Unsignalised Intersections



Turn type	Splitter island	Q_m (veh/h)
Right	No	= Q_{T1} + Q_{T2}+Q_L
Right	Yes	= Q_{T1} + Q_{T2}
Left	No/yes	= Q_{T2}

Figure 4-10. Calculation of the Major Road Traffic Volume Parameter, Q_M

[9] Figure 3.25(c)

Table 4-8. Turn Treatment Assessment at the Proposed Access Road for Marton Rail Hub

MAJOR ROAD	EXISTING LAYOUT	THROUGH MOVEMENT (Q^M)	TURN MOVEMENT (Q^L OR Q^R)	TURN TREATMENT REQUIRED
AM Peak Hour (7:30-8:30hrs)				
Eastern Access	Basic Right	Q^M = 256	Q^R = 107	Yes: CHR (S)
	Basic Left	Q^M = 94	Q^L = 48	No
Western Access	Basic Right	Q^M = 242	Q^R = 17	No
	Basic Left	Q^M = 125	Q^L = 8	No
PM Peak Hour (16:30-17:30hrs)				
Eastern Access	Basic Right	Q^M = 246	Q^R = 28	No
	Basic Left	Q^M = 134	Q^L = 12	No
Western Access	Basic Right	Q^M = 268	Q^R = 17	No
	Basic Left	Q^M = 129	Q^L = 8	No

The assessment indicates that a dedicated short channelised right turn bay will be required at the Eastern Access to support high access demands during the morning peak hour. An auxiliary lane to support left-turning movements into the access is not warranted at this location.

The assessment indicates turning bays are not required to support left or right turn access demands into the Western Access; however, it is recommended that the access is designed to comply with Waka Kotahi's Diagram E[10] (as shown in Figure 4-11). This would include widening of the existing road seal to enable light vehicles to pass turning traffic accessing the site, and the provision of a suitable bell-mouth radius to accommodate the swept path of the largest vehicles expected to access the site.

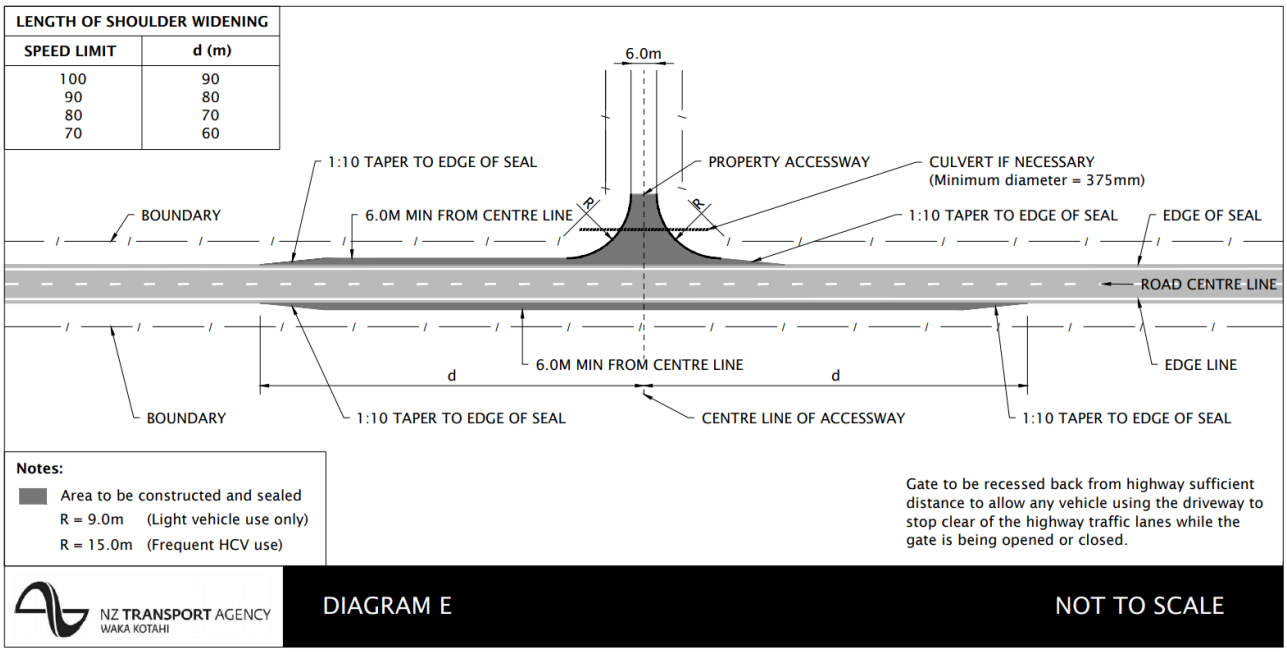


Figure 4-11: Accessway Formation Standards – NZTA (Waka Kotahi) Planning Policy Manual

[10] NZTA Planning Policy Manual (No: SP/M/001) version 1: Appendix 5B – Accessway standards and guidelines - Effective from 1 August 2007

4.4 Internal Vehicle Arrangements

The proposed internal road network is shown within the site layout plan (see **Appendix A**).

Although cross sections and designs for the internal road network have not been assessed as part of this Traffic Impact Assessment, it is expected that the internal network within the proposed development will be designed and constructed to conform with its intended network hierarchy and adhere with the relevant requirements of the Rangitikei District Plan[11] and appropriate subdivision engineering standards[12]. This includes (but is not limited to) vehicle crossing spacings, sight distance, and parking requirements. The proposed road layout arrangements will enable all traffic entering and exiting the site to do so in a forward motion.

4.4.1 Weigh Station Location

The Western Access is proposed to accommodate all heavy vehicle movements associated with the site. The proposed concept plan outlines two potential options for providing a weigh station; one inside the proposed CDP development to the north of the western vehicle access, and an alternative location on the midblock location of Makirikiri Road between the Western and Eastern site accesses.

The proposed location on the midblock of Makirikiri Road is not recommended as:

- The section of Makirikiri Road between the Western and Eastern Accesses has several crest and sag curves which limits forward visibility of heavy vehicles remerging with Makirikiri Road once they have passed through the weigh station, creating a potential safety issue; and
- Locating the weigh station on Makirikiri Road would only capture vehicles travelling in one direction, unless facilities are provided on both sides of the road. This arrangement would require heavy vehicles arriving from the west to perform U-turn manoeuvres on Makirikiri Road to backtrack to the Western Access, creating additional potential conflicts with opposing traffic.

The preferred option is to provide a weigh station facility within the proposed CDP, as this option would minimise potential conflicts with through traffic on Makirikiri Road. To reduce the potential for commercial vehicles queueing back onto Makirikiri Road when using the proposed weigh station, it is recommended within the detailed design that:

- The weigh station and accompanying gates are located at the far northern extent of the access road to maximise stacking space within the internal network; and
- Additional lanes are provided adjacent to the weight station to allow vehicles that do not require the use of the weigh station to bypass any queued traffic.

4.4.2 Signage and Wayfinding

Signage at the facility should be implemented and maintained to ensure that all site directions, traffic control measures and safety instructions are clear and legible to facility users. Implementing a clear and concise signage strategy will improve site accessibility, reduce indecision for drivers unfamiliar with the site as well as support safe and efficient circulation within the facility. In addition to signage, the provision of suitable lighting within the site will enable the safe operations outside of daylight operations.

Additional wayfinding or warning signage should be provided for pedestrians on any key desire lines or conflict areas within the site.

Information that may be provided on internal site signs include:

- Opening hours of the site;

[11] https://www.rangitikei.govt.nz/files/general/District-Plan-Operative-Plan/Rangitikei-District-Plan-Section-B-Rules-August-2018.pdf
[12] https://www.rangitikei.govt.nz/files/general/District-Plan-Maps/RDC-Subdivision-and-Land-Development-Addendum-Revised-version-March-2017.pdf

- Traffic control (signing and road markings)
- Directions to unloading and loading areas;
- Hazards that maybe present on site;
- Restricted or limited access areas; and
- Weight or height restrictions (should they apply).

4.4.3 On-Site Parking and Loading Provisions

In August 2020, new government policy[13] came into effect stating that developments are no longer required to provide minimum parking supply (other than for accessible carparks) for new development. Prior to this, local council planning regulations determined the number of car parking spaces a development must provide. Although these provisions have not been removed from the District Plan at present, the National Policy Statement (NPS-UD) states all local authorities are expected to remove requirements for minimum parking provisions no later than February 2020.

Given the high-level nature of the CDP, specific parking arrangements for individual sites within the proposed development area; however, at a subdivision consent stage, developers will be required to demonstrate sufficient parking is provided within each of the components of the CDP area to mitigate any adverse impact on the safe and efficient operation of the road network.

All parking spaces within the CDP should be designed to adhere with the parking space width dimensions and manoeuvring requirements outlined within Rule 9.10 of the District Plan, and suitably sealed and demarcated appropriately.

In addition to staff parking, any commercial or industrial activity established on site must make provision for a minimum of one off-street loading/ unloading space, designed to the required dimensions and with sufficient manoeuvring area to support a 90th percentile two-axle truck (Rule B9.9).

4.5 Safety Assessment

The NZ Transport Agency's Crash Analysis System (CAS) has been reviewed to determine the existing crash history at all four intersections assessed within the modelling component of the TIA, as well as the Makirikiri Road / Wellington Road. A high-level crash risk assessment based on the NZ Transport Agency's Crash Estimation Compendium (CEC)[14] has been undertaken to compare the existing injury crash rate at the intersection, prior to the development of the site, and the predicted injury crash rate (A^T) when the development is completed.

The full development traffic has been overlain onto the existing AADT to allow a direct comparison to better understand the impact of the development traffic on the safety of the intersection. Summary sheets of both the baseline and width development assessments are provided in **Appendix D**.

It should be noted the scenarios tested within the CEC assessment have assumed all westbound traffic would be either Makirikiri Road or Pukepapa Road to access SH3. In reality, demand is likely to be spread across both roads, therefore the CEC findings represent a "worst case scenario" in terms of crash prediction outcomes.

The suitability of the existing intersections in terms of minimum sight distances have also been assessed. The minimum sight distance for a 100km/hr posted speed limit is 282m according to the

[13] National Policy Statement on Urban Development, 2020

[14] According to crash prediction method in the Crash Estimation Compendium section 7.5 High-speed priority T-junctions ≥ 80 km/h

NZTA (Waka Kotahi) planning policy manual[15]. For the Wellington Road / Makirikiri Road intersection, the sightline requirements for local roads outlined in Section 4.3.1 have been referenced.

4.5.1 Makirikiri Road / SH1 Intersection

The sight distance from Makirikiri Road to SH1 in both directions is greater than 300m, so exceeds Waka Kotahi standards; however, the presence of vehicles on the left turn slip lane onto Makirikiri Road can impact on clear sightlines of northbound through traffic on SH1 (see Figure 4-12).

Figure 4-12: View from Makirikiri Road / SH1 Intersection to the South (Left) and North (Right)

The NZ Transport Agency's CAS database has recorded four injury crashes at the intersection in the last 10 years, with one serious injury and three minor injury crashes. Of the recorded crashes:

- Two of the crashes involved rear-end collisions with vehicles performing right-turn manoeuvres from SH1 onto Makirikiri Road. The serious crash involved a car that had pulled left off the State Highway onto the berm to wait for traffic to clear so that they could turn right into Makirikiri Road. When they have attempted to turn right, they have collided with a car also turning right into Makirikiri Road that the driver failed to identify; and
- Two of the crashes were the result of vehicles turning right from Makirikiri Road failing to give way to traffic on the State Highway. In one crash, State Highway traffic was masked by a truck using the slip lane to turn into Makirikiri Road.

Table 4-9 shows the results of the crash risks assessment (CEC). This indicates that the full development traffic is expected to result in a slight increase in the injury crash rate at the Makirikiri Road / SH1 intersection, as shown by an increase in the A_T from 0.21 per year to 0.28 per year for the without and with development scenarios, respectively. This equates to a potential additional injury crash every 14 years.

The primary increase in crash risk relates to the increased volume of right turning traffic from both Makirikiri Road and SH1 as a result of the development. At present, very few right turn traffic movements are currently recorded from SH1 into Makirikiri Road. Whilst forward site visibility of the intersection and oncoming traffic from this approach is acceptable, the high-speed road environment and the lack of a right-turn bay creates potential conflicts between turning traffic and through traffic. This is reflected within the existing crash history data.

[15] Based on the Absolute minimum Safe Intersection Sight Distances (SISD) in Austroads Guide to Traffic Engineering Part 5.

Table 4-9 Makirikiri Road / SH1 Crash Analysis

CRASH RISK ASSESSMENT	SH1	MAKIRIKIRI RD
Existing AADT, without development traffic	6,875 vpd	1,900 vpd
Existing AADT plus full development traffic	7,130 vpd	2,411 vpd
A_T – Existing, based on CAS data	0.40 per year	
A_T – Existing, based on CEC	0.21 per year	
A_T - Future, with development traffic, based on CEC	0.28 per year	

There is currently no right-turning bay provided from SH1 into Makirikiri Road; however, a channelised left-turn bay is provided. The forecast peak hour traffic turning volumes in 2024 (inclusive of development) have been assessed using the turning bay warrant methodology outlined within Section 4.3.2 of the report, and the threshold warrant for speed limits exceeding 70km/hr as outlined within Figure 4-13.

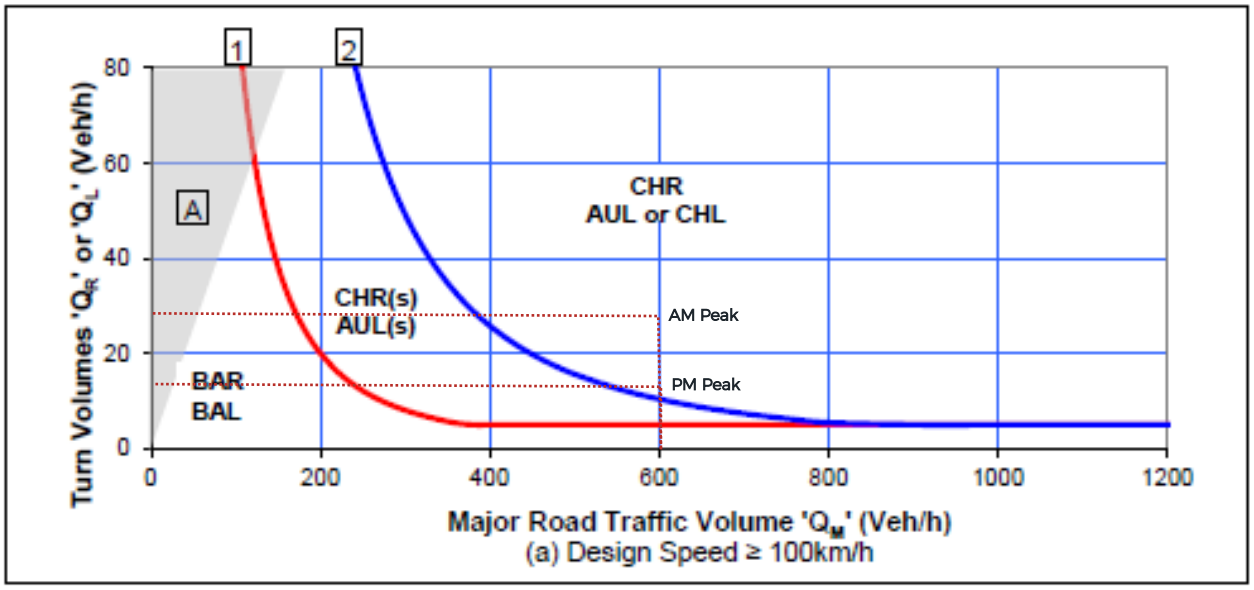


Figure 4-13: Warrants for Turn Treatments on the Major Road at Unsignalised Intersections with >100km/hr Design Speeds

Whilst a turning bay is not required from an intersection capacity perspective, the assessment indicates the increased volume of right turning movements from SH1 resulting from the development will warrant the provision of a channelised right turn bay to support safety.

Table 4-10: Turning Bay Treatment Assessment at SH1 / Makirikiri Road Intersection (100km/h)

MAJOR ROAD	EXISTING LAYOUT	THROUGH MOVEMENT (Q^M)	TURN MOVEMENT (Q^L OR Q^R)	TURN TREATMENT REQUIRED
AM Peak Hour (7:30-8:30hrs)				
State Highway 1 (N)	Basic Right	589	Q^R = 27	**Yes**: Channelised Right Turn Bay (Full)
PM Peak Hour (16:30-17:30hrs)				
State Highway 1 (N)	Basic Right	601	Q^R = 15	**Yes**: Channelised Right Turn Bay (Full)

4.5.2 Wings Line / SH1 Intersection

The sight distance from Wings Line to SH1 in both directions is greater than 300m, so exceeds Waka Kotahi standards (see Figure 4-14). Sight lines to the north could be further enhanced through the management of existing vegetation located at the north-western corner of the intersection.

Figure 4-14: View at the Wings Line / SH3 Intersection to the South (Left) and North (Right)

The crash risk assessment using Waka Kotahi's CEC methodology indicates that the predicted crash rate is 0.1 injury crash per year (see Table 4-11), which is higher than the actual injury crash rate. This could indicate that the intersection is operating relatively safely under its existing arrangement, or just the nature of crashes being rare and random in timing.

Addition of full development traffic results in a very minor increase in the predicted crash rate compared to with existing traffic volumes as most additional trips are expected to be through traffic on SH1. The proposed industrial zoning is not expected to result in significant change in crashes at the Wings Line intersection as:

- The intersection has a low crash rate and no identified crash issues that could be exacerbated by the additional traffic; and
- The intersection has a right turn bay on SH1 for traffic turning into Wings Line, providing separation for turning traffic from southbound through movements.

Table 4-11: Wings Line / SH1 Crash Analysis

CRASH RISK ASSESSMENT	SH1	WINGS LINE
Existing AADT, without development traffic	6,875 vpd	550vpd
Existing AADT plus full development traffic	7,013 vpd	583vpd
AT – Existing, based on CAS data	0.0 per year	
AT – Existing, based on CEC	0.12 per year	
AT - Future, with development traffic, based on CEC	0.13 per year	

4.5.3 Pukepapa Road and SH3 Intersection

The sight distance from Pukepapa Road to SH3 in both directions is greater than 300m, so exceeds Waka Kotahi standards (see Figure 4-15).

Figure 4-15: View at the Pukepapa Road / SH3 Intersection to the East (Left) and West (Right)

A review of the intersection crash history using the Waka Kotahi CAS database indicates three crashes have occurred at the intersection over the last ten years that have resulted in injury. Both injury crashes resulted in a single minor injury. Of the recorded crashes:

- All crashes were single party crashes, two of which resulted from a loss of control and one missing the intersection/end of the road;
- One crash was the result of a driver travelling under the influence of alcohol; and
- The two minor injury crashes were both the result of loss of control crashes, colliding with static roadside hazards (i.e. fencing or posts).

Table 4-12 shows the results of the crash risks assessment (CEC) which indicates existing crash data is similar to what is forecast through the crash risk assessment models. Inclusive of the full development, there is expected to be a slight increase in the injury crash rate (one additional injury crash every 50 years). This is shown by the increase of AT from 0.27 per year to 0.28 per year for the existing and full development scenario, respectively.

Table 4-12 Pukepapa Road / SH3 Crash Analysis

CRASH RISK ASSESSMENT	SH3	PUKEPAPA ROAD
Existing AADT, without development traffic	8,040vpd	1,360vpd
Existing AADT plus full development traffic	8,157vpd	1,593vpd
A_T – Existing, based on CAS data	0.33 per year	
A_T – Existing, based on CEC	0.27 per year	
A_T - Future, with development traffic, based on CEC	0.28 per year	

4.5.4 *Makirikiri Road and SH3 Intersection*

The sight distance from Makirikiri Road to SH3 to the east (looking left from Makirikiri) is 160m because a horizontal curve coupled with the existing fence line restricts visibility further (see Figure 4-16). This is less than the minimum safe sight distance required by Waka Kotahi, meaning traffic turning right out of Makirikiri Road may pull into an unsafe gap on SH3.

Figure 4-16: View at the Makirikiri Road / SH3 Intersection to the East (Left) and West (Right)

Potential mitigation measures that could be considered include:

- Setting back of the existing fence line further north to improve sightlines from the intersection to the east; and
- Intersection widening to provide wider shoulders ensuring there is safe avoidance space.

The sight distance from Makirikiri Road to SH3 to the west (looking right from Makirikiri) is 330m, so exceeds Waka Kotahi standards.

Two recorded crashes have occurred at the intersection of SH3 and Makirikiri Road that have resulted in injury over the last 10-years[16]. All recorded injury crashes resulted in minor injuries, with no deaths or serious injuries recorded.

One crash was the result of driver inattention resulting in an eastbound vehicle on SH3 veering off the road to the left and colliding with a vehicle waiting to exit Makirikiri Road. The second crash involved a right-turning truck and trailer unit on Makirikiri Road colliding with a westbound truck and trailer unit on SH3. Both injury crashes occurred within a week (March 2017), and alcohol was recorded a suspected factor within both recorded injury crash events.

The crash risk assessment indicates that the addition of full development traffic is expected to result in a minor increase in the injury crash rate at the Makirikiri Road / SH3 intersection. This is shown by the increase of AT from 0.08 per year to 0.10 per year inclusive of traffic from the full development scenario, respectively.

Table 4-13 Makirikiri Road / SH3 Crash Analysis

CRASH RISK ASSESSMENT	SH3	MAKIRIKIRI ROAD
Existing AADT, without development traffic	6,678vpd	460vpd
Existing AADT plus full development traffic	6,817vpd	693vpd
AT – Existing, based on CAS data	0.20 per year	
AT – Existing, based on CEC	0.08 per year	
AT - Future, with development traffic, based on CEC	0.10 per year	

[16] It should be noted, three injury crashes are recorded within CAS however, on further inspection two of the crashes recorded in the system were the same event recorded twice within the system.

4.5.5 *Wellington Road / Makirikiri Road Intersection*

The Wellington Road / Makirikiri Road intersection is a rural stop-controlled crossroads intersection, with Makirikiri Road forming the minor intersection arms. The intersection has a 70km/hr posted speed limit on all approaches. The proposed CDP area is expected to increase east-west crossing demands across Wellington Road as a result of growing regional demands to access SH3 to the west.

The sight distance from the Makirikiri Road eastern approach is restricted by the development surrounding the intersection (see Figure 4-17). Restricted safe sight distances mean traffic turning from Makirikiri Road may pull into an unsafe gap on at the crossroads.

Figure 4-17: View at the Makirikiri Road Eastern Approach to the Wellington Road Crossroads Looking North (Left) and West (Right)(Source: Google Maps)

The crash prediction models (see Table 4-14) indicate that the increased traffic volumes following the development are expected to have a less than minor increase in injury crashes at the intersection (1 additional injury crash every 50 years); however, it is recognised that the existing crash history at the intersection is more than double the expected injury crash rate for a cross road intersection.

Table 4-14 Wellington Road / Makirikiri Road Crash Analysis

CRASH RISK ASSESSMENT	WELLINGTON RD	MAKIRIKIRI RD
Existing AADT, without development traffic	2,020 vpd	1,320 vpd
Existing AADT plus full development traffic	2,020 vpd	1,553 vpd
A_T – Existing, based on CAS data	0.50 per year	
A_T – Existing, based on CEC	0.21 per year	
A_T - Future, with development traffic, based on CEC	0.23 per year	

Waka Kotahi's CAS data have recorded five crashes that have resulted in injury (1 serious injury and four minor injury crashes) over the past 10 years. Four of the five injury crashes involved turning movements at the intersection, where turning vehicles failed to give way to through traffic. The fifth crash involved a diesel spill, where an approaching vehicle skidded into the path of an oncoming vehicle as it was unable to stop. It is noted that the speed limits on roads approaching the intersection were reduced from 100km/hr to 70km/hr in 2014 as a safety response to historical crashes at the site.

Based on the forecast traffic volumes resulting from the CDP development, and constraints related to property boundaries, it is not expected that a change in intersection form would be warranted at the intersection from a capacity perspective (i.e. roundabout); however, a number of potential safety improvements could be explored by Council to improve safety at the intersection.

Potential options that could be considered to improve safety at the intersection include:

- Sight distance improvements on the minor approach arms;
- Electronic warning signs or enhancing signing on Wellington Road approaches;

- Speed reduction measures on Wellington Road such as transverse road markings, rumble strips or high friction coloured surfacing; and
- Potential further reduction in the posted speed limit on all intersection approaches.

Alternatively, dependent on actual future traffic flows through the intersection, the existing priorities of approaching arms could be altered so Wellington Road becomes the minor approach arms and gives-way to through traffic from Makirikiri Road.

4.5.6 Summary

The expected traffic generated by the site is expected to have a minor impact on crash risk at most key intersections within the vicinity of the development. The greatest increase in crash risk is expected on Makirikiri Road / SH1 as a result of increased right-turning movements into and from Makirikiri Road from the development.

Based on the findings of the safety assessment, it is recommended:

- A right-turn bay is implemented on State Highway 1 at the intersection with Makirikiri Road prior to completion of the development to safely support increased traffic turning demands resulting from the CDP area; and
- RDC investigates safety improvements at the Wellington Road / Makirikiri Road intersection in response to existing crash trends; and
- RDC undertakes regular monitoring of the safety performance of key intersections and roads within the vicinity of the CDP site to identify and respond to any future emerging crash trends on the network.

4.6 Makirikiri Road Rail Crossing Impacts

The Makirikiri Road railway crossing is located at KM178.24 of the North Island Main Trunk Line and approximately 1.3 kilometres west of the intersection of SH1 and Makirikiri Road. Traffic volumes at the railway crossing from the site are expected to increase over time as the site is developed. The crossing controls were upgraded from Flashing Lights and Bells to include Half Arm Barriers in 2015.

The relevant transportation rules relating to level crossings (Rule B9.5) are outlined below. It is noted that the proposal will use the existing railway crossing and no further vehicle crossings are proposed by the development. As outlined above, the preferred intersection locations exceed the 30m minimum requirements outlined within the District Plan standards.

B9.5	**Level Crossings**
B9.5-1	Road and rail intersections must be designed in accordance with the standards set out in Table B9.5, except for private farm and forestry roads which do not intersect with a railway line.
B9.5-2	Access across railway lines, by way of the formation of a level crossing, is only allowed where there is no alternative legal access available from another road.
B9.5-3	Where any vehicle access crosses a rail level crossing, the approaches must be formed to slope away from the railway at a minimum gradient of 1 in 50 for a minimum of 5 metres from the rail level crossing.
B9.5-4	New driveways or access ways must not be located within 30 metres of an existing level crossing.

To assess the impacts of potential future growth from the Marton Rail Hub area, a Level Crossing Safety Impact Assessment (LCSIA) was undertaken in 2019 to assess the suitability of the existing crossing arrangements and inform the future design process going forward, considering the potential effects of the development. A copy of the LCSIA is included within **Appendix E**.

As part of the LCSIA, KiwiRail and road controlling authority representatives evaluated the crossing and determined the crossing has appropriate sight distances and controls to safely manage current and future user volumes resulting from the plan change development. KiwiRail staff rated the crossing highly due to the clear sightlines between trains and vehicles due to the level approaches and lack of vegetation along adjacent property boundaries.

The LCSIA recommends additional user volume (including the proportion of user type) surveys are undertaken two years after the opening of the new intersection from the plan change area onto Makirikiri Road and review whether a change in controls is required. Subsequent surveys and reviews should be completed in three yearly cycles thereafter.

The LCSIA assessment recommends the following improvements are considered:

- The crossing signs and markings are not to the requirements of Traffic Control Devices (TCD) Manual, Part 9 (Level Crossing). Improvements could be made to install crossing approach warning signs, no passing markings and yellow hatching through the crossing.
- The pavement width at the crossing is narrow (i.e. 2 x 3.2m wide traffic lanes with no shoulders) meaning drivers tend to drive over the centreline through the crossing due to the narrow lane widths. Localised widening of the road on the approach to the railway crossing is recommended.
- KiwiRail representatives requested that future development works should not involve planting or structures that affect the existing sightlines between road and rail. It is noted that the existing sightlines to the north of Makirikiri Road are restricted by the existing trees adjacent to the railway line. As the proposals currently stand, all development will occur to the east of these trees therefore a similar level of visibility at the level crossing will be retained through the proposal.

Subject to the implementation of the recommendations outlined above, the additional traffic generated by the proposed development are not expected to warrant a fundamental change in rail crossing provisions at this location.

4.7 Construction Traffic

The development site is currently unoccupied for the most part. To facilitate construction, access is expected to be established from Makirikiri Road to accommodate truck movements to and from the site. The volume of earth works is unknown at this stage however can be undertaken over an extended period to minimise traffic effects of necessary.

As is typical with a development of this scale, it is recommended that as part of any later resource consent, a Construction Traffic Management Plan (CTMP) should be required as a condition. It is considered that this Construction Traffic Management Plan should include:

- Construction dates and hours of operation including any specific non-working hours for traffic congestion/noise etc;
- Truck route diagrams between the site and external road network.
- Temporary traffic management signage/details for both pedestrians and vehicles, to manage the interaction of these road users with heavy construction traffic; and
- Details of site access/egress over the entire construction period and any limitations on truck movements. All egress points should be positioned to achieve appropriate sight distances.

Based on experience of constructing similar projects and bearing in mind capacity within the existing road network, with the appropriate Construction Traffic Management Plan in place and the above measures implemented, it is considered that construction activities can be managed to ensure any generated traffic effects are appropriately mitigated.

5 Conclusions

WSP has been engaged by Rangitikei District Council (the Client) to prepare a Traffic Impact Assessment (TIA) to assess the impacts of the proposed Marton Rail Hub on Makirikiri Road, Marton. The proposed Comprehensive Development Plan (CDP) includes multiple industrial sites, a new rail siding, internal roads, and commercial premises. Access into the proposed industrial site is solely from Makirikiri Road via two new intersections.

As outlined within the report, the proposed CDP area comprises a mix of industrial activities, many of which are complementary to the log yard and associated debarking facility. The interdependence of activities within the hub means a higher than normal number of trips generated by land-uses are expected to be internal trips. The TIA has identified a trip generation potential of approximately 245 vehicle trips during each peak hour and 744 all-day vehicle trips.

Based on the assessment of effects relating to the trip generating potential of the CDP on wider network operations, it is concluded that:

- The key intersections with the State Highway within the vicinity of the proposed CDP are expected to operate within acceptable levels of capacity and delay following completion of the development; however, intersection upgrades are likely to be required at the Makirikiri Road/SH1 intersection after 2034 as a response to general traffic growth on the State Highway network;
- The expected traffic generated by the site is expected to have a minor impact on crash risk at most key intersections within the vicinity of the development. The greatest increase in crash risk is expected on Makirikiri Road / SH1 as a result of increased right-turning movements into and from Makirikiri Road from the development;
- The proposed access arrangements from the development can achieve the intersection separation distance and sightline requirements, subject to a reduction in the posted speed limit to 70km/hr or below;
- Subject to a reduced speed limit, the Eastern Access from Makirikiri Road will require a short channelised right-turn bay to support peak hour access demands. Although the Western Access will not require dedicated turning bays, it is recommended that the access design complies with Waka Kotahi's Diagram E of the access standards guidelines and is designed to support the access needs of the largest vehicles expected to use the site;
- As part of the detailed design process, the proposed weigh station should be located within the site itself at the northern extent of the Western Access road in a position that the risks of heavy vehicles queueing back onto Makirikiri Road are minimised; and
- Subject to the implementation of the recommendations outlined within the LCSIA, the additional traffic generated by the proposed development is not expected to warrant a fundamental change in rail crossing provisions.

5.1 Recommendations

Based on the findings of the transport assessment, it is recommended that RDC:

- Discusses the findings of the assessment with relevant funding and investment partners within Waka Kotahi to identify and confirm preferred options for future intersection upgrades to the State Highway network. This TIA recommends the following State Highway actions are undertaken as a response to development of the CDP:
    - Implementation of a right-turn bay on State Highway 1 at the intersection with Makirikiri Road prior to completion of the development to safely support increased traffic turning demands resulting from the CDP; and
    - Investigate options to upgrade the Makirikiri Road / State Highway 1 intersection in response to expected longer-term (post-2034) capacity issues on the network. This will

enable solutions to be identified, appraised, costed and suitable protection measures identified (if required); and

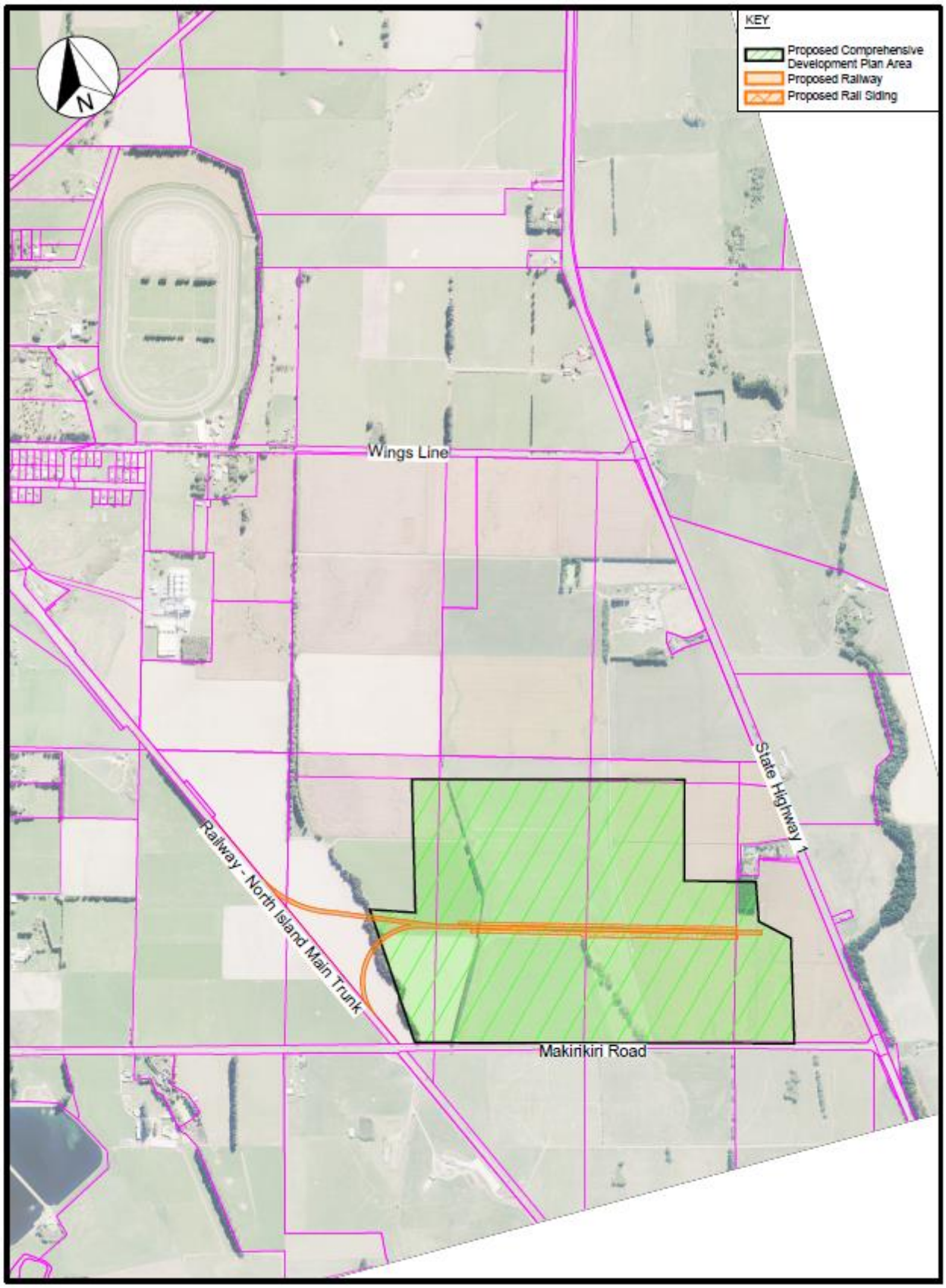
- Undertakes monitoring of key intersections with SH3 to determine if and when any upgrades are required to respond to potential future capacity and safety issues arising from the development on the network.

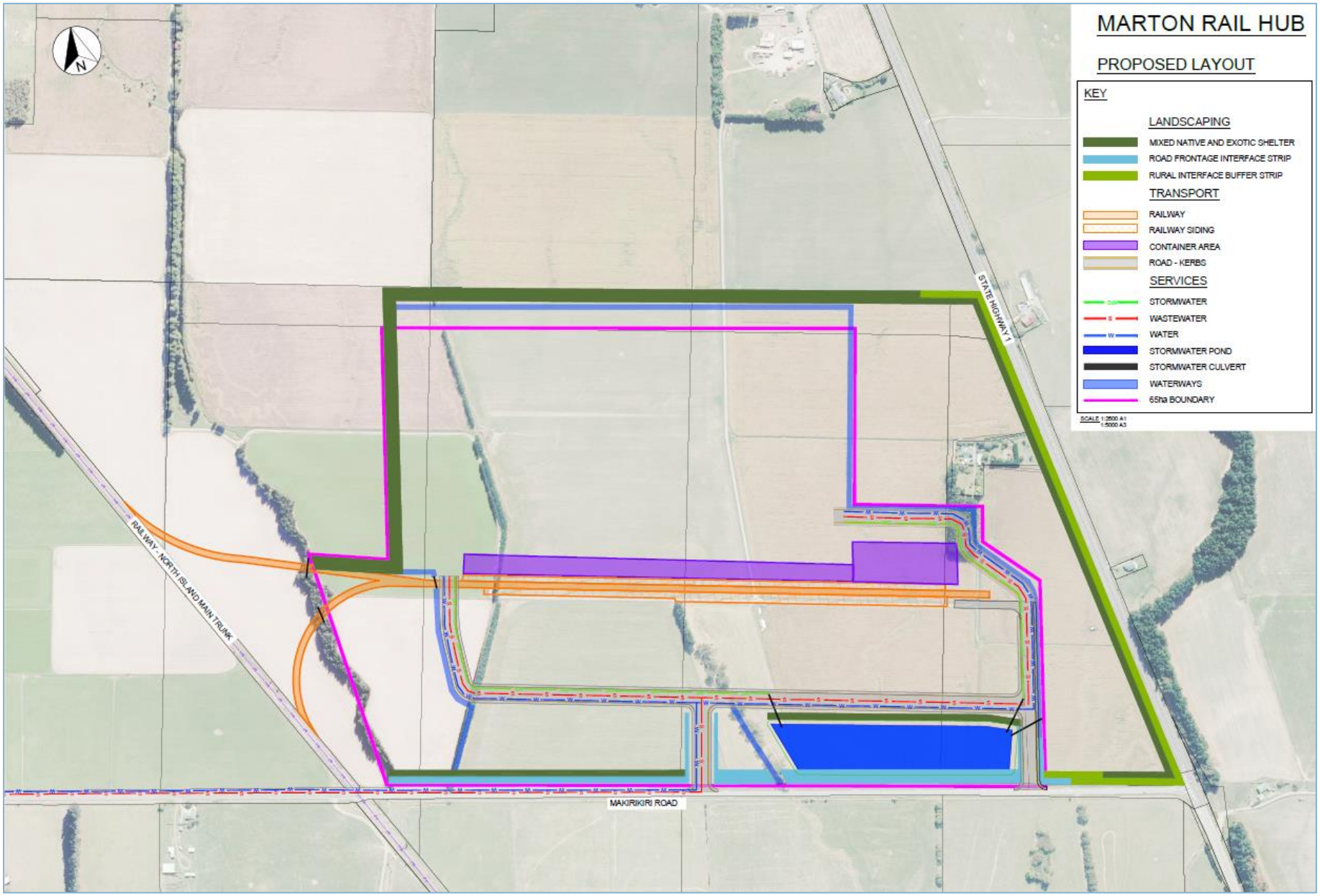
- Investigates improvements that could be implemented at the Wellington Road / Makirikiri Road crossroads intersection in response to the current higher than expected volume of injury crashes. Potential safety improvements include enhancing sightlines, implementing electronic warning signs, speed reduction measures and/or changes to posted speeds at the intersection.
- Implements a reduction in the posted speed limit on Makirikiri Road within the vicinity of the CDP site to 70km/hr or below prior to occupancy of the site, to adhere with the minimum intersection spacing requirements outlined within the District Plan;
- Considers improvements to the vertical road alignment between RP 0.340 and RP0.510 to maximise sightlines on Makirikiri Road from proposed accesses;
- Undertakes regular monitoring of the safety performance of key intersections and roads within the vicinity of the CDP site to identify and respond to emerging crash trends on the network;
- Adopts the recommendations of the LCSIA assessment, including installing crossing approach warning signs, no passing markings and yellow hatching through the crossing to comply with the requirements of TCD Manual Part 9, and localised widening of the road on the approach to the railway crossing; and
- Requires that a Construction Traffic Management Plan is developed by prospective developers and approved prior to commencing work on the site.

Subject to the recommended mitigation measures outlined above, it is concluded that the proposed CDP will operate safely and efficiently, and that traffic generated by the proposed activities on the site can be accommodated with a less than minor impact on the surrounding transport network. Therefore, it is considered that there is no traffic planning or traffic engineering reason to preclude the implementation of the development as intended.

Appendix A – Site Layout Plans

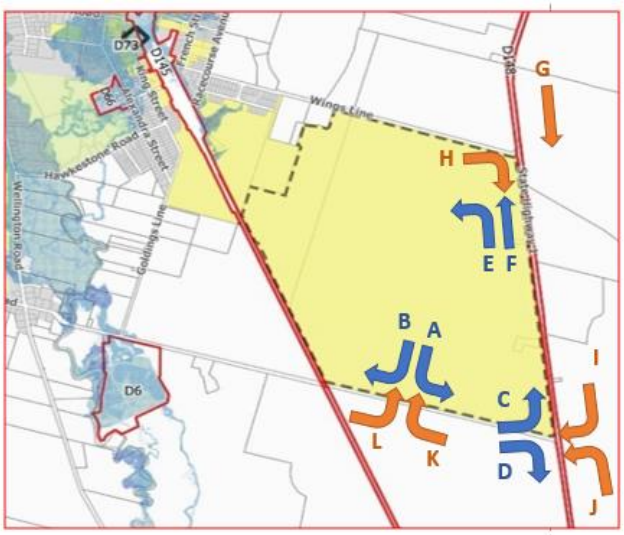
Marton Rail Hub





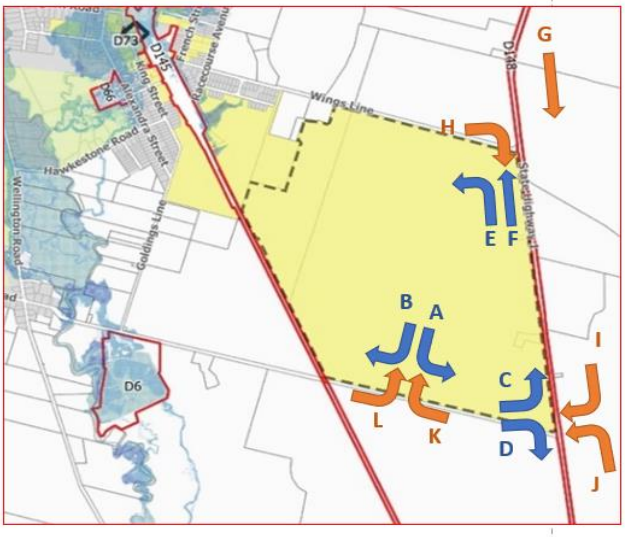
Appendix B – Traffic Turning Counts

Comprehensive Development Plan - Traffic Distribution and Turning Splits (Light and Heavy Vehicles)



Employee % Splits	AM	PM
% in	79%	21%
% out	21%	79%
A	14.2%	54.8%
B	6.4%	24.6%
C	1.6%	6.1%
D	12.6%	48.7%
E	0.0%	0.0%
F	1.6%	6.1%
G	6.1%	1.6%
H	0.0%	0.0%
I	6.1%	1.6%
J	48.7%	12.6%
K	54.8%	14.2%
L	24.6%	6.4%
	100%	100%

Employee Volumes	AM	PM
% in	79%	21%
% out	21%	79%
Total Vehs	195	195
A	28	107
B	12	48
C	3	12
D	25	95
E	-	-
F	3	12
G	12	3
H	-	-
I	12	3
J	95	25
K	107	28
L	48	12
Total Vehs	195	195



Freight % distribution	AM	PM
% in	50%	50%
% out	50%	50%
A	34.0%	34.0%
B	16.0%	16.0%
C	21.6%	21.6%
D	12.4%	12.4%
E	6.0%	6.0%
F	15.6%	15.6%
G	15.6%	15.6%
H	6.0%	6.0%
I	21.6%	21.6%
J	12.4%	12.4%
K	34.0%	34.0%
L	16.0%	16.0%
	100%	100%

Freight Volumes	AM	PM
% in	50%	50%
% out	50%	50%
Total Vehs	50	50
A	17	17
B	8	8
C	11	11
D	6	6
E	3	3
F	8	8
G	8	8
H	3	3
I	11	11
J	6	6
K	17	17
L	8	8
Total Vehs	50	50

Baseline Turning Count Volumes and Background Traffic Forecasts

Base Data

Base Traffic Volumes **Year** **2019**

Makirikiri Road / SH1		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
Makirikiri Road	Left	2	0	**2**	2	0	**2**
	Right	60	15	**75**	107	8	**115**
SH1 South	Left	77	16	**93**	73	9	**82**
	Through	162	41	**203**	188	42	**225**
SH1 North	Through	92	36	**128**	152	32	**184**
	Right	2	2	**4**	0	1	**1**

Wings Line / SH1		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
Wings Line	Left	3	1	**4**	2	1	**3**
	Right	13	2	**15**	13	5	**18**
SH1 South	Left	12	4	**16**	22	0	**22**
	Through	144	40	**184**	176	44	**220**
SH1 North	Through	79	36	**115**	143	26	**169**
	Right	3	1	**4**	1	2	**3**

Makirikiri Road / SH3		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	14	4	**18**	23	2	**25**
	Through	219	31	**250**	259	50	**309**
Makirikiri Road	Left	1	0	**1**	0	0	**0**
	Right	24	2	**26**	15	2	**17**
SH3 East	Through	192	36	**228**	242	29	**271**
	Right	0	0	**0**	1	0	**1**

Pukepapa Rd / SH3		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	6	1	**7**	2	1	**3**
	Through	231	26	**257**	260	47	**307**
Pukepapa Rd	Left	69	9	**78**	69	7	**76**
	Right	0	1	**1**	2	2	**4**
SH3 East	Through	196	43	**239**	233	31	**264**
	Right	46	9	**55**	111	5	**116**

Forecast - No Development

Year **2024** **Growth** **3%**

Makirikiri Road / SH1		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
Makirikiri Road	Left	2	0	**2**	2	0	2
	Right	69	17	**86**	123	9	132
SH1 South	Left	89	18	**107**	84	10	94
	Through	186	47	**233**	216	48	265
SH1 North	Through	106	41	**147**	175	37	212
	Right	2	2	**5**	0	1	1

Wings Line / SH1							
		Light	Heavy	Total	Light	Heavy	Total
Wings Line	Left	3	1	**5**	2	1	3
	Right	15	2	**17**	15	6	21
SH1 South	Left	14	5	**18**	25	0	25
	Through	166	46	**212**	202	51	253
SH1 North	Through	91	41	**132**	164	30	194
	Right	3	1	**5**	1	2	3

Makirikiri Road / SH3		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	16	5	**21**	26	2	29
	Through	252	36	**288**	298	58	355
Makirikiri Road	Left	1	0	**1**	0	0	0
	Right	28	2	**30**	17	2	20
SH3 East	Through	221	41	**262**	278	33	312
	Right	0	0	**0**	1	0	1

Pukepapa Rd / SH3		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	7	1	**8**	2	1	3
	Through	266	30	**296**	299	54	353
Pukepapa Rd	Left	79	10	**90**	79	8	87
	Right	0	1	**1**	2	2	5
SH3 East	Through	225	49	**275**	268	36	304
	Right	53	10	**63**	128	6	133

Year **2034** **Growth** **3%**

Makirikiri Road / SH1		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
Makirikiri Road	Left	3	0	**3**	3	0	3
	Right	87	22	**109**	155	12	167
SH1 South	Left	112	23	**135**	106	13	119
	Through	235	59	**294**	273	61	334
SH1 North	Through	133	52	**186**	220	46	267
	Right	3	3	**6**	0	1	1

Wings Line / SH1							
		Light	Heavy	Total	Light	Heavy	Total
Wings Line	Left	4	1	**6**	3	1	4
	Right	19	3	**22**	19	7	26
SH1 South	Left	17	6	**23**	32	0	32
	Through	209	58	**267**	255	64	319
SH1 North	Through	115	52	**167**	207	38	245
	Right	4	1	**6**	1	3	4

Makirikiri Road / SH3		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	20	6	**26**	33	3	36
	Through	318	45	**363**	376	73	448
Makirikiri Road	Left	1	0	**1**	0	0	0
	Right	35	3	**38**	22	3	25
SH3 East	Through	278	52	**331**	351	42	393
	Right	0	0	**0**	1	0	1

Pukepapa Rd / SH3		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	9	1	**10**	3	1	4
	Through	335	38	**373**	377	68	445
Pukepapa Rd	Left	100	13	**113**	100	10	110
	Right	0	1	**1**	3	3	6
SH3 East	Through	284	62	**347**	338	45	383
	Right	67	13	**80**	161	7	168

Forecast Traffic Turning Counts including CDP Development

Forecast - With Development

Year **2024** **Growth** **3%**

Makirikiri Road / SH1

		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
Makirikiri Road	Left	5	11	**16**	14	11	**25**
	Right	94	23	**117**	218	15	**233**
SH1 South	Left	184	25	**208**	108	17	**125**
	Through	186	47	**233**	216	48	**265**
SH1 North	Through	106	41	**147**	175	37	**212**
	Right	14	13	**27**	3	12	**15**

Wings Line / SH1

		Light	Heavy	Total	Light	Heavy	Total
Wings Line	Left	3	1	**5**	2	1	**3**
	Right	15	5	**20**	15	9	**24**
SH1 South	Left	14	8	**21**	25	3	**28**
	Through	169	54	**222**	214	58	**273**
SH1 North	Through	103	49	**152**	168	38	**205**
	Right	3	1	**5**	1	2	**3**

Makirikiri Road / SH3

		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	64	13	**77**	39	10	**49**
	Through	252	36	**288**	298	58	**355**
Makirikiri Road	Left	1	0	**1**	0	0	**0**
	Right	40	10	**50**	65	10	**76**
SH3 East	Through	221	41	**262**	278	33	**312**
	Right	0	0	**0**	1	0	**1**

Pukepapa Rd / SH3

		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	55	9	**64**	15	9	**24**
	Through	266	30	**296**	299	54	**353**
Pukepapa Rd	Left	79	10	**90**	79	8	**87**
	Right	12	9	**22**	50	10	**61**
SH3 East	Through	225	49	**275**	268	36	**304**
	Right	53	10	**63**	128	6	**133**

Year **2034** **Growth** **3%**

Makirikiri Road / SH1

		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
Makirikiri Road	Left	6	11	**17**	15	11	**26**
	Right	112	28	**139**	250	18	**268**
SH1 South	Left	207	29	**236**	130	19	**150**
	Through	235	59	**294**	273	61	**334**
SH1 North	Through	133	52	**186**	220	46	**267**
	Right	15	14	**29**	3	12	**15**

Wings Line / SH1

		Light	Heavy	Total	Light	Heavy	Total
Wings Line	Left	4	1	**6**	3	1	**4**
	Right	19	6	**25**	19	10	**29**
SH1 South	Left	17	9	**26**	32	3	**35**
	Through	212	66	**278**	267	72	**339**
SH1 North	Through	126	60	**186**	210	46	**256**
	Right	4	1	**6**	1	3	**4**

Makirikiri Road / SH3

		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	68	14	**82**	46	11	**57**
	Through	318	45	**363**	376	73	**448**
Makirikiri Road	Left	1	0	**1**	0	0	**0**
	Right	47	11	**58**	70	11	**81**
SH3 East	Through	278	52	**331**	351	42	**393**
	Right	0	0	**0**	1	0	**1**

Pukepapa Rd / SH3

		AM PEAK			PM PEAK		
		Light	Heavy	Total	Light	Heavy	Total
SH3 West	Left	57	9	**66**	15	9	**25**
	Through	335	38	**373**	377	68	**445**
Pukepapa Rd	Left	100	13	**113**	100	10	**110**
	Right	12	9	**22**	51	11	**62**
SH3 East	Through	284	62	**347**	338	45	**383**
	Right	67	13	**80**	161	7	**168**

Appendix C – SIDRA Traffic Modelling Results

SH1 / Makirikiri Road Intersection

Base Model AM Peak (2019)

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 AM (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	93	16	98	17.2	0.059	8.8	LOS A	0.0	0.0	0.00	0.64	0.00	63.6
2	T1	203	41	214	20.2	0.124	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		296	57	312	19.3	0.124	2.8	LOS A	0.0	0.0	0.00	0.20	0.00	87.1
North: SH1														
8	T1	128	36	144	28.1	0.094	0.1	LOS A	0.1	0.6	0.04	0.02	0.04	99.0
9	R2	4	2	4	50.0	0.094	11.6	LOS B	0.1	0.6	0.04	0.02	0.04	47.6
Approach		132	38	148	28.8	0.094	0.5	NA	0.1	0.6	0.04	0.02	0.04	96.6
West: Makirikiri Road														
10	L2	2	0	2	0.0	0.002	8.5	LOS A	0.0	0.0	0.30	0.58	0.30	67.6
12	R2	75	15	83	20.0	0.113	10.3	LOS B	0.4	3.1	0.45	0.76	0.45	57.9
Approach		77	15	86	19.5	0.113	10.3	LOS B	0.4	3.1	0.44	0.75	0.44	58.1
All Vehicles		505	110	545	21.9	0.124	3.3	NA	0.4	3.1	0.08	0.24	0.08	84.1

Base Model PM Peak (2019)

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 PM (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	82	9	90	11.0	0.052	8.6	LOS A	0.0	0.0	0.00	0.64	0.00	64.5
2	T1	230	42	253	18.3	0.145	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		312	51	343	16.3	0.145	2.3	LOS A	0.0	0.0	0.00	0.17	0.00	89.4
North: SH1														
8	T1	184	32	209	17.4	0.122	0.1	LOS A	0.0	0.2	0.01	0.00	0.01	99.6
9	R2	1	1	1	100.0	0.122	14.9	LOS B	0.0	0.2	0.01	0.00	0.01	43.7
Approach		185	33	210	17.8	0.122	0.1	NA	0.0	0.2	0.01	0.00	0.01	99.1
West: Makirikiri Road														
10	L2	2	0	2	0.0	0.002	8.6	LOS A	0.0	0.0	0.33	0.58	0.33	67.4
12	R2	115	8	124	7.0	0.169	10.6	LOS B	0.6	4.3	0.49	0.80	0.49	61.7
Approach		117	8	126	6.8	0.169	10.5	LOS B	0.6	4.3	0.49	0.80	0.49	61.8
All Vehicles		614	92	679	15.0	0.169	3.1	NA	0.6	4.3	0.09	0.23	0.09	86.4

2024 AM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 AM - 2024 No Development (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	107	18	113	16.8	0.068	8.7	LOS A	0.0	0.0	0.00	0.64	0.00	63.7
2	T1	233	47	245	20.2	0.142	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		340	65	358	19.1	0.142	2.8	LOS A	0.0	0.0	0.00	0.20	0.00	87.1
North: SH1														
8	T1	147	41	165	27.9	0.107	0.2	LOS A	0.1	0.7	0.04	0.02	0.04	98.9
9	R2	4	2	4	50.0	0.107	12.2	LOS B	0.1	0.7	0.04	0.02	0.04	47.6
Approach		151	43	170	28.5	0.107	0.5	NA	0.1	0.7	0.04	0.02	0.04	96.9
West: Makirikiri Road														
10	L2	2	0	2	0.0	0.002	8.6	LOS A	0.0	0.0	0.33	0.58	0.33	67.4
12	R2	86	17	96	19.8	0.139	10.8	LOS B	0.5	3.8	0.48	0.80	0.48	57.3
Approach		88	17	98	19.3	0.139	10.8	LOS B	0.5	3.8	0.48	0.79	0.48	57.5
All Vehicles		579	125	625	21.7	0.142	3.4	NA	0.5	3.8	0.09	0.24	0.09	84.0

2024 PM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 PM - 2024 No Development (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	94	10	103	10.6	0.060	8.6	LOS A	0.0	0.0	0.00	0.64	0.00	64.5
2	T1	264	48	290	18.2	0.166	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		358	58	393	16.2	0.166	2.3	LOS A	0.0	0.0	0.00	0.17	0.00	89.4
North: SH1														
8	T1	212	37	241	17.5	0.140	0.1	LOS A	0.0	0.3	0.01	0.00	0.01	99.6
9	R2	1	1	1	100.0	0.140	16.1	LOS C	0.0	0.3	0.01	0.00	0.01	43.7
Approach		213	38	242	17.8	0.140	0.1	NA	0.0	0.3	0.01	0.00	0.01	99.1
West: Makirikiri Road														
10	L2	2	0	2	0.0	0.002	8.8	LOS A	0.0	0.0	0.36	0.59	0.36	67.2
12	R2	132	9	142	6.8	0.212	11.3	LOS B	0.7	5.4	0.53	0.84	0.53	60.8
Approach		134	9	144	6.7	0.212	11.2	LOS B	0.7	5.4	0.53	0.84	0.53	60.9
All Vehicles		705	105	780	15.0	0.212	3.3	NA	0.7	5.4	0.10	0.24	0.10	86.2

2024 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 AM - 2024 With Development (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	209	25	220	12.0	0.129	8.6	LOS A	0.0	0.0	0.00	0.64	0.00	64.3
2	T1	233	47	245	20.2	0.142	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		442	72	465	16.3	0.142	4.1	LOS A	0.0	0.0	0.00	0.30	0.00	81.6
North: SH1														
8	T1	147	41	165	27.9	0.101	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	27	13	30	48.1	0.050	12.8	LOS B	0.2	1.9	0.53	0.76	0.53	54.3
Approach		174	54	196	31.0	0.101	2.0	NA	0.2	1.9	0.08	0.12	0.08	90.7
West: Makirikiri Road														
10	L2	16	11	18	68.8	0.020	10.2	LOS B	0.1	0.9	0.39	0.64	0.39	46.8
12	R2	117	23	130	19.7	0.270	14.7	LOS B	1.2	9.4	0.63	0.89	0.71	53.1
Approach		133	34	148	25.6	0.270	14.1	LOS B	1.2	9.4	0.61	0.86	0.67	52.2
All Vehicles		749	160	809	21.5	0.270	5.4	NA	1.2	9.4	0.13	0.36	0.14	76.9

2024 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 PM - 2024 With Development (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	125	17	137	13.6	0.081	8.7	LOS A	0.0	0.0	0.00	0.64	0.00	64.1
2	T1	264	48	290	18.2	0.166	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		389	65	427	16.7	0.166	2.8	LOS A	0.0	0.0	0.00	0.21	0.00	87.0
North: SH1														
8	T1	212	37	241	17.5	0.139	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	15	12	17	80.0	0.033	14.3	LOS B	0.1	1.4	0.54	0.75	0.54	50.2
Approach		227	49	258	21.6	0.139	1.0	NA	0.1	1.4	0.04	0.05	0.04	95.2
West: Makirikiri Road														
10	L2	25	11	27	44.0	0.029	9.9	LOS A	0.1	1.1	0.41	0.65	0.41	52.3
12	R2	233	15	251	6.4	0.512	17.6	LOS C	3.0	22.4	0.74	1.00	1.16	53.5
Approach		258	26	277	10.1	0.512	16.8	LOS C	3.0	22.4	0.71	0.97	1.08	53.3
All Vehicles		874	140	963	16.1	0.512	6.3	NA	3.0	22.4	0.21	0.38	0.32	77.1

2034 AM Peak With No Development

MOVEMENT SUMMARY

▽ **Site: 101 [Makirikiri Rd / SH1 AM - 2034 No Development (Site Folder: General)]**

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	135	23	142	17.0	0.086	8.8	LOS A	0.0	0.0	0.00	0.64	0.00	63.7
2	T1	294	59	309	20.1	0.179	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		429	82	452	19.1	0.179	2.8	LOS A	0.0	0.0	0.00	0.20	0.00	87.0
North: SH1														
8	T1	185	52	208	28.1	0.138	0.3	LOS A	0.1	1.3	0.06	0.02	0.06	98.3
9	R2	6	3	7	50.0	0.138	13.6	LOS B	0.1	1.3	0.06	0.02	0.06	47.4
Approach		191	55	215	28.8	0.138	0.7	NA	0.1	1.3	0.06	0.02	0.06	95.9
West: Makirikiri Road														
10	L2	3	0	3	0.0	0.003	8.9	LOS A	0.0	0.1	0.37	0.60	0.37	67.1
12	R2	109	22	121	20.2	0.209	12.2	LOS B	0.7	5.9	0.56	0.85	0.56	55.6
Approach		112	22	124	19.6	0.209	12.1	LOS B	0.7	5.9	0.56	0.85	0.56	55.8
All Vehicles		732	159	791	21.8	0.209	3.7	NA	0.7	5.9	0.10	0.25	0.10	83.3

2034 PM Peak With No Development

MOVEMENT SUMMARY

▽ **Site: 101 [Makirikiri Rd / SH1 PM - 2034 No Development (Site Folder: General)]**

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	119	13	131	10.9	0.076	8.6	LOS A	0.0	0.0	0.00	0.64	0.00	64.5
2	T1	334	61	367	18.3	0.211	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		453	74	498	16.3	0.211	2.3	LOS A	0.0	0.0	0.00	0.17	0.00	89.4
North: SH1														
8	T1	266	46	302	17.3	0.176	0.1	LOS A	0.0	0.4	0.01	0.00	0.01	99.5
9	R2	1	1	1	100.0	0.176	19.1	LOS C	0.0	0.4	0.01	0.00	0.01	43.7
Approach		267	47	303	17.6	0.176	0.2	NA	0.0	0.4	0.01	0.00	0.01	99.1
West: Makirikiri Road														
10	L2	3	0	3	0.0	0.003	9.1	LOS A	0.0	0.1	0.41	0.61	0.41	66.9
12	R2	167	12	180	7.2	0.328	13.7	LOS B	1.3	9.8	0.65	0.91	0.80	57.6
Approach		170	12	183	7.1	0.328	13.6	LOS B	1.3	9.8	0.65	0.91	0.80	57.7
All Vehicles		890	133	984	15.0	0.328	3.7	NA	1.3	9.8	0.12	0.25	0.15	85.1

2034 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 AM - 2034 With Development (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	236	29	248	12.3	0.145	8.6	LOS A	0.0	0.0	0.00	0.64	0.00	64.3
2	T1	294	59	309	20.1	0.179	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		530	88	558	16.6	0.179	3.9	LOS A	0.0	0.0	0.00	0.29	0.00	82.5
North: SH1														
8	T1	185	52	208	28.1	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	29	14	33	48.3	0.063	14.1	LOS B	0.2	2.3	0.58	0.82	0.58	52.9
Approach		214	66	240	30.8	0.127	1.9	NA	0.2	2.3	0.08	0.11	0.08	91.4
West: Makirikiri Road														
10	L2	17	11	19	64.7	0.023	10.6	LOS B	0.1	1.0	0.44	0.66	0.44	47.2
12	R2	140	28	156	20.0	0.404	19.1	LOS C	1.9	15.9	0.75	0.97	1.02	48.8
Approach		157	39	174	24.8	0.404	18.2	LOS C	1.9	15.9	0.72	0.94	0.96	48.7
All Vehicles		901	193	973	21.6	0.404	5.9	NA	1.9	15.9	0.15	0.36	0.19	76.4

2034 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH1 PM - 2034 With Development (Site Folder: General)]

Makirikiri Road / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	149	19	164	12.8	0.096	8.6	LOS A	0.0	0.0	0.00	0.64	0.00	64.2
2	T1	334	61	367	18.3	0.211	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		483	80	531	16.6	0.211	2.7	LOS A	0.0	0.0	0.00	0.20	0.00	87.5
North: SH1														
8	T1	266	46	302	17.3	0.173	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	15	12	17	80.0	0.040	16.2	LOS C	0.1	1.7	0.60	0.81	0.60	48.5
Approach		281	58	319	20.6	0.173	0.9	NA	0.1	1.7	0.03	0.04	0.03	95.8
West: Makirikiri Road														
10	L2	26	11	28	42.3	0.033	10.4	LOS B	0.1	1.2	0.46	0.69	0.46	52.2
12	R2	268	18	288	6.7	0.763	28.8	LOS D	5.9	44.0	0.90	1.20	2.11	43.8
Approach		294	29	316	9.9	0.763	27.2	LOS D	5.9	44.0	0.86	1.16	1.97	44.4
All Vehicles		1058	167	1166	15.9	0.763	8.8	NA	5.9	44.0	0.24	0.42	0.54	73.2

SH1 / Wings Line Intersection

Base Model AM Peak (2019)

MOVEMENT SUMMARY

▽ **Site: 101 [Wings Line / SH1 AM (Site Folder: General)]**

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	16	4	18	25.0	0.011	8.9	LOS A	0.0	0.0	0.00	0.64	0.00	62.6
2	T1	184	40	207	21.7	0.121	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		200	44	225	22.0	0.121	0.7	LOS A	0.0	0.0	0.00	0.05	0.00	96.4
North: SH1														
8	T1	115	36	134	31.3	0.083	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	4	1	5	25.0	0.005	9.5	LOS A	0.0	0.2	0.35	0.61	0.35	60.2
Approach		119	37	138	31.1	0.083	0.3	NA	0.0	0.2	0.01	0.02	0.01	98.3
West: Wings Line														
10	L2	4	1	5	25.0	0.004	8.9	LOS A	0.0	0.1	0.32	0.59	0.32	57.9
12	R2	15	2	17	13.3	0.026	10.6	LOS B	0.1	0.7	0.47	0.69	0.47	59.6
Approach		19	3	22	15.8	0.026	10.2	LOS B	0.1	0.7	0.44	0.67	0.44	59.2
All Vehicles		338	84	385	24.9	0.121	1.1	NA	0.1	0.7	0.03	0.08	0.03	94.4

Base Model PM Peak (2019)

MOVEMENT SUMMARY

▽ **Site: 101 [Wings Line / SH1 PM (Site Folder: General)]**

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	22	0	23	0.0	0.013	8.3	LOS A	0.0	0.0	0.00	0.64	0.00	67.2
2	T1	220	44	234	20.0	0.136	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		242	44	257	18.2	0.136	0.8	LOS A	0.0	0.0	0.00	0.06	0.00	96.6
North: SH1														
8	T1	169	26	192	15.4	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	3	2	3	66.7	0.005	11.4	LOS B	0.0	0.2	0.41	0.63	0.41	54.1
Approach		172	28	195	16.3	0.108	0.2	NA	0.0	0.2	0.01	0.01	0.01	98.8
West: Wings Line														
10	L2	3	1	3	33.3	0.003	9.2	LOS A	0.0	0.1	0.35	0.59	0.35	55.3
12	R2	18	5	19	27.8	0.035	12.1	LOS B	0.1	1.1	0.53	0.75	0.53	53.6
Approach		21	6	22	28.6	0.035	11.7	LOS B	0.1	1.1	0.50	0.72	0.50	53.9
All Vehicles		435	78	475	17.9	0.136	1.0	NA	0.1	1.1	0.03	0.07	0.03	94.8

2024 AM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 AM - 2024 No Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	19	5	21	26.3	0.014	9.0	LOS A	0.0	0.0	0.00	0.64	0.00	62.5
2	T1	212	46	238	21.7	0.139	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		231	51	260	22.1	0.139	0.7	LOS A	0.0	0.0	0.00	0.05	0.00	96.2
North: SH1														
8	T1	132	41	153	31.1	0.095	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	4	1	5	25.0	0.005	9.7	LOS A	0.0	0.2	0.38	0.62	0.38	60.1
Approach		136	42	158	30.9	0.095	0.3	NA	0.0	0.2	0.01	0.02	0.01	98.5
West: Wings Line														
10	L2	4	1	5	25.0	0.004	9.1	LOS A	0.0	0.1	0.35	0.60	0.35	57.7
12	R2	17	2	20	11.8	0.031	11.1	LOS B	0.1	0.9	0.50	0.72	0.50	59.4
Approach		21	3	24	14.3	0.031	10.7	LOS B	0.1	0.9	0.47	0.70	0.47	59.1
All Vehicles		388	96	442	24.8	0.139	1.1	NA	0.1	0.9	0.03	0.08	0.03	94.5

2024 PM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 PM - 2024 No Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	25	0	27	0.0	0.014	8.3	LOS A	0.0	0.0	0.00	0.64	0.00	67.2
2	T1	253	51	269	20.2	0.156	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		278	51	296	18.3	0.156	0.8	LOS A	0.0	0.0	0.00	0.06	0.00	96.6
North: SH1														
8	T1	194	30	220	15.5	0.124	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	3	2	3	66.7	0.005	11.8	LOS B	0.0	0.2	0.44	0.64	0.44	53.7
Approach		197	32	224	16.2	0.124	0.2	NA	0.0	0.2	0.01	0.01	0.01	99.0
West: Wings Line														
10	L2	3	1	3	33.3	0.003	9.4	LOS A	0.0	0.1	0.38	0.60	0.38	55.2
12	R2	21	6	22	28.6	0.045	13.2	LOS B	0.2	1.4	0.56	0.79	0.56	52.4
Approach		24	7	25	29.2	0.045	12.7	LOS B	0.2	1.4	0.54	0.76	0.54	52.7
All Vehicles		499	90	545	18.0	0.156	1.1	NA	0.2	1.4	0.03	0.07	0.03	94.7

2024 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 AM - 2024 With Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	22	8	25	36.4	0.017	9.2	LOS A	0.0	0.0	0.00	0.64	0.00	61.2
2	T1	223	54	251	24.2	0.149	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		245	62	275	25.3	0.149	0.8	LOS A	0.0	0.0	0.00	0.06	0.00	95.7
North: SH1														
8	T1	152	49	177	32.2	0.110	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	4	1	5	25.0	0.005	9.9	LOS A	0.0	0.2	0.40	0.62	0.40	60.0
Approach		156	50	181	32.1	0.110	0.3	NA	0.0	0.2	0.01	0.02	0.01	98.7
West: Wings Line														
10	L2	4	1	5	25.0	0.004	9.2	LOS A	0.0	0.1	0.36	0.60	0.36	57.7
12	R2	20	5	23	25.0	0.043	12.4	LOS B	0.2	1.3	0.54	0.76	0.54	54.1
Approach		24	6	28	25.0	0.043	11.8	LOS B	0.2	1.3	0.51	0.74	0.51	54.7
All Vehicles		425	118	485	27.8	0.149	1.3	NA	0.2	1.3	0.03	0.08	0.03	93.6

2024 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 PM - 2024 With Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	28	3	30	10.7	0.017	8.6	LOS A	0.0	0.0	0.00	0.64	0.00	64.5
2	T1	272	58	289	21.3	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		300	61	319	20.3	0.169	0.8	LOS A	0.0	0.0	0.00	0.06	0.00	96.1
North: SH1														
8	T1	206	38	234	18.4	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	3	2	3	66.7	0.005	12.1	LOS B	0.0	0.2	0.46	0.65	0.46	53.4
Approach		209	40	238	19.1	0.134	0.2	NA	0.0	0.2	0.01	0.01	0.01	99.0
West: Wings Line														
10	L2	3	1	3	33.3	0.003	9.6	LOS A	0.0	0.1	0.39	0.60	0.39	55.1
12	R2	24	9	25	37.5	0.060	14.6	LOS B	0.2	2.0	0.60	0.83	0.60	49.0
Approach		27	10	28	37.0	0.060	14.1	LOS B	0.2	2.0	0.58	0.81	0.58	49.6
All Vehicles		536	111	585	20.7	0.169	1.2	NA	0.2	2.0	0.03	0.08	0.03	93.9

2034 AM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 AM - 2034 No Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	23	6	26	26.1	0.017	9.0	LOS A	0.0	0.0	0.00	0.64	0.00	62.5
2	T1	267	58	300	21.7	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		290	64	326	22.1	0.176	0.7	LOS A	0.0	0.0	0.00	0.05	0.00	96.3
North: SH1														
8	T1	167	52	194	31.1	0.120	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	5	1	6	20.0	0.007	10.0	LOS B	0.0	0.2	0.43	0.64	0.43	60.4
Approach		172	53	200	30.8	0.120	0.3	NA	0.0	0.2	0.01	0.02	0.01	98.5
West: Wings Line														
10	L2	5	1	6	20.0	0.005	9.3	LOS A	0.0	0.2	0.39	0.61	0.39	59.1
12	R2	22	3	26	13.6	0.049	12.6	LOS B	0.2	1.4	0.56	0.79	0.56	57.0
Approach		27	4	31	14.8	0.049	12.0	LOS B	0.2	1.4	0.53	0.76	0.53	57.3
All Vehicles		489	121	557	24.8	0.176	1.2	NA	0.2	1.4	0.03	0.08	0.03	94.3

2034 PM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 PM - 2034 No Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	32	0	34	0.0	0.018	8.3	LOS A	0.0	0.0	0.00	0.64	0.00	67.2
2	T1	319	64	339	20.1	0.197	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		351	64	373	18.2	0.197	0.8	LOS A	0.0	0.0	0.00	0.06	0.00	96.5
North: SH1														
8	T1	245	38	278	15.5	0.157	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	4	3	5	75.0	0.008	13.2	LOS B	0.0	0.3	0.50	0.68	0.50	51.6
Approach		249	41	283	16.5	0.157	0.2	NA	0.0	0.3	0.01	0.01	0.01	98.8
West: Wings Line														
10	L2	4	1	4	25.0	0.004	9.7	LOS A	0.0	0.1	0.42	0.62	0.42	57.4
12	R2	26	7	27	26.9	0.071	15.6	LOS C	0.2	2.2	0.65	0.88	0.65	50.5
Approach		30	8	32	26.7	0.071	14.8	LOS B	0.2	2.2	0.62	0.84	0.62	51.3
All Vehicles		630	113	688	17.9	0.197	1.2	NA	0.2	2.2	0.03	0.08	0.03	94.5

2034 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 AM - 2034 With Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	26	9	29	34.6	0.020	9.2	LOS A	0.0	0.0	0.00	0.64	0.00	61.4
2	T1	278	66	312	23.7	0.185	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		304	75	342	24.7	0.185	0.8	LOS A	0.0	0.0	0.00	0.05	0.00	95.9
North: SH1														
8	T1	186	60	216	32.3	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	5	1	6	20.0	0.007	10.1	LOS B	0.0	0.2	0.44	0.64	0.44	60.2
Approach		191	61	222	31.9	0.134	0.3	NA	0.0	0.2	0.01	0.02	0.01	98.6
West: Wings Line														
10	L2	5	1	6	20.0	0.006	9.4	LOS A	0.0	0.2	0.40	0.62	0.40	59.0
12	R2	25	6	29	24.0	0.065	14.1	LOS B	0.2	2.0	0.60	0.83	0.60	52.6
Approach		30	7	35	23.3	0.065	13.3	LOS B	0.2	2.0	0.57	0.80	0.57	53.6
All Vehicles		525	143	599	27.3	0.185	1.3	NA	0.2	2.0	0.04	0.08	0.04	93.5

2034 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Wings Line / SH1 PM - 2034 With Development (Site Folder: General)]

Wings Line / SH1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1														
1	L2	35	3	37	8.6	0.021	8.5	LOS A	0.0	0.0	0.00	0.64	0.00	64.8
2	T1	339	72	361	21.2	0.210	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		374	75	398	20.1	0.210	0.8	LOS A	0.0	0.0	0.00	0.06	0.00	96.1
North: SH1														
8	T1	256	46	291	18.0	0.167	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	4	3	5	75.0	0.008	13.6	LOS B	0.0	0.3	0.52	0.69	0.52	51.2
Approach		260	49	295	18.8	0.167	0.2	NA	0.0	0.3	0.01	0.01	0.01	98.8
West: Wings Line														
10	L2	4	1	4	25.0	0.004	9.8	LOS A	0.0	0.1	0.43	0.62	0.43	57.3
12	R2	29	10	31	34.5	0.091	17.4	LOS C	0.3	2.9	0.69	0.90	0.69	47.3
Approach		33	11	35	33.3	0.091	16.5	LOS C	0.3	2.9	0.66	0.86	0.66	48.3
All Vehicles		667	135	728	20.2	0.210	1.3	NA	0.3	2.9	0.03	0.08	0.03	93.7

SH3 / Makirikiri Road Intersection

Base Model AM Peak (2019)

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 AM (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	228	36	253	15.8	0.146	0.0	LOS A	0.0	0.2	0.01	0.01	0.01	99.7
6	R2	2	1	2	50.0	0.146	10.8	LOS B	0.0	0.2	0.01	0.01	0.01	67.3
Approach		230	37	256	16.1	0.146	0.1	NA	0.0	0.2	0.01	0.01	0.01	99.3
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	8.6	LOS A	0.0	0.0	0.33	0.57	0.33	73.3
9	R2	26	2	29	7.7	0.041	10.3	LOS B	0.1	1.0	0.47	0.75	0.47	68.1
Approach		27	2	30	7.4	0.041	10.2	LOS B	0.1	1.0	0.46	0.74	0.46	68.3
West: SH3														
10	L2	18	4	19	22.2	0.156	8.4	LOS A	0.0	0.0	0.00	0.05	0.00	77.3
11	T1	250	31	260	12.4	0.156	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.7
Approach		268	35	279	13.1	0.156	0.6	NA	0.0	0.0	0.00	0.05	0.00	96.9
All Vehicles		525	74	565	14.1	0.156	0.9	NA	0.1	1.0	0.03	0.06	0.03	95.8

Base Model PM Peak (2019)

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 PM (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	271	29	282	10.7	0.156	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.8
6	R2	1	0	1	0.0	0.156	9.3	LOS A	0.0	0.1	0.00	0.00	0.00	88.3
Approach		272	29	283	10.7	0.156	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	8.9	LOS A	0.0	0.0	0.39	0.58	0.39	72.9
9	R2	17	2	24	11.8	0.040	11.4	LOS B	0.1	1.0	0.51	0.79	0.51	65.6
Approach		18	2	25	11.1	0.040	11.2	LOS B	0.1	1.0	0.51	0.78	0.51	66.0
West: SH3														
10	L2	25	2	27	8.0	0.204	8.1	LOS A	0.0	0.0	0.00	0.05	0.00	83.3
11	T1	309	50	332	16.2	0.204	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.2
Approach		334	52	359	15.6	0.204	0.6	NA	0.0	0.0	0.00	0.05	0.00	96.9
All Vehicles		624	83	668	13.3	0.204	0.8	NA	0.1	1.0	0.02	0.06	0.02	96.4

2024 AM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 AM - 2024 No Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	262	41	291	15.6	0.165	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.8
6	R2	1	0	1	0.0	0.165	9.1	LOS A	0.0	0.1	0.00	0.00	0.00	88.3
Approach		263	41	292	15.6	0.165	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	8.8	LOS A	0.0	0.0	0.36	0.58	0.36	73.1
9	R2	30	2	33	6.7	0.051	10.8	LOS B	0.2	1.2	0.50	0.79	0.50	67.7
Approach		31	2	34	6.5	0.051	10.8	LOS B	0.2	1.2	0.49	0.78	0.49	67.9
West: SH3														
10	L2	21	5	22	23.8	0.180	8.5	LOS A	0.0	0.0	0.00	0.05	0.00	76.6
11	T1	288	36	300	12.5	0.180	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.6
Approach		309	41	322	13.3	0.180	0.6	NA	0.0	0.0	0.00	0.05	0.00	96.8
All Vehicles		603	84	649	14.0	0.180	0.9	NA	0.2	1.2	0.03	0.07	0.03	95.9

2024 PM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 PM - 2024 No Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	311	33	324	10.6	0.178	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.9
6	R2	1	0	1	0.0	0.178	9.7	LOS A	0.0	0.1	0.00	0.00	0.00	88.3
Approach		312	33	325	10.6	0.178	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	9.2	LOS A	0.0	0.0	0.42	0.59	0.42	72.8
9	R2	19	2	27	10.5	0.050	12.2	LOS B	0.2	1.2	0.58	0.84	0.58	64.9
Approach		20	2	28	10.0	0.050	12.1	LOS B	0.2	1.2	0.57	0.83	0.57	65.3
West: SH3														
10	L2	28	2	30	7.1	0.234	8.0	LOS A	0.0	0.0	0.00	0.05	0.00	83.7
11	T1	356	58	383	16.3	0.234	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.2
Approach		384	60	413	15.6	0.234	0.6	NA	0.0	0.0	0.00	0.05	0.00	97.0
All Vehicles		716	95	766	13.3	0.234	0.8	NA	0.2	1.2	0.02	0.06	0.02	96.4

2024 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 AM - 2024 With Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	262	41	291	15.6	0.165	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.8
6	R2	1	0	1	0.0	0.165	9.4	LOS A	0.0	0.1	0.00	0.00	0.00	88.3
Approach		263	41	292	15.6	0.165	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	8.8	LOS A	0.0	0.0	0.36	0.58	0.36	73.1
9	R2	50	10	56	20.0	0.099	12.2	LOS B	0.3	2.6	0.55	0.85	0.55	62.4
Approach		51	10	57	19.6	0.099	12.1	LOS B	0.3	2.6	0.54	0.85	0.54	62.6
West: SH3														
10	L2	77	13	80	16.9	0.215	8.3	LOS A	0.0	0.0	0.00	0.14	0.00	77.6
11	T1	288	36	300	12.5	0.215	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	95.7
Approach		365	49	380	13.4	0.215	1.8	NA	0.0	0.0	0.00	0.14	0.00	91.2
All Vehicles		679	100	729	14.8	0.215	1.9	NA	0.3	2.6	0.04	0.14	0.04	91.1

2024 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 PM - 2024 With Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	311	33	324	10.6	0.179	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.9
6	R2	1	0	1	0.0	0.179	9.9	LOS A	0.0	0.1	0.00	0.00	0.00	88.3
Approach		312	33	325	10.6	0.179	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	9.2	LOS A	0.0	0.0	0.42	0.59	0.42	72.8
9	R2	75	10	106	13.3	0.207	13.3	LOS B	0.7	5.4	0.63	0.89	0.65	63.0
Approach		76	10	107	13.2	0.207	13.2	LOS B	0.7	5.4	0.63	0.88	0.65	63.1
West: SH3														
10	L2	49	10	53	20.4	0.250	8.4	LOS A	0.0	0.0	0.00	0.08	0.00	77.3
11	T1	356	58	383	16.3	0.250	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	97.4
Approach		405	68	435	16.8	0.250	1.0	NA	0.0	0.0	0.00	0.08	0.00	94.5
All Vehicles		793	111	868	14.0	0.250	2.2	NA	0.7	5.4	0.08	0.15	0.08	90.7

2034 AM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 AM - 2034 No Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	330	52	367	15.8	0.208	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.9
6	R2	1	0	1	0.0	0.208	9.7	LOS A	0.0	0.1	0.00	0.00	0.00	88.3
Approach		331	52	368	15.7	0.208	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	9.1	LOS A	0.0	0.0	0.41	0.58	0.41	72.8
9	R2	38	3	42	7.9	0.081	12.5	LOS B	0.3	1.9	0.60	0.87	0.60	65.4
Approach		39	3	43	7.7	0.081	12.4	LOS B	0.3	1.9	0.59	0.86	0.59	65.5
West: SH3														
10	L2	26	6	27	23.1	0.227	8.5	LOS A	0.0	0.0	0.00	0.05	0.00	76.9
11	T1	363	45	378	12.4	0.227	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.6
Approach		389	51	405	13.1	0.227	0.6	NA	0.0	0.0	0.00	0.05	0.00	96.8
All Vehicles		759	106	816	14.0	0.227	1.0	NA	0.3	1.9	0.03	0.07	0.03	95.7

2034 PM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 PM - 2034 No Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	393	42	409	10.7	0.226	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.9
6	R2	1	0	1	0.0	0.226	10.7	LOS B	0.0	0.1	0.00	0.00	0.00	88.3
Approach		394	42	410	10.7	0.226	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	9.7	LOS A	0.0	0.0	0.47	0.61	0.47	72.4
9	R2	25	3	35	12.0	0.089	15.0	LOS B	0.3	2.1	0.70	0.90	0.70	61.5
Approach		26	3	37	11.5	0.089	14.8	LOS B	0.3	2.1	0.69	0.89	0.69	61.9
West: SH3														
10	L2	36	3	39	8.3	0.296	8.1	LOS A	0.0	0.0	0.00	0.05	0.00	83.1
11	T1	449	73	483	16.3	0.296	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.1
Approach		485	76	522	15.7	0.296	0.6	NA	0.0	0.0	0.00	0.05	0.00	96.8
All Vehicles		905	121	969	13.4	0.296	0.9	NA	0.3	2.1	0.03	0.06	0.03	96.0

2034 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 AM - 2034 With Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	330	52	367	15.8	0.208	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.9
6	R2	1	0	1	0.0	0.208	10.1	LOS B	0.0	0.1	0.00	0.00	0.00	88.3
Approach		331	52	368	15.7	0.208	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	9.1	LOS A	0.0	0.0	0.41	0.58	0.41	72.8
9	R2	58	11	64	19.0	0.143	14.1	LOS B	0.5	3.7	0.65	0.89	0.65	60.7
Approach		59	11	66	18.6	0.143	14.0	LOS B	0.5	3.7	0.65	0.88	0.65	60.9
West: SH3														
10	L2	82	14	85	17.1	0.261	8.3	LOS A	0.0	0.0	0.00	0.13	0.00	77.9
11	T1	363	45	378	12.4	0.261	0.0	LOS A	0.0	0.0	0.00	0.13	0.00	96.2
Approach		445	59	464	13.3	0.261	1.6	NA	0.0	0.0	0.00	0.13	0.00	92.2
All Vehicles		835	122	897	14.7	0.261	1.8	NA	0.5	3.7	0.05	0.13	0.05	91.6

2034 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Makirikiri Rd / SH3 PM - 2034 With Development (Site Folder: General)]

Makirikiri Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	393	42	409	10.7	0.226	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	99.9
6	R2	1	0	1	0.0	0.226	10.9	LOS B	0.0	0.1	0.00	0.00	0.00	88.3
Approach		394	42	410	10.7	0.226	0.0	NA	0.0	0.1	0.00	0.00	0.00	99.8
North: Makirikiri Rd														
7	L2	1	0	1	0.0	0.001	9.7	LOS A	0.0	0.0	0.47	0.61	0.47	72.4
9	R2	81	11	114	13.6	0.301	17.1	LOS C	1.1	8.5	0.76	0.95	0.90	59.0
Approach		82	11	115	13.4	0.301	17.0	LOS C	1.1	8.5	0.75	0.95	0.90	59.1
West: SH3														
10	L2	57	11	61	19.3	0.311	8.4	LOS A	0.0	0.0	0.00	0.08	0.00	77.8
11	T1	449	73	483	16.3	0.311	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	97.5
Approach		506	84	544	16.6	0.311	1.0	NA	0.0	0.0	0.00	0.08	0.00	94.8
All Vehicles		982	137	1070	14.0	0.311	2.4	NA	1.1	8.5	0.08	0.14	0.10	90.7

SH3 / Pukepapa Road Intersection

Base Model AM Peak (2019)

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 AM (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	239	43	263	18.0	0.151	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	55	9	60	16.4	0.063	9.6	LOS A	0.2	2.0	0.40	0.68	0.40	66.7
Approach		294	52	323	17.7	0.151	1.8	NA	0.2	2.0	0.07	0.13	0.07	91.4
North: Pukepapa Rd														
7	L2	78	9	96	11.5	0.104	9.6	LOS A	0.4	2.9	0.38	0.69	0.38	68.3
9	R2	1	1	1	100.0	0.006	26.3	LOS D	0.0	0.3	0.74	0.80	0.74	42.2
Approach		79	10	98	12.7	0.104	9.8	LOS A	0.4	2.9	0.39	0.69	0.39	67.8
West: SH3														
10	L2	7	1	8	14.3	0.005	8.2	LOS A	0.0	0.0	0.00	0.66	0.00	69.4
11	T1	257	26	279	10.1	0.153	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		264	27	287	10.2	0.153	0.2	NA	0.0	0.0	0.00	0.02	0.00	98.8
All Vehicles		637	89	708	14.0	0.153	2.3	NA	0.4	2.9	0.09	0.16	0.09	89.8

Base Model PM Peak (2019)

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 PM (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	264	31	290	11.7	0.162	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	116	5	127	4.3	0.135	9.7	LOS A	0.5	3.9	0.46	0.72	0.46	70.2
Approach		380	36	418	9.5	0.162	3.0	NA	0.5	3.9	0.14	0.22	0.14	88.5
North: Pukepapa Rd														
7	L2	76	7	87	9.2	0.102	10.0	LOS B	0.4	2.8	0.43	0.72	0.43	68.5
9	R2	4	2	5	50.0	0.022	24.3	LOS C	0.1	0.7	0.77	0.90	0.77	47.3
Approach		80	9	92	11.3	0.102	10.8	LOS B	0.4	2.8	0.45	0.73	0.45	67.0
West: SH3														
10	L2	3	1	3	33.3	0.002	8.7	LOS A	0.0	0.0	0.00	0.66	0.00	63.7
11	T1	307	47	345	15.3	0.194	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		310	48	348	15.5	0.194	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.3
All Vehicles		770	93	858	12.1	0.194	2.6	NA	0.5	3.9	0.12	0.19	0.12	89.4

2024 AM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 AM - 2024 No Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	274	49	301	17.9	0.173	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	63	10	69	15.9	0.076	9.9	LOS A	0.3	2.4	0.43	0.70	0.43	66.5
Approach		337	59	370	17.5	0.173	1.9	NA	0.3	2.4	0.08	0.13	0.08	91.3
North: Pukepapa Rd														
7	L2	89	10	110	11.2	0.125	9.9	LOS A	0.5	3.5	0.42	0.71	0.42	68.1
9	R2	1	1	1	100.0	0.008	31.6	LOS D	0.0	0.3	0.79	0.86	0.79	39.8
Approach		90	11	111	12.2	0.125	10.2	LOS B	0.5	3.5	0.42	0.72	0.42	67.6
West: SH3														
10	L2	8	1	9	12.5	0.005	8.2	LOS A	0.0	0.0	0.00	0.66	0.00	70.0
11	T1	296	30	322	10.1	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		304	31	330	10.2	0.176	0.2	NA	0.0	0.0	0.00	0.02	0.00	98.8
All Vehicles		731	101	812	13.8	0.176	2.3	NA	0.5	3.5	0.09	0.16	0.09	89.8

2024 PM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 PM - 2024 No Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	304	36	334	11.8	0.186	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	134	6	147	4.5	0.168	10.2	LOS B	0.7	4.9	0.50	0.76	0.50	69.6
Approach		438	42	481	9.6	0.186	3.1	NA	0.7	4.9	0.15	0.23	0.15	88.1
North: Pukepapa Rd														
7	L2	87	8	100	9.2	0.126	10.5	LOS B	0.5	3.4	0.47	0.76	0.47	68.0
9	R2	4	2	5	50.0	0.029	29.9	LOS D	0.1	0.9	0.82	0.94	0.82	44.1
Approach		91	10	105	11.0	0.126	11.3	LOS B	0.5	3.4	0.48	0.76	0.48	66.4
West: SH3														
10	L2	3	1	3	33.3	0.002	8.7	LOS A	0.0	0.0	0.00	0.66	0.00	63.7
11	T1	353	54	397	15.3	0.224	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		356	55	400	15.4	0.224	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.4
All Vehicles		885	107	986	12.1	0.224	2.8	NA	0.7	4.9	0.13	0.20	0.13	89.1

2024 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 AM - 2024 With Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	274	49	301	17.9	0.174	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	63	10	69	15.9	0.082	10.4	LOS B	0.3	2.5	0.47	0.73	0.47	66.0
Approach		337	59	370	17.5	0.174	2.0	NA	0.3	2.5	0.09	0.14	0.09	91.2
North: Pukepapa Rd														
7	L2	89	10	110	11.2	0.125	9.9	LOS A	0.5	3.5	0.42	0.71	0.42	68.1
9	R2	21	9	26	42.9	0.109	22.7	LOS C	0.4	3.5	0.76	0.92	0.76	49.4
Approach		110	19	136	17.3	0.125	12.4	LOS B	0.5	3.5	0.48	0.75	0.48	63.5
West: SH3														
10	L2	64	9	70	14.1	0.041	8.2	LOS A	0.0	0.0	0.00	0.66	0.00	69.5
11	T1	296	30	322	10.1	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		360	39	391	10.8	0.176	1.5	NA	0.0	0.0	0.00	0.12	0.00	92.7
All Vehicles		807	117	897	14.6	0.176	3.3	NA	0.5	3.5	0.11	0.22	0.11	86.1

2024 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 PM - 2024 With Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	304	36	334	11.8	0.186	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	134	6	147	4.5	0.173	10.3	LOS B	0.7	5.1	0.51	0.77	0.51	69.3
Approach		438	42	481	9.6	0.186	3.2	NA	0.7	5.1	0.16	0.24	0.16	88.0
North: Pukepapa Rd														
7	L2	87	8	100	9.2	0.126	10.5	LOS B	0.5	3.4	0.47	0.76	0.47	68.0
9	R2	60	10	69	16.7	0.303	26.1	LOS D	1.2	9.2	0.83	0.97	0.98	51.2
Approach		147	18	169	12.2	0.303	16.9	LOS C	1.2	9.2	0.62	0.84	0.68	60.0
West: SH3														
10	L2	24	9	27	37.5	0.018	8.8	LOS A	0.0	0.0	0.00	0.66	0.00	62.5
11	T1	353	54	397	15.3	0.224	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		377	63	424	16.7	0.224	0.6	NA	0.0	0.0	0.00	0.04	0.00	96.2
All Vehicles		962	123	1074	12.8	0.303	4.3	NA	1.2	9.2	0.17	0.26	0.18	84.6

2034 AM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 AM - 2034 No Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	346	62	380	17.9	0.219	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	80	13	88	16.3	0.110	10.7	LOS B	0.4	3.4	0.50	0.76	0.50	65.5
Approach		426	75	468	17.6	0.219	2.0	NA	0.4	3.4	0.09	0.14	0.09	90.9
North: Pukepapa Rd														
7	L2	113	13	140	11.5	0.178	10.7	LOS B	0.7	5.1	0.49	0.78	0.49	67.0
9	R2	1	1	1	100.0	0.014	47.8	LOS E	0.0	0.5	0.88	0.96	0.88	33.8
Approach		114	14	141	12.3	0.178	11.1	LOS B	0.7	5.1	0.49	0.78	0.49	66.5
West: SH3														
10	L2	10	1	11	10.0	0.006	8.1	LOS A	0.0	0.0	0.00	0.66	0.00	70.9
11	T1	373	38	405	10.2	0.222	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		383	39	416	10.2	0.222	0.2	NA	0.0	0.0	0.00	0.02	0.00	98.8
All Vehicles		923	128	1025	13.9	0.222	2.5	NA	0.7	5.1	0.11	0.18	0.11	89.3

2034 PM Peak With No Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 PM - 2034 No Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	383	45	421	11.7	0.234	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	168	7	185	4.2	0.245	11.3	LOS B	1.0	7.3	0.57	0.85	0.59	68.2
Approach		551	52	605	9.4	0.245	3.5	NA	1.0	7.3	0.18	0.26	0.18	87.5
North: Pukepapa Rd														
7	L2	110	10	126	9.1	0.186	11.6	LOS B	0.7	5.1	0.54	0.84	0.54	66.6
9	R2	6	3	7	50.0	0.077	47.8	LOS E	0.2	2.3	0.90	0.97	0.90	36.3
Approach		116	13	133	11.2	0.186	13.5	LOS B	0.7	5.1	0.56	0.84	0.56	63.9
West: SH3														
10	L2	4	1	4	25.0	0.003	8.5	LOS A	0.0	0.0	0.00	0.66	0.00	66.1
11	T1	445	68	500	15.3	0.282	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
Approach		449	69	504	15.4	0.282	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.4
All Vehicles		1116	134	1243	12.0	0.282	3.2	NA	1.0	7.3	0.15	0.22	0.15	88.3

2034 AM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 AM - 2034 With Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	346	62	380	17.9	0.220	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	80	13	88	16.3	0.119	11.2	LOS B	0.5	3.7	0.53	0.78	0.53	64.9
Approach		426	75	468	17.6	0.220	2.1	NA	0.5	3.7	0.10	0.15	0.10	90.7
North: Pukepapa Rd														
7	L2	113	13	140	11.5	0.178	10.7	LOS B	0.7	5.1	0.49	0.78	0.49	67.0
9	R2	21	9	26	42.9	0.165	31.5	LOS D	0.5	5.1	0.85	0.95	0.85	44.1
Approach		134	22	165	16.4	0.178	14.0	LOS B	0.7	5.1	0.54	0.80	0.54	62.0
West: SH3														
10	L2	66	9	72	13.6	0.042	8.2	LOS A	0.0	0.0	0.00	0.66	0.00	69.7
11	T1	373	38	405	10.2	0.222	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		439	47	477	10.7	0.222	1.3	NA	0.0	0.0	0.00	0.10	0.00	93.8
All Vehicles		999	144	1111	14.5	0.222	3.5	NA	0.7	5.1	0.12	0.22	0.12	86.0

2034 PM Peak With Development

MOVEMENT SUMMARY

▽ Site: 101 [Pukepapa Rd / SH3 PM - 2034 With Development (Site Folder: General)]

Pukepapa Rd / SH3
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH3														
5	T1	383	45	421	11.7	0.234	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	168	7	185	4.2	0.252	11.6	LOS B	1.1	7.6	0.59	0.86	0.61	67.8
Approach		551	52	605	9.4	0.252	3.5	NA	1.1	7.6	0.18	0.26	0.19	87.3
North: Pukepapa Rd														
7	L2	110	10	126	9.1	0.186	11.6	LOS B	0.7	5.1	0.54	0.84	0.54	66.6
9	R2	62	11	71	17.7	0.519	46.8	LOS E	2.0	16.4	0.93	1.04	1.29	39.6
Approach		172	21	198	12.2	0.519	24.3	LOS C	2.0	16.4	0.68	0.91	0.81	53.5
West: SH3														
10	L2	24	9	27	37.5	0.018	8.8	LOS A	0.0	0.0	0.00	0.66	0.00	62.5
11	T1	445	68	500	15.3	0.282	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
Approach		469	77	527	16.4	0.282	0.5	NA	0.0	0.0	0.00	0.03	0.00	96.9
All Vehicles		1192	150	1330	12.6	0.519	5.4	NA	2.0	16.4	0.18	0.27	0.21	82.7

Appendix D – Intersection Safety Assessment (Crash Risk)

Crash Estimate Compendium - Crash Prediction Models

7.4 High-Speed Priority T -Junctions (>80km/h on main road)

Factors Assessed	
q1	Right turn flow from minor road (veh/day)
q2	Left-Turn Flow from minor road (veh/day)
q3	Right-Turning flow from major road (veh/day)
q4	Through vehcile flow on major road to right of minor road vehicles (veh/day)
q5	Through vehicle flow to left of minor road vehicles (veh/day)
q6	Left Turning flow from major road in (veh/day)

Wings Line / SH1

Existing

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		201					2778			1	0.016637638
right-turning and following vehicles					47	3817			100		0.065051579
Other	1.32*10-5*(q5+q6)^0.91						2778	233			0.019328532
Other	2.48*10-4*(q3+q4)^0.51				47	3817					0.016743314
Other	1.22*10-2*(q1+q2)^-.02	201		69							0.003983028
											0.121744091

With Development

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		217				2839				1	0 0.018535455
right-turning and following vehicles					47	3877			100		0.065744536
Other	1.32*10-5*(q5+q6)^0.91						2839	249			0.019779448
Other	2.48*10-4*(q3+q4)^0.51				47	3877					0.016877247
Other	1.22*10-2*(q1+q2)^-.02	217		69							0.003936154
											0.124872842

Makirikiri Rd / SH1

Existing

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		886					3246			1	0.122723392
right-turning and following vehicles					33	2667			100		0.043169802
Other	1.32*10-5*(q5+q6)^0.91						3246	929			0.026024962
Other	2.48*10-4*(q3+q4)^0.51				33	2667					0.013945398
Other	1.22*10-2*(q1+q2)^-.02	886		52							0.003103999
											0.208967554

With Development

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		1064					3246			1	0.156582852
right-turning and following vehicles					110	2667			100		0.075349069
Other	1.32*10-5*(q5+q6)^0.91						3246	1107			0.027032888
Other	2.48*10-4*(q3+q4)^0.51				110	2667					0.014147569
Other	1.22*10-2*(q1+q2)^-.02	1064		130							0.002958088
											0.276070466

Makirikiri Road / SH3

Existing

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		295					3236			1	0.028445346
right-turning and following vehicles					2	3301			100		0.01428057
Other	1.32*10-5*(q5+q6)^0.91						3236	161			0.021567793
Other	2.48*10-4*(q3+q4)^0.51				2	3301					0.015457264
Other	1.22*10-2*(q1+q2)^-.02	295		2							0.003905992
											0.083656964

With Development

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		412					3236			1	0.044307182
right-turning and following vehicles					2	3301			100		0.01428057
Other	1.32*10-5*(q5+q6)^0.91						3236	277			0.022241069
Other	2.48*10-4*(q3+q4)^0.51				2	3301					0.015457264
Other	1.22*10-2*(q1+q2)^-.02	412		2							0.00365569
											0.099941774

Pukepapa / SH3

Existing

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		54					3556			1	0.003032438
right-turning and following vehicles					688	3749			100		0.219940371
Other	1.32*10-5*(q5+q6)^0.91						3556	46			0.022757127
Other	2.48*10-4*(q3+q4)^0.51				688	3749					0.017967052
Other	1.22*10-2*(q1+q2)^-.02	54		571							0.003365894
											0.267062883

With Development

	Equation	q1	q2	q3	q4	q5	q6	SL	VD		AT
Model 2		171					3556			1	0.01395645
right-turning and following vehicles					688	3749			100		0.219940371
Other	1.32*10-5*(q5+q6)^0.91						3556	163			0.023426896
Other	2.48*10-4*(q3+q4)^0.51				688	3749					0.017967052
Other	1.22*10-2*(q1+q2)^-.02	171		571							0.003252708
											0.278543478

Crash Prediction according to the NZTA Crash Estimation Compendium
Section 6.1 Cross Roads 50-70km/hr

require input
cell with formula - do not override

Crash Risk Assessment	Qmajor (vpd) Wellington Road	Qminor (vpd) *Makirikiri Road*
Existing AADT, without development traffic	2020	1320
Predicted AADT, including full development traffic (2034)	2020	1553
A_T - existing, based on **CAS data** (per year)	0.5	
A_T - existing, based on **CEC** (per year)	0.21	
A_T - future, with development traffic, based on **CEC** (per year)	0.23	

Appendix E – Level Crossing Safety Impact Assessment

Makirikiri Road Level Crossing 529, Marton

Level Crossing Safety Impact Assessment

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Contents

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Revision	Date	Author	Reviewed by	Approved by	Status
1	10/10/19	B. Feary	T. Burt	M. Evis	For Comment
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Revision Details

Revision	Details
2	Approved by KiwiRail

Executive Summary

A District Plan Change is proposed to rezone 217 Hectares of rural land immediately northeast of the Makirikiri Road Level Crossing 529 to industrial land. The North Island Main Trunk Line is the western boundary of the land to be rezoned, the others being Makirikiri Road to the south, Wings Line to the North and State Highway 1 to the east. The main road access into the industrial area is planned to be from Makirikiri Road to the east of the existing level crossing.

Traffic volumes from the site will travel east and west and are expected to increase over time as the site is developed. In addition, it is anticipated the development will include access to the rail line, however this is yet to be confirmed.

The existing crossing carries a daily volume of 1640vpd with 13% HCV, which with the proposed industrial development is expected to increase to 5700-7900vpd with 44% HCV in 5-years and 8000-8900vpd with 50% HCV in 10 years. The road posted speed limit is 100km/h and the rail line speed 100-110km/h.

The crossing controls were upgraded from Flashing Lights and Bells to include Half Arm Barriers in 2015. The change in controls was not updated in the LXM database so is not reflected in the current crossing risk calculations. The crossing signs and markings are not to TCD 9 requirements and should be upgraded. Grade separation of the crossing is not possible or feasible with the plan change. No nearby crossings with lower volumes are proposed to be closed.

The consensus from the KiwiRail and RCA representatives who met on site to evaluate the crossing is that the crossing has appropriate sight distances and controls to safely manage current and future user volumes resulting from the plan change development. The crossing meets LCSIA Risk Criterion 2 and signs and markings upgrades to TCD 9 are recommended.

LCSS and ALCAM Evaluation

The Level Crossing Safety Score (LCSS) Procedure assesses and scores the risk of a fatality at the crossing for the upgraded existing, proposal and future traffic volume scenarios.

The tables below detail the progression of the LCSS for the level crossing through the stages of this LCSS while aiming to achieve the KiwiRail LCSIA Criteria.

An attempt was made to achieve Criterion 1 through road infrastructure changes to the crossing. Current S2 and S3 sighting meet requirements, the crossing already has flashing lights, bells and half arm barriers but the signs and road markings are not to TCD 9 requirements. The rail line speed is 110km/h. KiwiRail representatives confirmed this is not the operating speed for all trains using the line as this will depend on the train and its loading.

No additional road infrastructure tested in the LXM database could address the main crossing risk of the High Speed Rail line. No infrastructure proposal tested created any significant reduction in the ALCAM risk level which remained High for all existing and increased volume scenarios. Infrastructure changes tested included duplication of the existing Flashing Lights at the crossing and advance train activated warning signs. Upgrading of road signs and markings to TCD 9 was included in the proposals.

The Proposal and Future LCSS scores were able to meet Criterion 2, an LCSS number out of 60, equal to the Updated Existing LCSS number.

Table No. 1: Summary of change in LCSS at Crossing 529

	Updated Existing	Change in Use	Proposal	Future
LCSS	34/60	38/60	34/60	34/60
LCSS Risk Band	Medium	Medium	Medium	Medium
Criterion met	-	None	Criterion 2	

The updated existing LCSS is Medium and the Change in Use, Proposal and Future Scores all achieve a Medium Level Crossing Safety Score.

A summary of the changes to the ALCAM risk bands are presented in the following table.

Table No. 2: Summary of ALCAM change at crossing 529

	Updated Existing	Change in Use	Proposal	Future
ALCAM Risk Band	High	High	High	High
ALCAM Risk Score Change (%)	-	309%	234%	287%
Fatal Return Period	267	65	80	69

The updated existing ALCAM risk band was High, which stayed high for the future volume and upgraded crossing scenarios. The return period for predicted fatal crashes has reduced by 198 years from the Updated Existing to Future Use Scenarios.

Recommended Road Crossing Improvements

As discussed on site with KiwiRail staff, the current road markings and signs are not compliant with TCD 9. The proposed design includes providing duplicated WX1L and WX1R advance warning signs to the correct sight distance on each approach, yellow hatching in the crossing, and no passing markings on the approaches.

Also tested in the LXM database were duplicate Flashing Lights on each approach and advance Active Warning signs. These upgrades did not change the ALCAM risk score significantly enough to move it out of the LCSS High risk band of 28/30 for the change in use, proposal or future scenarios.

There has been one incident at the crossing involving a vehicle racing the barrier arms in 2016 which resulted in the barrier arm striking a towed car on a trailer. The LE identified the existing crossing as one of the better crossings on the network due to available sightlines, and with signs and markings upgrades to TCD 9 to reduce the likelihood of drivers overtaking on the approaches, for the future use scenarios as one of the best on the network. The LE cautioned that future development works should not involve planting or structures that affect the existing sightlines between road and rail.

Future User Volume Surveys

The applicant is required to conduct additional user volume (including proportion of user type) surveys two years after the opening of the new intersection from the plan change area onto

Makirikiri Road and review whether a change in controls is required. Subsequent surveys and reviews must be completed in three yearly cycles thereafter.

Recommended Updates in ALCAM

Update the crossing controls to include the existing half arm barriers which were installed in 2015.

1 Background

This Level Crossing Safety Impact Assessment is for a change in use of the existing ALCAM Level Crossing 529 Makirikiri Road, Marton. The crossing is located at KM178.24 of the North Island Main Trunk Line and 1.294 kilometres west of the intersection of SH1 and Makirikiri Road.

A District Plan Change is proposed to re-zone 217 Hectares of rural land south of Marton which is bounded by SH1, Makirikiri Road, the North Island Main Trunk Line (NIMT) and Wings Line to Industrial land. The level crossing is at the southwest corner of the proposed industrial zone. At this stage the location of the road access points from the industrial area have not been confirmed but two road access points are proposed, the major one from Makirikiri Road and a secondary access from Wings Line. Access to the rail line from the industrial area is also proposed.

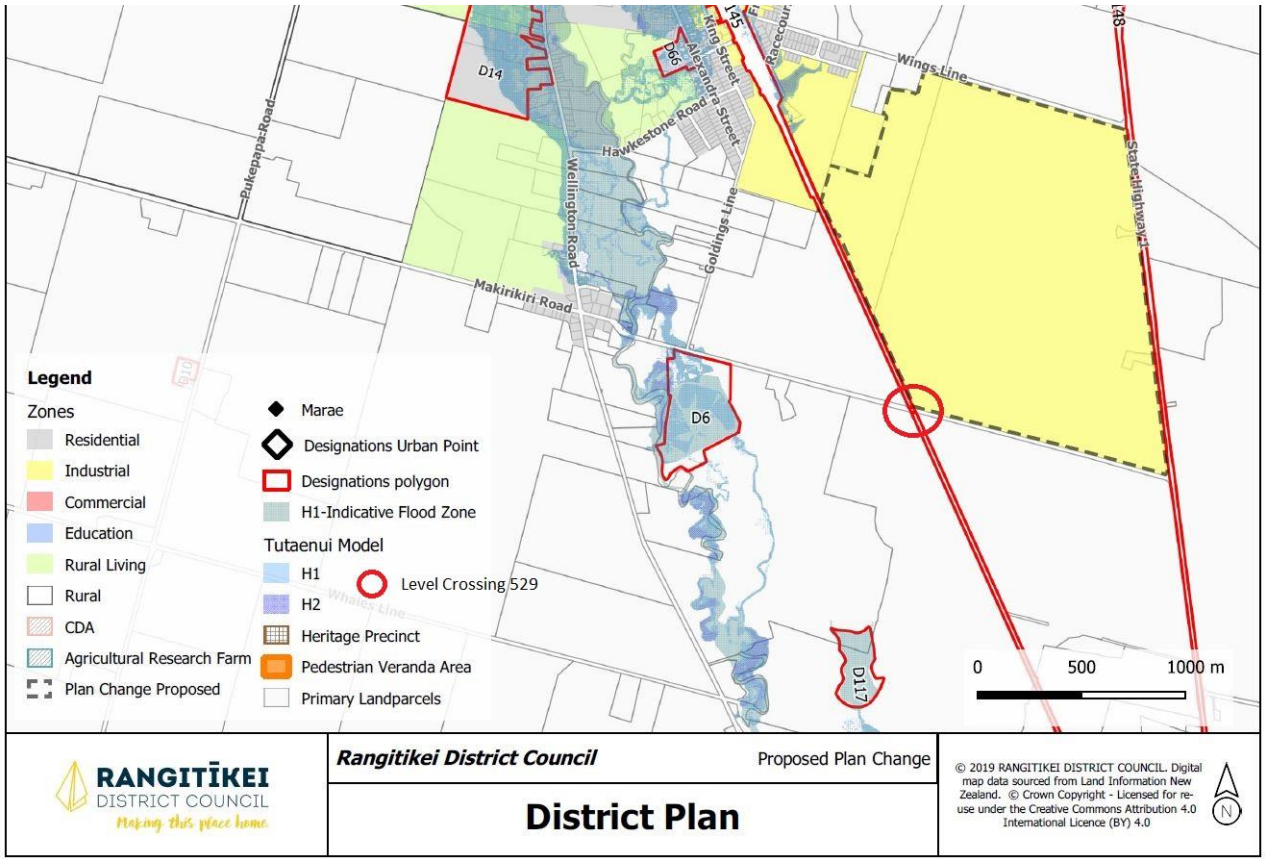

Figure 1: Extract – Rangitikei District Council District Plan Change

2 Existing Crossing

The existing crossing is controlled by Flashing Lights, Bells and Barrier Arms. KiwiRail site staff confirmed these were installed four years ago, in 2015. The LXM database has not been updated with the change in controls, so the updated existing evaluation includes a change in infrastructure and ADT.

KiwiRail Staff confirmed the current train speed at the crossing is up to 100-110km/h and there are 32 trains per day. Current road volumes are 1640vpd with 13% HCV (est, 01/04/2019).

2.1 General Safety Review

The crossing is a high speed rural crossing with a 100km/h road speed limit and a 100-110km/h rail line speed. The crossing has flashing lights, bells and half arm barriers but the signs and markings

on site are not to TCD 9 requirements. There are no Level Crossing Ahead Steam Train (WX1L and WX1R) signs in advance of the crossing, the crossing advance warning signs are white crossbucks. There are no no-overtaking markings on the approaches to the crossing and no yellow crosshatching within the crossing. There are Rail X markings on both approaches and vehicle limit lines.

KiwiRail staff rated the crossing highly due to the clear sightlines between trains and vehicles due to the level approaches and lack of vegetation along adjacent property boundaries. If planting is added to the environment in the future, they would caution the locations be reviewed to ensure they do not affect visibility for train drivers.

Their only concerns were related to driver behaviour and the road width at the crossing. The high-speed approach can lead to drivers racing around the barrier arms and the lack of shoulders to drivers driving marginally over the centreline through the crossing.

3 Change in Use Proposal

The purpose of this LCSIA is to inform the design process going forward.

The following traffic volumes are the calculated projected daily traffic volume on Makirikiri Road through the crossing due to the industrial plan change.

Table No. 3: Traffic Volume Scenarios

Daily Traffic Volume Scenario	5-years	10-years
No Development	1977	2304
With the Industrial Development (volume range)	5700 – 7900 vpd 44% HCV	8000 – 8900 vpd 50% HCV

The highest volume in the 10-year range has been used in the Change in Use and Future volume scenarios. The highest volume in the 5-year range has been used in the Proposed Design scenario as the opening volume.

The general principle for modifying an existing level crossing is the Proposed Design and Future Score LCSS achieve Criterion 1, however where the modifications required to meet Criterion 1 are not reasonably practicable for an existing level crossing upgrade the level of treatment must meet or exceed Criterion 2.

The current crossing with updated existing data has a safety flag in the LXM database for high speed rail. Road infrastructure upgrades do not significantly affect the ALCAM risk scores, which remain High for all upgrade options proposed. Therefore, to reduce the ALCAM score the crossing upgrade options are to grade separate or close the crossing to address the flag, which are not reasonably practicable for the crossing or the plan change. As such the aim of the assessment has been to achieve Criterion 2, which is achieved in the Proposed and Future evaluations.

Criterion 1: *requires the Proposed Design and Future Score of a level crossing to achieve a 'Low' or 'Medium-Low' level of risk as determined by the LCSS.*

Criterion 2*: requires the Proposed Deign and Future Score of a level crossing to achieve an LCSS number (out of 60), lower than or equal to the Updated Existing LCSS number.*

The Level Crossing Safety Score Risk Bands are defined in the following figure:

Figure 7: Level crossing safety score risk bands

Figure 2: Level Crossing Safety Score Risk Bands

4 Level Crossing Safety Score

The level crossing safety score has been calculated for the Updated Existing crossing, an improvement proposal (signs and markings to TCD 9) and a future road volume as follows.

1 Updated Existing – ALCAM and LCSS Scoring for the existing level crossing conditions found on site.
2 Change in Use – ALCAM and LCSS Scoring for the forecast 10-year user volumes over the crossing in its Updated Existing state.
3 Proposed Design – ALCAM and LCSS incorporating all the improvement recommendations for the user volumes shortly after opening, that aim to achieve Criterion 1. As improvements to meet Criterion 1 are not reasonably practicable, the aim is to achieve Criterion 2.
4 Future Score – ALCAM and LCSS ten years post opening with proposed design improvements that aim to achieve Criterion 1. As improvements to meet Criterion 1 are not reasonably practicable, the aim is to achieve Criterion 2.

4.1 ALCAM Level Crossing Safety Score

Table No. 4: ALCAM Level Crossing Score – Existing Crossing

LCSS	Score	Fatality Return	Risk % Change	Comments
Published Score	26/30	128 years	-	This is for historic crossing controls: Primary Flashing Lights only, an ADT of 1340 and rail volume of 32. The crossing was upgraded in 2015 to include barrier arms. **The ALCAM Risk Score is 78. The Risk Band Jurisdiction is High and the Likelihood Band Jurisdiction is High.** The LCSS Risk Score is 26 and the Risk Band is High.
Top Rated Characteristics				Safety Risk Flags
▪ Distance from Advance warning to crossing ▪ Slowest train speed at crossing ▪ Conformance to TCD Part 9				▪ High Speed train ▪ Sun Glare Sighting Crossing on Road
Updated Existing	25/30	267 years	-	The existing LXM data has been updated to reflect that the current crossing has half arm barriers, flashing lights and bells, an ADT of 1650vpd with 13% HCV and an asphalt panel and approach surfacing and the limit lines have been relocated to ~8m from the rail line. **The ALCAM Risk Score is 37.5 The Risk Band Jurisdiction is High and the Likelihood Band Jurisdiction is High**. The LCSS Risk Score is 25 and the Risk Band is High.
Top Rated Characteristics				Safety Risk Flags
▪ SSD – advance visibility of crossing from road ▪ Distance from advance warning to crossing ▪ Slowest train speed at crossing				▪ High Speed Train
Change in Use	28/30	65 years	309%	The updated existing crossing has had the forecast 10-year user volumes (8900 vpd, 50% HCV) added to the crossing. **The ALCAM Risk Score is 153.3. The Risk Band Jurisdiction is High and the Likelihood Band Jurisdiction is High.** The LCSS Risk Score is 28 and the Risk Band is High.
Top Rated Characteristics				Safety Risk Flags

LCSS	Score	Fatality Return	Risk % Change	Comments
▪ SSD – advance visibility of crossing from road ▪ Distance from advance warning to crossing.				▪ High Speed Train ▪ Sighting S1
Proposal	28/30	80 years	234%	The proposed design uses the 5-year volumes as the opening volumes. The improvements include – signs and markings to TCD 9, including yellow hatching and duplicated advance warning signs to SSD requirements **The ALCAM Risk Score is 125.2 The Risk Band Jurisdiction is High and the Likelihood Band Jurisdiction is High**. The LCSS Risk Score is 28 and the Risk Band is High.
Top Rated Characteristics				**Safety Risk Flags**
▪ SSD – advance visibility of crossing from road ▪ Slowest train speed at crossing (typical)				▪ High Speed Train ▪ Sighting S1
Future	28/30	69 years	287%	The future design uses the 10-year volumes and the crossing upgraded with signs and markings to TCD 9 as per the Proposal. **The ALCAM Risk Score is 145.1 The Risk Band Jurisdiction is High and the Likelihood Band Jurisdiction is High**. The LCSS Risk Score is 28 and the Risk Band is High.
Top Rated Characteristics/Mechanisms				**Safety Risk Flags**
▪ SSD – advance visibility of crossing from road ▪ Slowest train speed at crossing (typical)				▪ High Speed Train ▪ Sighting S1

4.2 Crash and Incident History Score

As per table 4 of the LCSIA Risk Guide, we have scored the one IRIS incident below as a 3 based on the vehicle driving under the barrier arm in 2016.

For the change in use we have assumed with the increase in heavy vehicle volumes and no upgrades one non-injury hit heavy vehicle incident, so a score of 4/10. For the proposed and future, with crossing upgrades including upgraded signs, markings and no passing markings on the approaches we have assumed one driving under/around near miss so a score of 3/10.

4.2.1 KiwiRail IRIS Data – one incident recorded

Incident No	164359
Incident Date	19/07/2016
Sub Code	NCLV- Near Collision Light Road Vehicle
Line	NIMT – North Island Main Trunk
Meterage	178.24
ALCAM ID	529
ALCAM NAME	Makirikiri Road
Protection	Primary Flashing Lights
Protection Type	FLB – Flashing Lights and Bells
Council	Rangitikei District Council
Region	Manawatu-Wanganui
Daily Train Traffic	32
Description	Level crossing barrier arm came down on car at the Makirikiri level crossing between Greatford and Marton. LE of 567 advised that a car towing a car trailer with a car on the trailer went through the crossing ahead of him but the barrier arm came down on the car on the trailer. No details of car given Placed a 10km/h speed restriction over the crossing until signals could attend. SIgnals advised no damage to barrier arms, all ok.

4.2.1 NZTA Crash Analysis System (CAS) Data (10-yr data)

No crashes have been recorded in the past 10 years within 50m of the crossing.

Historically there have been 3 crashes within the vicinity of the crossing. The CAS record was supplied by Manawatu District Council. The crashes have not been included in the analysis due to their age.

- A serious injury crash in 1982 involving a westbound car hitting a train – the car did not stop at a flashing red light. The crash occurred on Thursday 2/12/1982 at 6:40pm in fine weather on a dry road with bright sun.
- A minor injury crash in 2002 involved an eastbound car with a learner driver which went off the road to the left. The driver was under instruction and the road was wet, it was dark and light rain was falling. The crash occurred 1km west of SH1, approximately 300m east of the crossing on Monday 23/09/2002 at 11:50pm.
- A non-injury crash in 2006 involved an eastbound car rear ending another car at the crossing. The driver was following too closely in wet, dark conditions during heavy rain. The crash occurred on Monday 12/06/2006 at 6:50pm.

4.3 Site Specific Safety Score

The level crossing is on a Primary Collector road with a posted speed limit of 100km/h, so the Rural assessment table has been used for the site-specific safety evaluation. The updated existing score is 2/10 for the SSSS.

For the proposal and future volume scenarios, we have presumed any issues with the pavement will have been repaired reducing the Category 5 score to 1/5. This is a total SSSS for the proposal and future scenarios of 4/30, which rounds to 1/10.

There are no red flag scenarios at this crossing.

Table No. 5: Rural Road Site Specific Safety Score – Updated Existing

Score	Scenario
Category 1: Crossing Controls (5 points)	
2 – Updated Existing, change in use, proposed and future	Half Arm Barriers with Flashing Lights and Bells are currently installed. No median islands are proposed due to the 100km/h approach speeds.
Category 2: Side Road and Intersection Proximity (5 points)	
0 – Updated Existing, change in use, proposed and future	No side road or intersection on either side of the level crossing The main access to the industrial area will be to the east on the left-hand side on the departure side of the crossing and will not be in close proximity, so will not form queues back over the level crossing.
Category 3: Horizontal and Vertical Alignment of Crossing (5 points)	
1 – Updated Existing, change in use, proposed and future	The crossing is on a level profile and the road approaches are on a consistent perpendicular alignment. No changes to the horizontal and vertical alignment of the crossing are proposed.
Category 4: Short Stacking/Grounding Out (10 points)	
0 – Updated Existing, change in use, proposed and future	No intersections near the level crossing and no evidence of grounding out visible. The main access to the industrial area will be to the east on the left-hand side on the departure side of the crossing and will not be in close proximity, so will not create short stacking at the crossing.
Category 5: Road Surface Condition (5 points)	
2 – updated existing, change in use 1 – proposed and future	Minor issues with the road surface – there is a small patch on one approach. Assuming minor pavement repair will have been completed.
5/30 – Updated Existing, change in use **4/30 – Proposed and Future**	**Site Specific Safety Score of 2/10 for the Updated Existing and Change in Use Crossing** **SSSS of 1/10 for the Proposed and Future Crossing**

4.4 Site Evaluation

A site visit was undertaken on Monday 23 September 2019 and attended by the following representatives of KiwiRail, the RCA and WSP-Opus:

- Bill Edwards – KiwiRail
- Jarrod Colville – KiwiRail
- Ian Avison - KiwiRail
- John Jones – Manawatu District Council
- Bridget Feary – WSP-Opus
- Matthew Evis – WSP-Opus

The site visit notes are included in the appendices. Several items were raised in the evaluation:

- The crossing signs and markings do not comply with TCD 9. Improvements could be made to install crossing approach warning signs, no passing markings and yellow hatching through the crossing.
- The pavement width at the crossing is narrow (i.e. 2 x 3.2m wide traffic lanes with no shoulders) – drivers tend to drive over the centreline through the crossing due to the narrow lane widths.

4.5 Engineer's Risk Score

The Locomotive Engineer and the RCA Engineer both scored the existing crossing as 2/5. This gives a total score of 4/10. The detailed comments from each party are included in the appendices.

For a crossing to TCD 9 requirements and a future crossing both scored 1/5, so for the proposal and future scores the total is 2/10.

4.6 LCSS Results

The combined risk scores are tabulated below:

- Updated Existing scores the existing level crossing conditions found on site.
- Change in Use scores the existing level crossing conditions found on site for the forecast 10-year user volumes.
- Proposed Design scores all the improvement recommendations for the user volumes shortly after opening, that aim to achieve Criterion 1. As improvements to meet Criterion 1 are not reasonably practicable, the aim is to achieve Criterion 2.
- Future Score is ten years post opening with the proposed design improvements that aim to achieve Criterion 1. As improvements to meet Criterion 1 are not reasonably practicable, the aim is to achieve Criterion 2.

Criterion 2: requires the Proposed Design and Future Score of a level crossing to achieve an LCSS number (out of 60) lower than, or equal to, the Updated Existing LCSS number.

Table No. 6: Level Crossing Safety Score Results

Scored Items	Updated Existing	Change in Use	Proposed Design	Future Score	Comments
ALCAM	25/30	28/30	28/30	28/30	Updated Existing includes barrier arms. Proposed Design uses 5-year volumes.
Crash & Incident History	3/10	4/10	3/10	3/10	One IRIS Near Miss Incident which involved a vehicle speeding under the barrier arm. For the change in use we have assumed with the increase in heavy vehicle volumes and no upgrades one non-injury hit heavy vehicle incident, so a score of 4/10. For the proposed and future, we with upgrades we have assumed one driving under/around near miss so a score of 3/10.

Scored Items	Updated Existing	Change in Use	Proposed Design	Future Score	Comments
Site Specific Safety	2/10	2/10	1/10	1/10	Site specific score reduces in the future assuming a minor pavement repair is completed.
Engineer Risk	4/10	4/10	2/10	2/10	Engineer score halves with crossing signs and markings upgraded to TCD 9.
LCSS Score	34/60	38/60	34/60	34/60	The Proposed Design and Future Score meet Criterion 2, to achieve an LCSS number equal to the Updated Existing LCSS number.
LCSS Risk Band	Medium	Medium	Medium	Medium	
Criterion Met	-	None	2	2	The proposed and future scores meet Criterion 2.

Appendix A
Site Evaluation

Appendix A Site Evaluation

Features Reviewed at the Road Crossing		Comments
1	Is there suitable lighting at the crossing point and is it of good quality?	This is a rural road with no streetlighting on the approaches or the crossing.
2	Does vegetation restrict sight lines at the crossing point or on the approach to the crossing?	No, the LE confirmed all sightlines are clear.
3	Is there any rail infrastructure in the rail corridor that restricts visibility for all users?	No.
4	Does the signage meet TCD Part 9 standards? Do any signs need to be replaced due to age or damage?	No. All existing signs are in fair condition, but do not meet TCD 9 regarding approach warning signs.
5	What is the quality of the road surfacing in the near vicinity of the level crossing?	The road surfacing is asphalt and is generally in good repair. There is a minor patch repair in the eastbound lane at the crossing.
6	What is the quality of the panel between the tracks (and on the outside) at the level crossing, is it badly deformed?	The panel is asphalt and is in good repair.
7	What is the line marking condition? Is 'Rail X' marked on the approaches (if it should be)?	The line markings are in fair condition. Rail X is marked on both approaches.
8	Are LX1 (steam train) signs present for all approaches, including nearby side roads?	No LX1 signs are present on the approaches to the crossing.
9	Is the LX1 sign pointing in the right direction (to the road centreline)?	N/A
10	Is the LX1 sign gated on approaches when the volume is greater than 2,000 AADT?	N/A
11	Are other advanced warning signs present?	Crossbucks are used as advanced warning signs.
12	Are there side roads or accessways nearby and how do they interact with the level crossing?	There are no side roads nearby. There is a farm access approximately 40m west of the crossing on the south side of the road (i.e. exit side)

Features Reviewed at the Road Crossing		Comments
13	Should flashing lights and bells be facing the side roads, if they are not already present?	N/A
14	Is there a short stacking or grounding out risk? Is there anything in place to mitigate that, i.e. signs for heavy vehicles or escape areas?	There is no short stacking or grounding out risk.

KiwiRail Evaluation – Safety Evaluation and Crossing Risk Score

This risk score reflects the level of crash risk that KiwiRail Locomotive Engineers and/or signalling staff would give to the level crossing compared with other crossings they encounter regularly within their jurisdiction.

Crossing Score		Best	compared with other crossings you encounter regularly within your jurisdiction			Worst
KiwiRail LE	Existing crossing with new volumes	1	2	3	4	5
	Proposed Design	1	2	3	4	5
	Future Crossing	1	2	3	4	5
Comments:	This is a high speed road, so the only issues with safety are drivers speeding to beat the barrier arms and driving over the centreline through the crossing. There are no sighting issues – approaching trucks are clearly visible on the approaches due to the straight alignment and the lack of vegetation. Any future development in the area should ensure it does not affect rail sightlines -in particular by carefully considering where future buildings and trees are placed so they do not affect intervisibility. Proposed improvements could include steam train signs on the approaches, additional FLB displays on the RHS of the approaches, widening the pavement through the crossing to give drivers more space (lane widths are 3.2m with no shoulders), no passing markings on the approaches and yellow hatching in the crossing.					

Questions regarding crossing history		Answer
1	Current train speed at crossing for both directions.	100-110km/h (maximum line speed is 110km/h)
2	Number of likely train movements per day.	32
3	Does shunting occur at this crossing, if so how many movements per day?	No
4	Are there whistle boards present?	Yes

Questions regarding crossing history		Answer
5	Any near miss episodes not reported in IRIS?	No
6	Any vandalism of signs or controls?	1 incident in the last 10 years
7	Any vehicle incidents which have hit KiwiRail infrastructure?	No
8	Does reverse tracking occur?	Yes, but very infrequently – once every 6 months.
9	General view on the level of safety of the crossing.	The crossing has very good sight distance of the road approaches. Sight distance along the track to the rail signals is limited by the rail alignment and overhead electrical infrastructure.

Road Controlling Authority – Safety Evaluation and Crossing Risk Score

This risk score reflects the level of crash risk that RCA staff would give to the level crossing compared with other crossings they encounter regularly within their jurisdiction.

Crossing Score		Best	compared with other crossings you encounter regularly within your jurisdiction			Worst
RCA Engineer	Existing crossing with new volumes	1	2	3	4	5
	Proposed Design	1	2	3	4	5
	Future Crossing	1	2	3	4	5
Comments:						

Questions regarding crossing history		Answer
1	Are there any known public concerns about the crossing?	No
2	Are there any incidents or crash history at the crossing you are aware of?	No additional incidents other than those recorded in CAS.
3	Are there any other changes nearby that may influence this level crossing, i.e. a new subdivision consent, a new walking or cycling facility that will change traffic patterns or volumes?	No, only the possible rezoning as industrial land of the area bounded by the railway line, Makirikiri Road, SH1 and Wings Line.

Questions regarding crossing history		Answer
4	General view on the level of safety of the crossing.	At the moment I do not have any safety concerns.

Appendix B
Crossing Characteristics

Appendix B Crossing Characteristics

ALCAM Characteristic	Existing	Updated Existing
Jurisdiction	NZ	
Street	Makirikiri Road	
Suburb	Marton	
Line Section	North Island Main Trunk - non-metro	
Rail Km	178.24	
Primary Control	Primary Flashing Lights	Half Boom Flashing Lights and Bells
Location	Non Metro	
Primary Rail Manager	KiwiRail	
Secondary Rail Manager(s)		
Primary Road Manager	NZTA - Taranaki	
Secondary Road Manager(s)		
Rail Status	Active	
Road Access	Public	
Legal Status	Public	
Crossing Class	Public road / path - Public access	
Daily Train Numbers	32	
Road Vehicle Numbers (AADT)	1340	1650
Raw Infrastructure Factor	129.4112	
Exposure Factor	0.022084158	
Infrastructure Factor	1.05183264	
Likelihood Factor	0.023228838	
Consequence Factor	0.335975723	
Risk Factor	0.007804326	
Risk Score Status	Current	
Years Between Collisions	43.0499358	
Years Between Fatalities	128.134067	
Last Calculated Date	18/10/2018 18:00	
Org Asset ID	PUB1079	
Street Directory Ref		
Route ID	NZ-NIMT_2	
Rail Traffic Type	PASSENGER	
Pass RD		
Number Of Tracks	1	
Road Status	Open	
Left Approach Pavement	CHIP-SEAL	
Left Immediate Approach Pavement	CHIP-SEAL	
Panel Pavement	CHIP-SEAL	
Right Immediate Approach Pavement	CHIP-SEAL	
Right Approach Pavement	CHIP-SEAL	
Council Region	Rangitikei District Council	

ALCAM Characteristic	Existing	Updated Existing
Main Roads Region	Manawatu-Wanganui	
Road Angle (R)	115	
Road Angle (L)	65	
Max Train Speed Up	110	
Max Train Speed Down	110	
Road Width	6.7	
Road Clearance Width	0	
Number Of Attached Peds	0	
Last ALCAM Survey Date	15/10/2008 0:00	
Last Sighting Date	15/10/2008 0:00	
Sighting Description		
High Speed Train	110kph	
Multiple Tracks	-	
Non-Compliance to Standard	-	
Queueing	-	
Short Stacking	-	
Sighting S1	-	
Sighting S2	-	
Sighting S3	-	
Road Condition	-	
Hump, Dip or Rough Surface	-	
Sun Glare Sighting Crossing on Road	Rating (5)	
Sun Glare Sighting Train	-	
Extreme S3 Required Sighting	-	
Sighting Model	AS1742_7_2007	
Number Of Left Approaches	1	
Number Of Right Approaches	1	
Left S1 - Available	251.99	
Left S1 - Required	250.44	
Right S1 - Available	242.99	
Right S1 - Required	241.38	
Left S2 Up - Measured	432	
Left S2 Up - Required	315.71	
Left S2 Down - Measured	447	
Left S2 Down - Required	315.71	
Left S2 Up - Distance	432	
Left S2 Down - Distance	447	
Right S2 Up - Measured	33	
Right S2 Up - Required	306.85	
Right S2 Down - Measured	219	
Right S2 Down - Required	306.85	
Right S2 Up - Distance	33	
Right S2 Down - Distance	219	
Left S3 - Up Required	555.38	

ALCAM Characteristic	Existing	Updated Existing
Left S3 - Down Required	555.38	
Left S3 - Up Measured	20	
Left S3 - Down Measured	524	
Right S3 - Up Required	596.04	
Right S3 - Down Required	596.04	
Right S3 - Up Measured	650	
Right S3 - Down Measured	23	
Signposted Road Speed	100	
Left - 85th Percentile Vehicle Speed	100	
Right - 85th Percentile Vehicle Speed	100	
Track Width	1.07	
Left Control Point Distance	201	
Right Control Point Distance	201	
True Bearing Up	166.79	
Left Exit True Bearing	238.21	
Right Exit True Bearing	58.21	
Left - True Bearing Road	238.21	
Right - True Bearing Road	58.21	
Left - Stop Line Clearance	5.9	8
Right - Stop Line Clearance	6.9	8
Left - Grade At S1	-1	
Right - Grade At S1	1	
Left - Grade At S3	0	
Right - Grade At S3	1	
Left Vehicle Length	26	
Right Vehicle Length	26	
Top Rated Characteristics	Slowest train speed at crossing (typical), Distance from advance warning to crossing, Conformance with AS 1742.7 and NZTA Part 9, Longest train length (typical)	
Comments (sighting)		
Left Road Vehicle Type	B-Double	
Right Road Vehicle Type	B-Double	
% Commercial Vehicles	10	13
Control Class	Primary Flashing Lights	Half Boom Flashing Lights and Bells
Jurisdiction Likelihood Band (Control Class)	High	
Jurisdiction Likelihood Band	High	
Global Likelihood Band (Control Class)	High	
Global Likelihood Band	High	
Jurisdiction Risk Band (Control Class)	High	

ALCAM Characteristic	Existing	Updated Existing
Jurisdiction Risk Band	High	
Global Risk Band (Control Class)	High	
Global Risk Band	High	

Appendix C
Signalling and Interlocking Plan

Appendix C Signalling and Interlocking Plan

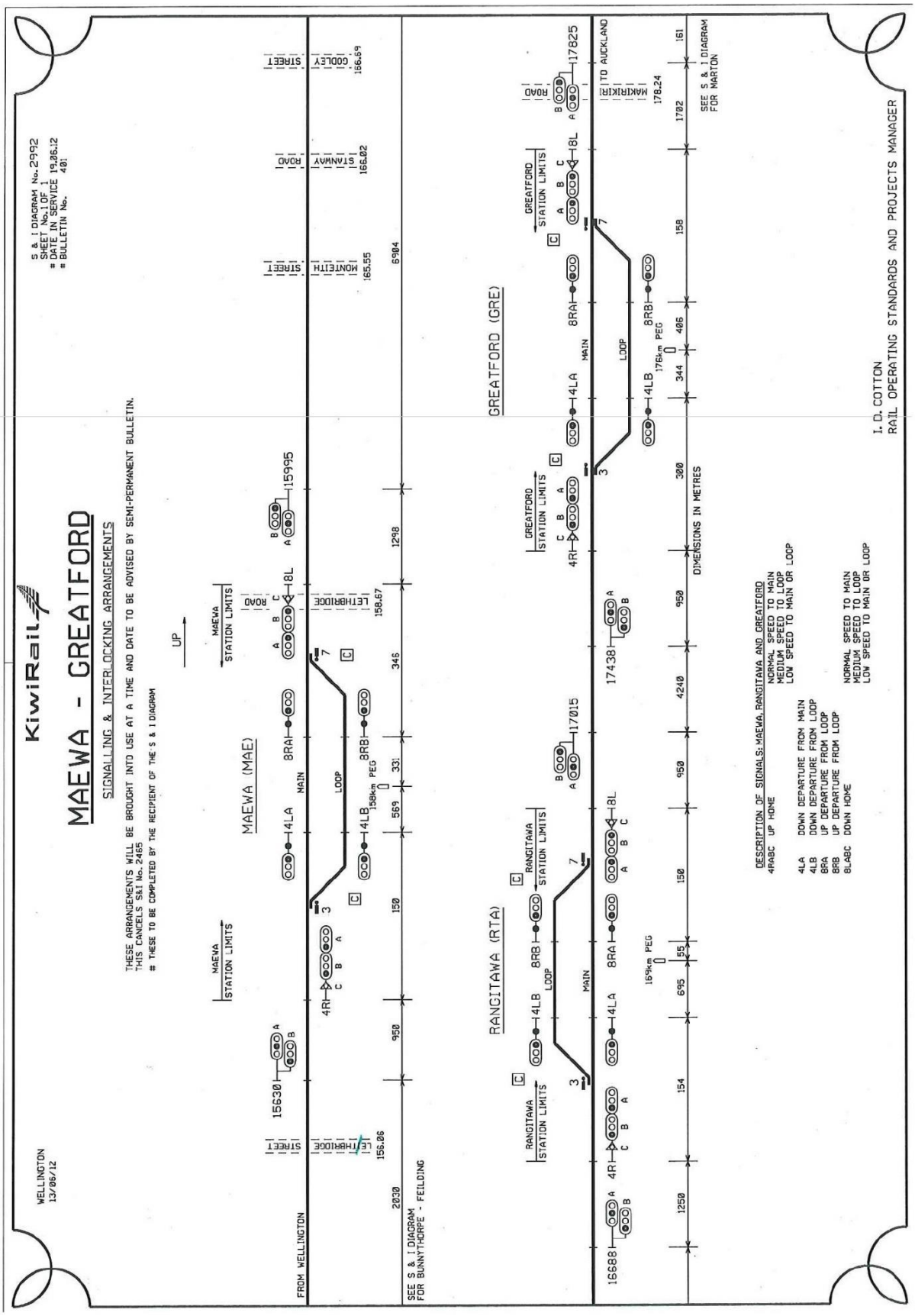

Figure 3: ALCAM Crossing 529, Makirikiri Road Marton: KM178.24

Appendix D
Site Photos

Appendix D Site Photos

Figure 4: East Approach Makirikiri Road looking west from 100m east of crossing

Figure 5: East Approach – looking south from 1.5m back from limit line

Figure 6: East Approach – looking north from 1.5m back from limit line

Figure 7: East Approach – looking west from 1.5m back from limit line

Figure 8: East Approach – Flashing Lights Bells and Half Arm Barrier

Figure 9: Panel Condition and approach surfacing

Figure 10: West Approach Makirikiri Road – looking east from 100m west of crossing

Figure 11: West Approach – looking north from 1.5m back from limit line

Figure 12: West Approach – looking south from 1.5m back from limit line

Figure 13: West Approach – looking east from 1.5m back from limit line

Figure 14: West Approach – Flashing Lights Bells and Half Arm Barrier

Appendix E
ALCAM Risk Rating

Appendix E ALCAM Risk Rating

Extracts from ALCAM Risk Rating Reports

Controls

Controls at Crossing	Primary Flashing Lights
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Human Factors	Public response phone number
Crossing Environment	Maintenance programme for vegetation etc (Road)

Crossing Volume (AADT) Road: 1340 Rail: 32

Outputs

Raw Infrastructure Factor:	**129**		
Infrastructure Factor:	**1.05183**		
Exposure Factor:	**0.02208**		
Likelihood Factor:	**0.02323**	Years Between Collisions:	**43**
Consequence Factor:	**0.33598**		
Risk Score:	**0.0078**	Years Between Fatalities:	**128**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**High**	Likelihood Band All:	**High**
Risk Band Jurisdiction:	**High**	Likelihood Band Jurisdiction:	**High**

Within Primary Flashing Lights Control Class

Risk Band All:	**High**	Likelihood Band All:	**High**
Risk Band Jurisdiction:	**High**	Likelihood Band Jurisdiction :	**High**

Flags:

High Speed Train

Sun Glare Sighting Crossing on Road

Figure 15: Existing Crossing Road Rating Report Extract

Controls

Controls at Crossing	Half Boom Flashing Lights
Additional Crossing Controls	Bells/Audible Warning Devices
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	Rail-X Pavement Marking
Human Factors	Public response phone number
Crossing Environment	Maintenance programme for vegetation etc (Road)

Crossing Volume (AADT) Road: 1650 Rail: 32

Outputs

Raw Infrastructure Factor:	**123**		
Infrastructure Factor:	**1.04324**		
Exposure Factor:	**0.00999**		
Likelihood Factor:	**0.01042**	Years Between Collisions:	**96**
Consequence Factor:	**0.35963**		
Risk Score:	**0.00375**	Years Between Fatalities:	**267**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**High**	Likelihood Band All:	**Medium High**
Risk Band Jur.	**High**	Likelihood Band Jur:	**High**

Within Boom Barrier Control Class

Risk Band All:	**High**	Likelihood Band All:	**Medium**
Risk Band Jurisdiction:	**High**	Likelihood Band Jurisdiction :	**Medium**

Flags:

High Speed Train

Figure 16: Updated Existing Crossing Road Rating Report Extract

Controls

Controls at Crossing	Half Boom Flashing Lights
Additional Crossing Controls	Bells/Audible Warning Devices
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	Rail-X Pavement Marking
Human Factors	Public response phone number
Crossing Environment	Maintenance programme for vegetation etc (Road)

Crossing Volume (AADT) Road: 8900 Rail: 32

Outputs

Raw Infrastructure Factor:	**123**		
Infrastructure Factor:	**1.0438**		
Exposure Factor:	**0.02255**		
Likelihood Factor:	**0.02354**	Years Between Collisions:	**42**
Consequence Factor:	**0.65138**		
Risk Score:	**0.01533**	Years Between Fatalities:	**65**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**High**	Likelihood Band All:	**High**
Risk Band Jur.	**High**	Likelihood Band Jur:	**High**

Within Boom Barrier Control Class

Risk Band All:	**High**	Likelihood Band All:	**High**
Risk Band Jurisdiction:	**High**	Likelihood Band Jurisdiction :	**High**

Flags:

High Speed Train
Sighting S1

Figure 17: Change in Use Road Rating Report Extract

Controls

Controls at Crossing	Half Boom Flashing Lights
Additional Crossing Controls	Bells/Audible Warning Devices
Additional Crossing Controls	"Keep Tracks Clear" signs and yellow box marking
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	DUPLICATED Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	Rail-X Pavement Marking
Human Factors	Public response phone number
Train Related	Whistle board / location board for train
Crossing Environment	Maintenance programme for vegetation etc (Road)

Crossing Volume (AADT) Road: 7900 Rail: 32

Outputs

Raw Infrastructure Factor:	**83**		
Infrastructure Factor:	**0.98764**		
Exposure Factor:	**0.02098**		
Likelihood Factor:	**0.02072**	Years Between Collisions:	**48**
Consequence Factor:	**0.60407**		
Risk Score:	**0.01252**	Years Between Fatalities:	**80**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**High**	Likelihood Band All:	**High**
Risk Band Jur.	**High**	Likelihood Band Jur:	**High**

Within Boom Barrier Control Class

Risk Band All:	**High**	Likelihood Band All:	**Medium High**
Risk Band Jurisdiction:	**High**	Likelihood Band Jurisdiction :	**High**

Flags:

High Speed Train
Sighting S1

Figure 18: Proposed Design Road Rating Report Extract

Controls

Controls at Crossing	Half Boom Flashing Lights
Additional Crossing Controls	Bells/Audible Warning Devices
Additional Crossing Controls	"Keep Tracks Clear" signs and yellow box marking
Advance Warning	SINGLE Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	DUPLICATED Standard Advance Warning (W7-4, W7-7, NZ WX1 OR NZ WX3)
Advance Warning	Rail-X Pavement Marking
Human Factors	Public response phone number
Train Related	Whistle board / location board for train
Crossing Environment	Maintenance programme for vegetation etc (Road)

Crossing Volume (AADT) Road: 8900 Rail: 32

Outputs

Raw Infrastructure Factor:	**83**		
Infrastructure Factor:	**0.98764**		
Exposure Factor:	**0.02255**		
Likelihood Factor:	**0.02227**	Years Between Collisions:	**45**
Consequence Factor:	**0.65138**		
Risk Score:	**0.01451**	Years Between Fatalities:	**69**

Risk / Likelihood Bands

Across Control Classes

Risk Band All:	**High**	Likelihood Band All:	**High**
Risk Band Jur.	**High**	Likelihood Band Jur:	**High**

Within Boom Barrier Control Class

Risk Band All:	**High**	Likelihood Band All:	**Medium High**
Risk Band Jurisdiction:	**High**	Likelihood Band Jurisdiction :	**High**

Flags:

High Speed Train
Sighting S1

Figure 19: Future Crossing Road Rating Report Extract

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