URBAN CONNECTION
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SH58 & SH59 Porirua Region

Existing Road - Safe System Audit Report

Prepared for Waka Kotahi

REVISION 1 - MARCH 2023

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Executive Summary

The purpose of this Safe System Audit (SSA) is to address the Board of Enquiry consent condition NZTA.83; Traffic Safety Audit, which states:

No earlier than 6 months after the commencement of operation of the Transmission Gully Motorway (TG), and no later than 12 months from that date, the Requiring Authority shall complete a traffic safety audit (in accordance with the NZ Transport Agency Guidelines 'Road Safety Audit Procedures for Projects' (November 2004) to ascertain the effects of reduced traffic and potentially higher environmental speeds on the coastal route resulting from the operation of the Transmission Gully Motorway. The audit shall outline what measures are necessary to remedy those effects. A copy of the audit and its findings shall be sent to the relevant territorial authorities.

Since preparing this condition, the NZ Transport Agency Guidelines 'Road Safety Audit Procedures for Projects' have been superseded by the Safe System Assessment Procedures for Projects, bringing together key elements of both the Safe System assessment framework and road safety audit procedures to provide a comprehensive transport project audit that assesses both the Safe System alignment, and the risk ranking of road safety concerns. i.e. this level of assessment is considered to exceed that previously specified.

With regards to the coastal route and the intention of the consent condition, the Audit Team have had specific regard to whether the issues identified where;

- An existing risk that would have been present prior to commissioning Transmission Gully and either;
    - remains unchanged;
    - benefited from reduced vehicle exposure;
    - exacerbated the risk as a direct consequence; or
    - A new risk generated as a result of commissioning Transmission Gully.

In undertaking this process, it is acknowledged that a Road Safety audit and in turn a Safe System Assessment is a qualitative process but focuses on recognised risk management and harm minimisation principles.

Based on the experience of the Audit Team, all audit issues have been assessed in relation to the consent condition and are summarised below:

An Existing Risk Prior to TG			A new risk
Remains unchanged	Benefit from reduced exposure	Exacerbated	
No.	No.	No.	No.

It is concluded that the Coastal Corridor has significantly benefited from TG, predominantly through the form of reduced vehicle exposure to existing risks identified. It must be recognised that the remaining risks are predominantly inherent and historic risks identified along the coastal corridor and the commissioning of TG has provided a material response to that.

Nevertheless, the Audit has outlined existing risks that were identified during the assessment, and while not generated by TG, have the ability to generate harm over time and should be managed along with existing priorities.

1 Safe System Auditing for Transport Projects

A Safe System audit is an independent review of an existing or future transport project to identify any safety concerns that may affect the safety performance and alignment to a Safe System. The audit team considers the safety of all road users and qualitatively reports on road safety issues or opportunities for safety improvement.

A Safe System audit is, therefore, a formal examination of a transport project, or any type of project which affects road users (including cyclists, pedestrians, mobility impaired etc.), carried out by an independent competent team which identifies and documents Safe System alignment and road safety concerns.

A Safe System audit is intended to help deliver a safe road system and is not a review of compliance with standards.

1.1 Safe System Audit Procedure

The primary objective of this Safe System audit is to deliver a road environment that achieves an outcome consistent with the Safe System approach, that is, minimisation of death and serious injury. The Safe System audit is a safety review used to identify all areas of a road environment that are inconsistent with a safe system and bring those concerns to the attention of the client in order that the client can make a value judgement as to appropriate action(s) based on the risk guidance provided by the safety audit team.

The key objective of a Safe System audit is summarised as follows:

To deliver road environments that contribute towards a Safe System by identifying and ranking potential safety concerns for all road users and others affected by a transport project.

Based on the level of concern and context shared by Waka Kotahi, this audit framework has been used to identify potential safety issues which are contributing to the safety and accessibility of the existing roads.

A Safe System audit is not intended as a technical or financial audit and does not substitute for a design check on standards or guidelines.

Any recommended treatment of an identified safety concern is intended to be indicative only and to focus the design team on the type of improvements that might be appropriate. It is not intended to be prescriptive and other ways of improving road safety or operational problems identified should also be considered.

In accordance with the procedures set down in the "Waka Kotahi NZ Transport Agency Safe System Audit Guidelines," the audit report should be submitted to Waka Kotahi, which is to instruct the design team to respond. The design team should consider the report and comment to Waka Kotahi on each of the concerns identified, including their cost implications where appropriate, and make a recommendation to either accept or reject the audit report recommendation.

For each audit team's recommendation that is accepted, Waka Kotahi shall make the final decision and brief the design team to make the necessary changes and/or additions. As a result of this instruction,

the design team shall action the approved amendments. Waka Kotahi may involve a safety engineer to provide commentary to aid the decision.

Decision tracking is an important part of the Safe System audit process. A decision tracking table is embedded into the report format at the end of each set of recommendations to be completed by the design team, safety engineer and Waka Kotahi for each issue, documenting the design team's response, Waka Kotahi decision and the action taken.

A copy of the report, including the design team's response to Waka Kotahi and the Waka Kotahi's decision on each recommendation, shall be given to the Safe System audit team leader as part of the important feedback loop. The Safe System audit team leader is to disseminate this to team members.

1.2 The Safe System

A Safe System is a forgiving road system that takes into account human fallibility and vulnerability. Under a Safe System, the whole transport system is designed to protect people from exposure to high crash forces that lead to death and serious injury (DSI).

It is recognised that people are vulnerable, and the key crash types and associated crash forces that people can be exposed to lead to death or serious injuries. A Safe System manages crash forces within these limits to protect people.

The audit team is required to understand the human tolerance to force and identify where these boundary conditions are likely to be exceeded when reviewing the transport project.

1.3 Report Format

The purpose of this Safe System Audit is to address the Board of Enquiry consent condition NZTA.83; Traffic Safety Audit, which states:

No earlier than 6 months after the commencement of operation of the Transmission Gully Motorway, and no later than 12 months from that date, the Requiring Authority shall complete a traffic safety audit (in accordance with the NZ Transport Agency Guidelines 'Road Safety Audit Procedures for Projects' (November 2004) to ascertain the effects of reduced traffic and potentially higher environmental speeds on the coastal route resulting from the operation of the Transmission Gully Motorway. The audit shall outline what measures are necessary to remedy those effects. A copy of the audit and its findings shall be sent to the relevant territorial authorities.

The potential road safety problems identified have been ranked as follows:

- The expected crash probability is qualitatively assessed on the basis of expected exposure (how many road users are to be exposed to a safety issue) and the likelihood of a crash resulting from the presence of the issue;
- The severity of a crash outcome is qualitatively assessed on the basis of factors such as expected impact speeds, type of collision, angle of collision and type of vehicle involved.

The key crash types and respective impact speed thresholds are shown below in Figure 1.3-1.

Key crash type		Impact speed threshold
Car/pedestrian/cyclist		20-30 km/h
Car/motorcyclist		20-30 km/h
Car/tree or pole (non-frangible objects)		30-40 km/h
Car/car (side-impact, intersections)		50 km/h
Car/car (head-on, rear-end)		70 km/h

Figure 1.3-1 – Key crash types and impact speed thresholds

Reference to historic crash rates or other research for similar elements of projects, or projects as a whole, can be drawn if considered appropriate to assist in understanding the likely crash types, frequency and likely severity that may result from a particular concern.

The frequency and severity ratings are used in conjunction to develop a combined qualitative risk ranking for each safety issue using the Safety Concern Risk Rating Matrix below (refer to Figure 1.3-2). The qualitative assessment requires professional judgement and a wide range of experience in projects of all sizes and locations.

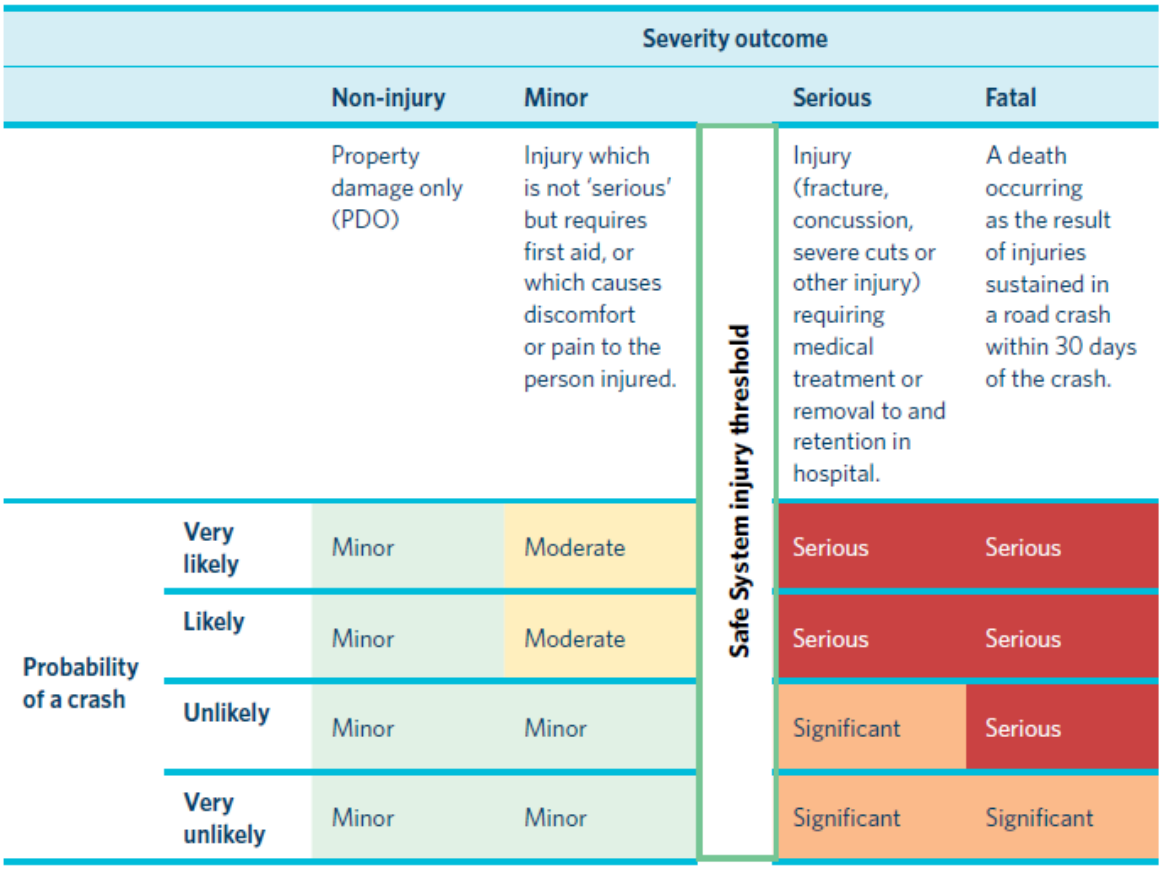


Figure 1.3-2 - Safety Concern Risk Rating Matrix

With regards to the coastal route and the intention of the consent condition, the Audit Team have had specific regard to whether the issues identified where;

- An existing risk that would have been present prior to commissioning Transmission Gully and either;
  - remains unchanged,
  - benefited from reduced vehicle exposure
  - exacerbated the risk as a direct consequence, or
- A new risk generated as a result of commissioning Transmission Gully.

In undertaking this process, it is acknowledged that a Road Safety audit and in turn a Safe System Assessment is a qualitative process but focuses on recognised risk management and harm minimisation principles.

1.4 Disclaimer

The findings and recommendations in this report are based on an examination of available relevant plans, the specified road and its environs, and the opinions of the SSA team. However, it must be recognised that eliminating safety concerns cannot be guaranteed since no road can be regarded as absolutely safe, and no warranty is implied that all safety issues have been identified in this report. Safe system audits do not constitute a design review nor an assessment of standards with respect to engineering or planning documents.

Readers are urged to seek specific technical advice on matters raised and not rely solely on the report.

While every effort has been made to ensure the report's accuracy, it is made available on the basis that anyone relying on it does so at their own risk without any liability to the safety audit team or their organisations.

2 Safe System Audit Details

2.1 Type of Audit

This report has been prepared for Waka Kotahi to carry out an Existing Road Safe System Audit (SSA) for the SH58 & SH59 Porirua Region as per the Transmission Gully Board of Inquiry condition NZTA.83.

The Existing Road SSA aims to identify safety concerns and alignment with a Safe System approach (exposure, likelihood and severity of safety risks) of the existing roading configuration. No proposed design exists at this stage, and contrary to the typical Safe System Assessment, the Safe System alignment of the existing road is not compared against any design options. Therefore, this SSA is expected to provide a base safety assessment for interventions that could be investigated throughout the sections in question.

Each of the safety concerns identified in this report is accompanied with countermeasures that address the safety concerns. This includes a list of recommended treatments to address the safety concerns and takes into consideration the Transmission Gully Board of Inquiry condition NZTA.3B.

The SSA team are not aware of any previous safe system audits, road safety audits, or exemptions for the project.

2.2 The Safety Audit Team

The safe system audit was carried out in accordance with the Waka Kotahi NZ Transport Agency Safe System Audit Guidelines, Road to Zero Edition – August 2022 by:

- Steve James, Urban Connection Limited, Wellington – Team leader
- Matheus Boaretto, Urban Connection Limited, Hawke's Bay – Team member

2.3 Meetings and Site Inspections

A briefing meeting was held on Wednesday, 16 November 2022, involving the Safe System Audit Team and representatives of Waka Kotahi, Porirua City Council and Greater Wellington Regional Council. These were Errol Ritson (Waka Kotahi), Gowshik Murugesan (Porirua City Council) and Ben Leah (Greater Wellington Regional Council).

An online desktop review of the existing road was undertaken on Tuesday and Wednesday, 22 and 23 November 2022.

The SSA team conducted a site inspection during the day in fine conditions on Thursday and Friday, 24 and 25 November 2022. A night-time inspection was also undertaken on Thursday, 24 November 2022. Weekend observations were undertaken on Saturday, 26 November 2022.

3 Project Description

3.1 Project Background and Objective

This Existing Road Safe System Audit has been undertaken throughout two sections of the State Highway (SH) network as follows:

- SH59 in the Porirua City region from the intersection with SH1 (Transmission Gully) to the southern boundary of the Kapiti Coast District. Waka Kotahi proposes to retain SH59 for resilience purposes as an alternative route in and out of Wellington;

- SH58 in the Porirua City region from Pauatahanui (i.e., Paekakariki Hill Road roundabout) to Paremata (roundabout with SH59). Waka Kotahi proposes revoking SH58, ensuring that the road's transport function is fit for purpose as a local road when handed over to Porirua City Council.

A key driver of the project is the identification of hazards or deficiencies that can potentially result in serious and fatal crashes.

3.2 Existing Conditions and Context

The existing conditions and context of the sections subject of this assessment are as follows:

- SH59, from approximately RP 0000/5.850 (Kapiti Coast District boundary) to RP 0020/6.585 (intersection with SH1) in the Porirua City region.

    - SH59, previously SH1, recorded annual average daily traffic (AADT) ranging from 25,700 to 48,500 vehicles per day (vpd) before the opening of the Transmission Gully. After the Transmission Gully (new SH1) opening, AADTs from approximately 4,000 to 19,000 vpd were recorded from April to November 2022.

    - The posted speed limit is 100 km/h from the intersection with SH1 (south of Porirua), through the urban fringe of Porirua to Paremata, and north of Paremata to the south of Pukerua Bay. North of Pukerua Bay to the Kapiti Coast District boundary, the posted speed limit is 80 km/h. The speed limit of 50 km/h is posted through Paremata (i.e., through Mana Esplanade) and Pukerua Bay.

    - The section is on the urban fringe on its southern end (through Porirua), urban through Paremata and Pukerua Bay, rural in between the latter townships and coastal to the north of Pukerua Bay. Both residents and regional traffic utilise the transport network throughout a typical day. The adjoining roads are a mix of urban connectors, local streets, rural connectors and one State Highway (SH58).

    - A relatively high proportion of pedestrians/cyclists are required to cross the corridor to access railway stations offered throughout the section. A shared path is provided from Paremata to the north to Paekakariki. The shared path generally runs parallel to SH59, crossing intersecting roads. This path is part of the Te Araroa Trail. The path is typically offset from SH59 through Paremata and is adjacent to SH59 to the north. Therefore,

demand is expected for cyclists and pedestrians to cross and travel through SH59 for recreational and commuting purposes.

- SH58, from approximately RP 0012/0.000 (Paekakariki Hill Road intersection) to RP 0012/5.050 (intersection with SH59) in the Porirua City region.
    - SH58 recorded an AADT of 19,100 vpd before the opening of the Transmission Gully. An approximate AADT of 6,000 vpd was recorded from April to August 2022 after the Transmission Gully opening.
    - The posted speed limit is 80 km/h from the intersection with Paekakariki Hill Road to the west. The posted speed limit is reduced to 50 km/h from the Postgate Drive intersection to the end of the section at the intersection with SH59.
    - SH58 is coastal on the eastern portion of the section on the urban fringe of Whitby. It is urban on its western end (through Paremata). Both residents and regional traffic utilise the transport network throughout a typical day. The adjoining roads are typically local roads and urban connectors.
    - Pedestrian presence is uncommon on the eastern portion of the corridor, where the road is narrow, and no facilities are provided. However, recreational cyclists are known to use the road. Pedestrian activity is expected on the western end of the section (i.e., west of the Postgate Drive roundabout), given the residential land use. Similarly, cyclists are also expected to travel along SH58 through this section for recreational and commuting purposes.

4 Assessment of Safe System Alignment

4.1 Safe System Assessment Summary

The Safe System Assessment Matrix scores for the existing condition for the several homogeneous sections throughout SH58 and SH59 have been calculated. Typically, Safe System Assessments are undertaken to compare the existing infrastructure to proposed options. However, in this case, Safe System Assessments have been undertaken to assess the alignment of the existing road with Safe System principles. The several different sections have been divided for the purpose of this assessment as follows:

- SH59
    - Section 1: from the intersection with SH1 to the Paremata roundabout. The section is within the urban fringe of Porirua. This section is characterised by the four-lane two-way divided carriageway (i.e., motorway configuration), with median barriers for the entire section. The alignment is largely straight. The posted speed limit is 100 km/h;
    - Section 2: Mana Esplanade, from the Paremata roundabout to the Plimmerton roundabout. This section is urban, with the adjacent land use being predominantly residential. The road cross-section is four-lane two-way with a flush median separation for the greater length. The alignment is largely straight. The posted speed limit is 50 km/h;
    - Section 3: from the Plimmerton roundabout to Pukerua Bay. This section is rural. The road cross-section is four-lane two-way, with most of the section having median wire-rope barriers. The horizontal alignment is straight to curved. The posted speed limit is 100 km/h;
    - Section 4: within Pukerua Bay. This section is urban. This section has a two-lane two-way cross-section configuration. The alignment is windy. The posted speed limit is 50 km/h;
    - Section 5: north of Pukerua Bay to the Kapiti Coast District Council boundary. This section is coastal, with no developments through it. The road cross-section is two-lane two-way. The horizontal alignment is windy. The posted speed limit is 80 km/h.

The scores for the existing SH59 are shown in Table 4.1-1. The scores for each crash type are shown in Figure 4.1-1. The detailed assessments are presented in Appendix A.

Table 4.1-1 - Safe System Assessment Score Summary – SH59

Road	Section	Score – Existing
SH59	1 - SH59/SH1 intersection to Paremata roundabout	162 / 448
	2 - Mana Esplanade - Paremata roundabout to Plimmerton roundabout	199 / 448
	3 - Plimmerton roundabout to Pukerua Bay	147.5 / 448
	4 - Pukerua Bay	201 / 448
	5 - North of Pukerua Bay to Kapiti Coast District Boundary	169.25 / 384

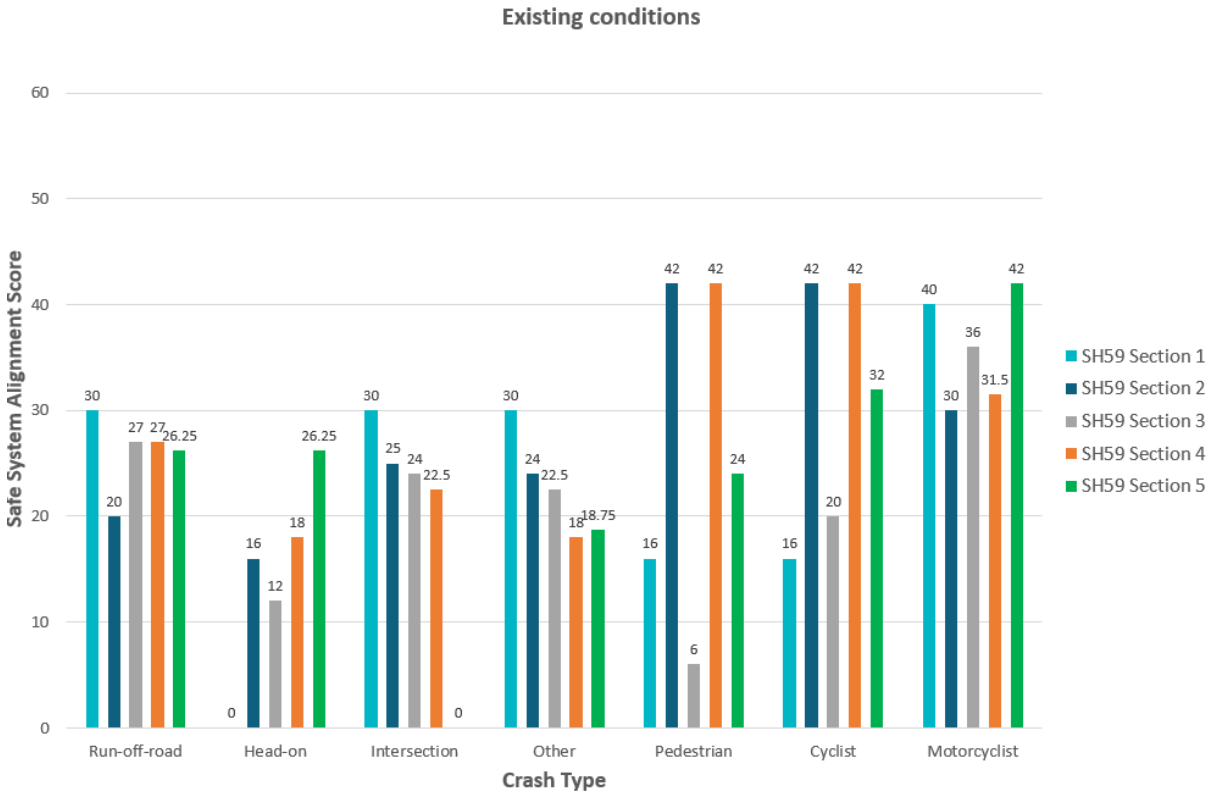


Figure 4.1-1 - Safe System Assessment Score Summary – SH59 – Sections 1 to 5

The assessment shows that the worst alignment with Safe System principles is given on crash types involving vulnerable road users (pedestrians, cyclists and motorcyclists). This is predominantly driven by a high exposure, especially through Mana Esplanade and Pukerua Bay, and a high likelihood due to the poor walking and cycling facilities available. Conflict impact speeds are also expected to exceed the biomechanical tolerances for vulnerable road users (20 to 30 km/h), suggesting that, potentially, serious or fatal injuries could result in the event of conflicts involving these users.

If the scores were to be compared to the condition Pre-opening of the Transmission Gully, it would be noted that most of the sections (3 to 5) have better alignment in the present conditions. This is due to the reduced traffic volumes (not exceeding 10,000 vpd) throughout these sections, reducing the number of users exposed to the risk. However, the likelihood and severity factors are likely to remain unchanged as no changes have been made to the existing infrastructure since the Transmission Gully opening.

The sections throughout SH58 have been divided as follows:

- SH58
    - Section 1: from the Pauatahanui roundabout to the Postgate Drive roundabout. This section is coastal within the urban fringe of Paremata. The road cross-section is two-lane two-way. The alignment is windy/tortuous. The posted speed limit is 80 km/h;
    - Section 2: from the Postgate Drive roundabout to the Paremata/SH59 roundabout. This section is urban, with adjacent residential land use. The road cross-section is two-lane two-way. The alignment is windy. The posted speed limit is 50 km/h;

The scores for the existing SH58 are shown in Table 4.1-2. The scores for each crash type are shown in Figure 4.1-2. The detailed assessments are presented in Appendix A.

Table 4.1-2 - Safe System Assessment Score Summary – SH58

Road	Section	Score – Existing
SH58	1 - Pauatahanui roundabout to Postgate Drive roundabout	222.5 / 448
	2 - Postgate Drive roundabout to Paremata roundabout	230 / 448

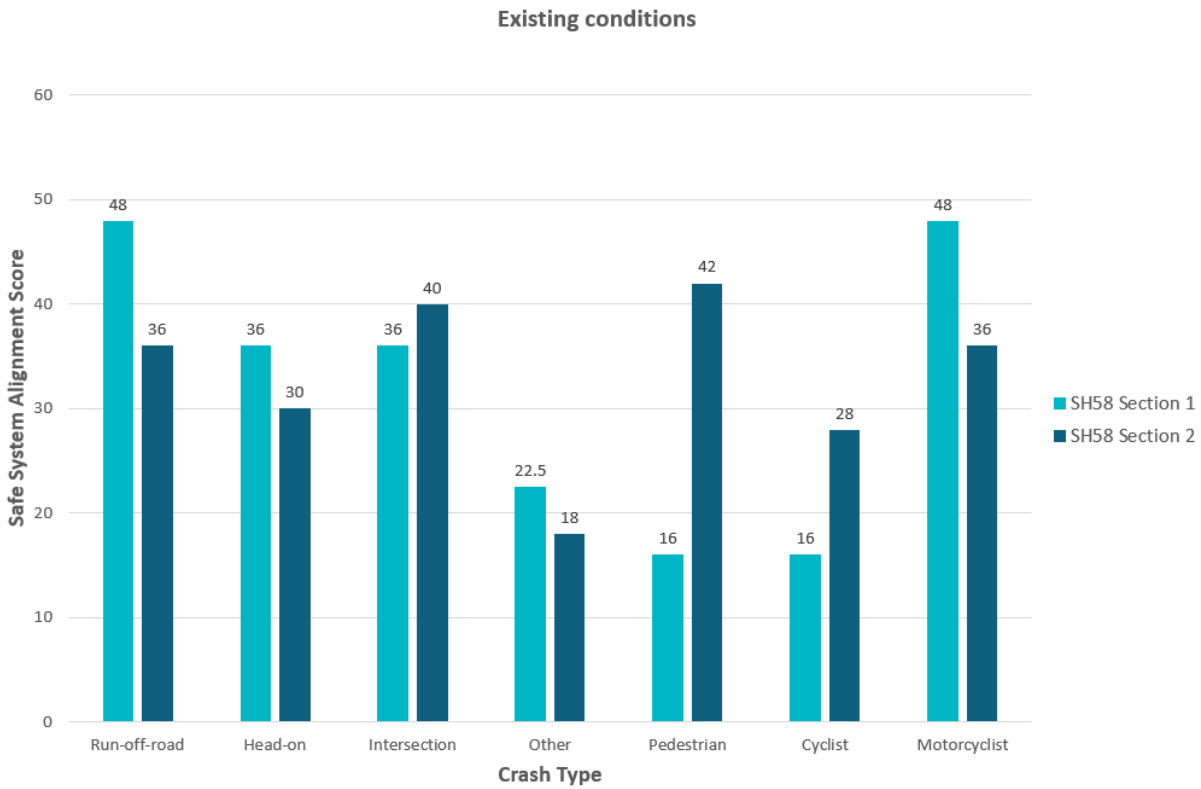


Figure 4.1-2 - Safe System Assessment Score Summary – SH58 – Sections 1 and 2

The worst alignment with Safe System principles is related to run-off-road crash types, including those involving motorcyclists, especially in the coastal section of SH58 (Section 1). This is mainly related to the windy/tortuous horizontal alignment combined with unprotected drop-offs into the water. The road cross-section has minimal-width sealed shoulders with poor delineation and the relatively high posted speed limit also adversely contributes to run-off-road crashes.

Furthermore, a high likelihood of crashes involving pedestrians and cyclists is observed due to the poor (or non-existent) provision of walking and cycling. Through Section 1, the lack of walking and cycling infrastructure indicates a low exposure of these vulnerable road users, resulting in a relatively low score. This instance changes in Section 2, where a higher exposure of users is expected, therefore, resulting in a poor alignment with Safe System principles. In all cases, conflict impact speeds are expected to exceed the biomechanical tolerances for vulnerable road users (20 to 30 km/h), suggesting that, potentially, serious or fatal injuries could result in the event of conflicts involving these users.

Similar to SH59, the scores Post-opening of the Transmission Gully are more aligned with Safe System principles in relation to the Pre-opening condition. This is driven by reduced traffic volumes since opening the new road, reducing road users' exposure. However, the likelihood and severity factors are likely to remain unchanged as no changes have been made to the existing infrastructure.

In this instance, the only thing that has changed is the exposure, with reduced traffic volumes due to TG opening, which has taken some 12,000 to 19,000 vehicles per day off SH58 and SH59 respectively (a 40% to 68% reduction). The Safe System assessment scores 0 to 4 for exposure. Any AADT over 10,000 scores a 4. Even with the introduction of TG, SH59 has an AADT of over 10,000 in most parts. Therefore, the significant reduction in vehicle exposure is not able to be recognised within this framework.

Despite the minimal benefit illustrated through the SSA, it is recognised that the significant level of redistribution in traffic will result in considerable safety benefits overall.

5 Safety Concerns

5.1 Crash History

The crash history of the site was assessed to assist the SSA team in understanding the safety performance of the site. A ten-year CAS assessment was undertaken from 2013 to 2022 (and 2023 to date). The crash location maps are shown in Figure 5.1-1 and Figure 5.1-2, and the summary of the crashes is presented in Table 5.1-1 and Table 5.1-2.

For SH58 and SH59 sections, which had a significant change in traffic volumes given the opening of the Transmission Gully, ideally, a 5-year pre- and post-opening crash assessment would be undertaken to better describe the current crash profile – this is not possible given the relatively short time since the Transmission Gully's opening. It is noted that the crash frequency is expected to be significantly reduced due to the change in traffic volumes. However, for the purpose of this assessment, the 10-year assessment is considered appropriate given that predominant crash trends are likely to remain relatively unchanged as no changes have occurred to the existing infrastructure.

Figure 5.1-1 – Crash Locations – SH59 Porirua Region

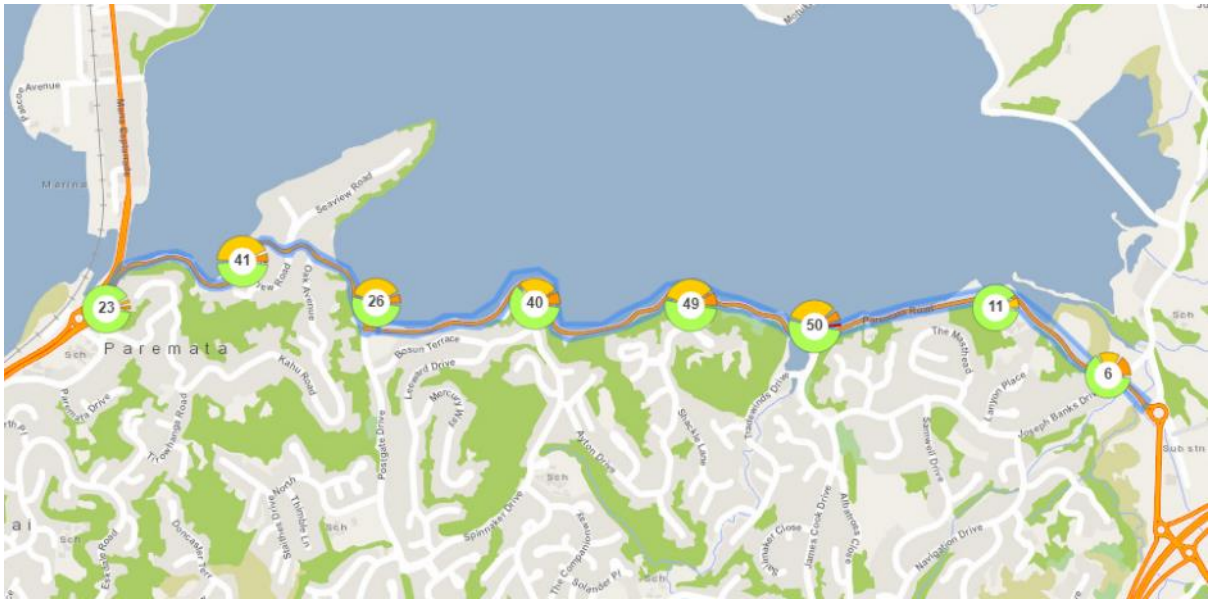


Figure 5.1-2 – Crash Locations – SH58

Table 5.1-1: Crash Summary 2013 – 2023 (to date) – SH59

Crash Severity	SH59 Porirua Region			
	Frequency		Casualties	
Fatal	5		5	
Serious	33		36	
Minor-Injury	172		238	
Non-injury	910		-	
Total	**1,120**		**279**	
Crash Type		**Environment**		
Overtaking crashes	258 (23%)	Natural light conditions	Light/overcast	794 (70.9%)
Straight road lost control/head-on	146 (13%)		Dark/twilight	296 (26.4%)
Bend lost control/head-on	172 (15.4%)	Road conditions	Dry	826 (73.8%)
Read end/obstruction	402 (35.9%)		Wet	268 (23.9%)
Crossing/turning	132 (11.8%)		Ice or Snow	1 (0.1%)
Others	10 (0.9%)			
Involved motorcyclists	48 (4.3%)	Intersection		555 (49.5%)
Involved pedestrians/cyclists	21 (1.9%)	Midblock		565 (50.5%)

Table 5.1-2: Crash Summary 2013 – 2023 (to date) – SH58

Crash Severity	SH58 Porirua Region	
	Frequency	Casualties
Fatal	2	2
Serious	20	21
Minor-Injury	77	100
Non-injury	147	-
Total	**246**	**123**

Crash Type		Environment		
Overtaking crashes	12 (4.9%)	Natural light conditions	Light/overcast	169 (68.7%)
Straight road lost control/head-on	5 (2%)		Dark/twilight	73 (29.7%)
Bend lost control/head-on	160 (65%)	Road conditions	Dry	135 (54.9%)
Read end/obstruction	43 (17.5%)		Wet	107 (43.5%)
Crossing/turning	19 (7.8%)		Ice or Snow	-
Others	7 (2.8%)			
Involved motorcyclists	14 (5.7%)	Intersection		80 (32.5%)
Involved pedestrians/cyclists	10 (4.1%)	Midblock		166 (67.5%)

5.2 Summary of findings

The frequency of risk rankings associated with this Safe System Audit is provided below, with detailed findings to follow. This summary illustrates the degree of consideration that should be given when working through the findings.

Table 5.2-1: Summary of Findings

Serious	Significant	Moderate	Minor	Comment	Total
21	5	1	2	-	29

5.3 SH59 – Section 1: SH1/SH59 intersection to Paremata Roundabout

5.3.1 Roadside hazards **Serious**

Roadside hazards have been identified throughout this section of SH59. In the event of an errant manoeuvre or loss of control crash, these hazards are likely to result in a more severe crash outcome. Furthermore, the closer these hazardous objects are in relation to the road, the more likely they are to be hit by vehicles. The Safe System boundaries for crashes against rigid objects are direct impact speeds exceeding between 30 and 40 km/h.

The following hazards have been identified throughout this section:

- 059-0020/2.800 RHS: Non-frangible poles and train/railway (narrow offset from the road);
- 059-0020/3.650 RHS: Non-frangible concrete end (The Ramp interchange);
- 059-0020/4.430 RHS: Non-frangible concrete end (Mungavin Avenue interchange);
- 059-0020/3.960 to 4.700: Metal fence over the concrete median barrier. This represents a snagging hazard for motorcyclist handlebars;

The probability of crashes against these hazards has been assessed as 'Unlikely' due to the predominantly straight and flat alignment and moderate to wide sealed shoulders. However, impact speeds of over 90 km/h with these unprotected hazards could result in 'Fatal' crashes.

Table 5.3-1: Risk analysis

Prominent crash type		Against non-frangible objects
Probability	Unlikely	Straight alignment and wide shoulders
Severity	Fatal	Impact speeds > 90 km/h

Figure 5.3-1 – Poles and railway hazard

Figure 5.3-2 – Non-frangible concrete end (The Ramp interchange)

Figure 5.3-3 – Non-frangible concrete end (Mungavin Avenue interchange)

Figure 5.3-4 – Steel fence (Mungavin Avenue interchange)

Recommendation:

1. *Identify roadside hazards and either remove, relocate, underground, or protect with roadside barriers;*
2. *Consider opportunities for additional roadside barrier protection by extending the length of existing barriers (during replacement) to close off roadside hazards further.*

Probability Rating: ***The probability of a crash is*** **Unlikely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. All recommendations have been noted and will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.3.2 SH59/SH58 Roundabout – Southbound approach speed

Serious

During the site visit, the SSA team observed a near-miss crash at the SH59/SH58 roundabout. This near-miss crash involved a southbound vehicle on SH59 and a vehicle turning right onto SH58. The near-miss crash seemed to be a result of excessive approach speed for the southbound vehicle, which has been noted on other vehicles approaching the roundabout. Note that the posted speed limit in this area is 50 km/h, but some vehicles appear to exceed the speed limit.

The observed safety hazard could be a result of an insufficient entry deflection on the north side of the roundabout. For instance, it can be observed that the conflict angle between approaching southbound vehicles and others on the circulating carriageway is somewhat close to 90 degrees, likely to generate high impact angles (refer to red arrows in Figure 5.3-5). This is unusual for a typical roundabout layout. In turn, high impact angles are likely to result in more severe crashes. In contrast, the southern approach generates lower impact angles, likely to result in less severe crashes (refer to green arrows below).

The probability of crashes is assessed as 'Likely' due to the combination of relatively high approach speeds and high traffic volumes. A disproportional number of crashes is also recorded on this leg of the roundabout. The approach layout that results in high crash impact angles combined with impact speeds that can exceed Safe System principles (i.e., 50 km/h or less) could result in a 'Serious' injury outcome.

Table 5.3-2: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Likely	Relatively high impact speeds and high traffic volumes
Severity	Serious	Impact speeds of 50-60 km/h

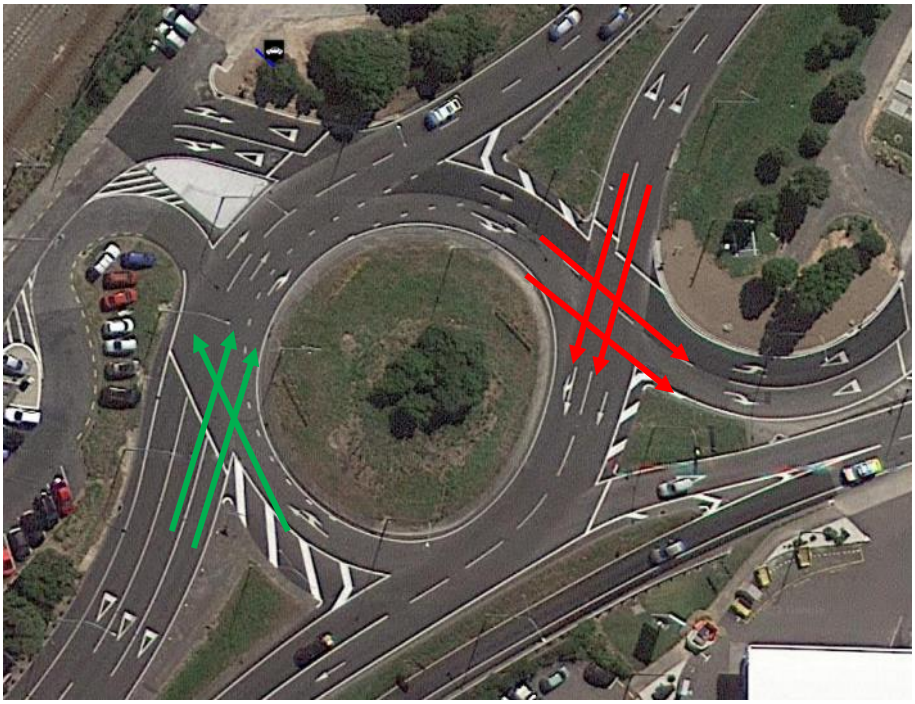


Figure 5.3-5 – Intersection layout and conflict angles at the SH59/SH58 roundabout

Recommendation:

1. *Investigate the design of the intersection, particularly the entry deflection curve on the northern approach, against best practice design parameters;*
2. *Consider amending the layout for the provision of reduced impact angles;*
3. *Investigate if a dual-lane roundabout is still required with the reduced traffic volumes;*
4. *Consider speed management (raised safety platforms or improved horizontal deflection) on the approaches to the roundabout to mitigate the high entry speeds and higher impact angles.*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Serious**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and safety improvements at this roundabout will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted, and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.3.3 Whitford Brown intersection – Speed and impact angle — Serious

The SH59/Whitford Brown Avenue is signalised. The posted speed limit through the intersection is 100 km/h, with similar expected operating speeds. The layout consists of right-turn movements in and out of Whitford Brown Avenue at 90-degree angles with SH59. Therefore, side-impact crashes involving right-turning vehicles in this locality are expected to result in high impact angles (refer to Figure 5.3-6). This configuration does not align with Safe System principles.

The probability of side-impact crashes is considered 'Unlikely', given that the risk is predominantly limited to late runners (red-light runners). However, side-impact crashes at this intersection involving the opposing movements mentioned above could have impact speeds of 100 km/h with high impact angles, as most motorists would not expect non-compliance with the traffic lights, being generally unprepared to react and brake to reduce impact speeds sufficiently. Therefore, significant crash forces that are likely to result in a 'Fatal' outcome are expected to be generated.

Table 5.3-3: Risk analysis – Side-impact

Prominent crash type		Side-impact at high impact angles
Probability	Unlikely	Risk is typically limited to late runners
Severity	Fatal	Impact speeds > 90 km/h

Furthermore, rear-end crashes are expected to occur at this intersection due to braking when signals change from the green to red phase. This is a common crash type in high-speed areas with traffic signals. It is noted that over 50% of the crashes at this intersection are of the rear-end type. Therefore, the probability is assessed as ‘Likely’. This crash type is expected to result in low impact angles. However, a 'Serious' outcome could occur given the potential for high impact speeds of 100 km/h.

Table 5.3-4: Risk analysis – Rear-end

Prominent crash type		Rear-end collisions
Probability	Likely	Traffic signals in a high-speed area with high traffic volumes
Severity	Serious	Impact speeds > 90 km/h

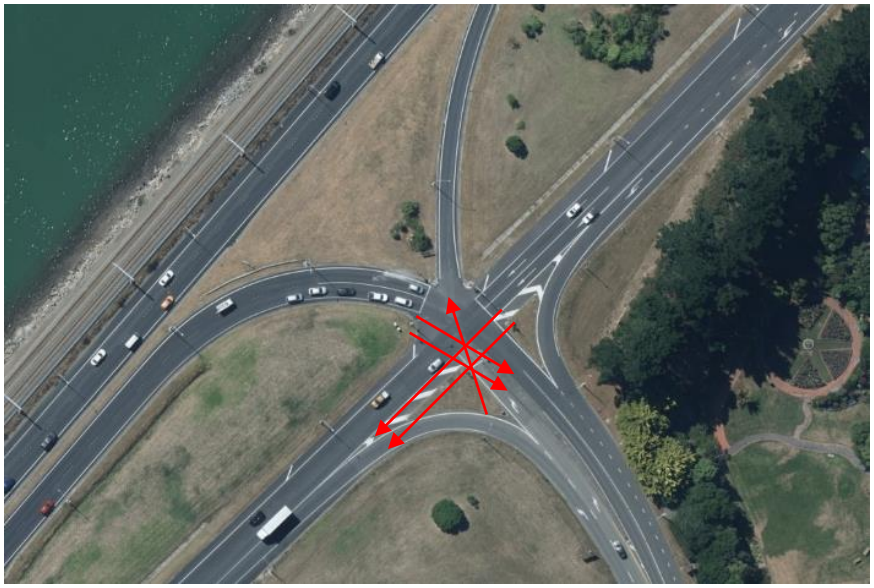


Figure 5.3-6 – Intersection layout and conflict angles at the Whitford Brown intersection

Recommendation:

1. *Consider upgrading the intersection to a roundabout or grade-separated layout;*
2. *Consider the installation of raised safety platforms to reduce speeds through the intersection;*
3. *Consider reviewing the signal timings to ensure that all movements are appropriately catered for;*

Probability Rating: ***The probability of a crash is*** **Unlikely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *This intersection is included for safety investigation and improvements during the current National Land Transport Plan. Design work is in progress and in consultation with Porirua City Council. There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. Further major long-term improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. There is work on this intersection being undertaken currently. Further major long-term improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Action Taken: *There is work on this intersection being undertaken currently. Further major long-term improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.4 SH59 – Section 2: Mana Esplanade – Paremata Roundabout to Plimmerton Roundabout

5.4.1 Pedestrian crossing opportunities **Serious**

Most pedestrian crossing opportunities throughout Mana Esplanade are provided at signalised intersections. One overpass is offered in the vicinity of the Plimmerton Train Station. One pedestrian refuge island is provided at 059-0000/18.290. The posted speed limit is 50 km/h. Other than the pedestrian overpass, the pedestrian crossings provisions throughout this section of SH59 are considered unsafe due to the following:

- The road cross-section on Mana Esplanade is very wide, with four traffic lanes and a central flush (or raised) median (14.8 m wide as per MobileRoad). This results in pedestrians being exposed to traffic for a long time;
- During the site visit, it was observed that the signal phasing appeared to allow a relatively short time for crossing the whole road width;
- No mid-block crossing facilities are provided throughout the section (other than the single pedestrian refuge and the overpass);
- The single pedestrian overpass increases travelled distances. Some users may prefer to cross at grade to obtain the shorter (and natural) path. Overpasses (or underpasses) are unlikely to be used where the walking distance is more than 50% greater than the at-grade distance. Even less than this, some pedestrians will try the shortest route[1];
- The distance between crossing opportunities is relatively high, approximately 350 m on average. This could result in an increase in walking distance of 700 m for some pedestrians. For the long detour, which could take approximately 10 minutes for aged or mobility-impaired users, pedestrians can be expected to choose the shorter path and cross the road mid-block, where no facilities are available;
- At existing kerb crossings (cutdowns) at pedestrian crossings, no Tactile Ground Surface Indicators (TGSI) are provided, putting blind and vision-impaired people at risk;
- An existing crossing just south of the Plimmerton Roundabout has intervisibility between pedestrians and vehicles obscured by vegetation (refer to Figure 5.4-2), increasing the likelihood of crashes against vulnerable road users (VRU);

Due to the above factors, the probability of conflicts involving pedestrians crossing SH59, especially the elderly and mobility-impaired users, is assessed as 'Likely'. Impact speeds of 50 km/h (or slightly above)

[1] Waka Kotahi's Pedestrian Planning and Design Guide Section 15.14

could be expected in this area, with the potential to result in a 'Fatal' outcome. Note that the Safe System speeds for crashes involving vulnerable road users (VRU) are 20 to 30 km/h.

Table 5.4-1: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians)
Probability	Likely	Long crossing distance, long distance between facilities, no mid-block facilities, short signal pedestrian phase, no TGSI
Severity	Fatal	Impact speeds ≥ 50 km/h

Figure 5.4-1 – Crossing/kerb cutdown at the Plimmerton Roundabout

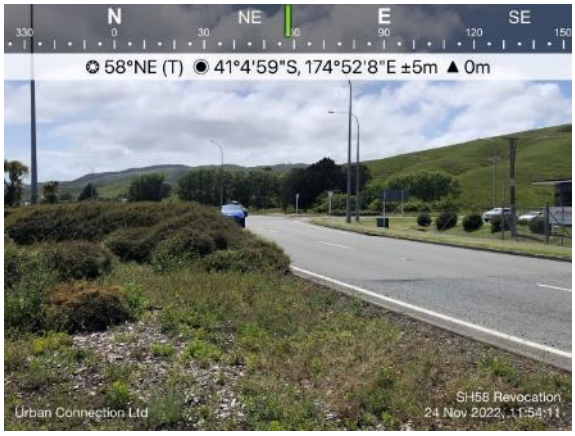


Figure 5.4-2 – Visibility at the Plimmerton Roundabout

Recommendation:

1. *Consider speed management (for example, raised safety platforms) on existing pedestrian crossings;*
2. *Consider reducing the crossing distance (for example, kerb build-outs) on existing pedestrian crossings;*
3. *Investigate if the signal phase for pedestrians accounts for the long crossing distance and walking speeds of all users (including mobility-impaired and the elderly);*
4. *Consider providing additional pedestrian crossings where pedestrians may be inclined to cross, including speed management at these future crossings;*
5. *Consider providing TGSIs on kerb cutdowns and crossings to guide and warn vision-impaired people;*
6. *Improve visibility in the vicinity of crossings where intervisibility is adversely affected.*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term pedestrian improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. The character of this corridor varies significantly between the two roundabouts and the crossing facilities need to be carefully considered in context. All recommendations have been noted and further long-term pedestrian improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Action Taken: *All recommendations have been noted and further long-term pedestrian improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.4.2 Cycling facilities **Serious**

No cycling facilities are provided along Mana Esplanade. An off-road cycle path runs west of SH59 (Mana Esplanade) through this section – this is part of the Te Araroa trail. Most recreational use is expected to occur along this off-road path. However, given the residential land use throughout Mana Esplanade and its surroundings, cyclists can be expected to ride along and cross the road for commuting and leisure purposes. The following road safety issues are observed in relation to the lack of cycling facilities:

- The lack of cycling facilities means that, legally, cyclists must share the road with traffic. The road cross-section consists of two lanes in each direction with no sealed shoulders. This road carries an average of approximately 16,500 vehicles per day (vpd). High traffic volumes, as observed, can increase the probability of cycle-related crashes;
- A clearway treatment is provided through part of Mana Esplanade, meaning that vehicles can park along the road at specific periods of time. On-road cyclists are required to move away from parked vehicles, displacing towards the central traffic lane, exposing them to conflicts with vehicles;
- No treatment (road markings, signage) for cyclists is provided at intersections and high-volume driveways that would delineate paths and highlight cyclists' presence;
- The connection between the off-road pathway and Mana Esplanade is considered poor due to the lack of appropriate treatment and opportunities for cyclists to safely connect to and from these points. Only one underpass safely provides this connection at the south end of this section;
- No mid-block cycle crossings or refuges cater for this VRU category;
- The busy road, with no appropriate cycling facilities, is expected to encourage cyclists to ride informally on the footpaths (although this is against the law as mentioned above). It can be expected that the majority of the non-confident (i.e., interested but concerned category) would do so. Existing footpaths, including crossings on side roads, are not planned (and treated) for shared use. The paths have limited width that could be insufficient for shared use, with obstacles (poles, signs, overhung vegetation) along the way, increasing the chances of conflicts with pedestrians, and reducing the available effective width further. Several driveways with restricted visibility also raise concerns about conflicts with vehicles;

The above factors increase the likelihood of crashes involving this VRU category. This is assessed as 'Likely' due to the combination of factors. Impact speeds of 50 km/h (or slightly above) could be expected in this area, with the potential to result in a 'Fatal' outcome. Note that the Safe System speeds for crashes involving VRU are 20 to 30 km/h.

Table 5.4-2: Risk analysis

Prominent crash type		Against vulnerable road users (cyclists)
Probability	Likely	No cycling facilities, no treatment at intersections, informal shared use, parked vehicles, poor connectivity to the off-road pathway, no cycle crossing /refuge
Severity	Fatal	Impact speeds ≥ 50 km/h

Figure 5.4-3 – Road cross-section (no cycling facilities)

Recommendation:

1. *Consider providing cycling facilities (preferably separated) through Mana Esplanade, including treatment at intersections and high-volume driveways;*
2. *Consider improving the connectivity between the off-road pathway and Mana Esplanade (including adding appropriate wayfinding signage);*
3. *Consider providing mid-block crossings;*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term cycling and multi-modal improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. The character of this corridor varies significantly between the two roundabouts and the facilities for cyclists need to be carefully considered in context. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.4.3 Footpaths **Minor**

Footpaths are provided throughout Mana Esplanade. This provision is generally found on both sides of the road in this section. The following safety concerns are observed in relation to the existing provision:

- Several obstacles (typically poles and traffic signs) reduce the effective width of the path. This condition can result in some conflicts among users, especially considering that some cyclists could be expected to ride on footpaths since Mana Esplanade has no provision for this user type. Furthermore, the condition also reduces overall walking comfort;
- Overhung/overgrown vegetation also reduces the effective width of the path and could lead to conflicts or injuries, especially for the elderly;
- On rubbish/recycle collection days, the width is further reduced due to bins positioned on the footpath;
- Successive vehicle crossings are translated to multiple level rises and falls on the footpath. This results in accessibility issues for the elderly and vision- and mobility-impaired users;
- The footpaths are not entirely connected. A connectivity issue is observed from 059-0000/17.745 to 18.010;

The prominent conflict due to the above deficiencies is related to conflict among vulnerable road users (including cyclists) due to reduced width, which is adversely affected by several obstacles. Some of the factors above can result in pedestrians tripping and injuring themselves. The probability of conflicts is assessed as 'Unlikely' as the relatively low number of users and walking/riding speeds. Due to the latter, conflict severities would be expected to be largely 'Minor'.

Table 5.4-3: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians and cyclists)
Probability	Unlikely	Obstacles reduce path width, but a relatively low number of users and walking/riding speeds
Severity	Minor	Impact speeds of < 20 km/h

Figure 5.4-4 – Footpath width adversely affected by signal poles

Figure 5.4-5 – Section of the path with overgrown vegetation

Figure 5.4-6 – Overgrown vegetation

Figure 5.4-7 – Rubbish bins and car parked on the footpath

Recommendation:

1. *Consider widening the footpaths;*
2. *Consider repositioning/removing obstacles that reduce the footpath width;*
3. *Investigate if footpaths meet accessibility standards and upgrade them accordingly if standards are not met;*
4. *Trim/remove overgrown vegetation and maintain it regularly;*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Unlikely**	***Crashes are likely to be*** **Minor**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. All recommendations have been noted and further safety improvements will be assessed and coordinated with the council's maintenance teams.*	
Client Decision: *The character of this corridor varies significantly between the two roundabouts and facilities for vulnerable users and the impact of routine operations need to be carefully considered in context. All maintenance requirements will be assessed and coordinated with the Wellington Transport Alliance & local council's maintenance teams*	
Action Taken: *All maintenance requirements will be assessed and coordinated with the Wellington Transport Alliance & local council's maintenance teams*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.4.4 Clearway treatment (on-street parking) Significant

On-street parking is offered through a significant portion of Mana Esplanade, with the following clearway treatments:

- 6:30 am to 9:30 am in the southbound direction on weekdays;
- 2:30 pm to 6:00 pm in the northbound direction on weekdays;
- 10.30 am to 2:00 pm on weekends in both directions.

The following safety issues are observed as a result of on-street parking:

- Parked vehicles restrict the visibility of vehicles exiting driveways throughout Mana Esplanade. This can lead to side-impact crashes;
- Vehicles on SH59 are required to change lanes if a vehicle is parked. These merge and diverge manoeuvres can result in conflicts (rear-end, side-swipe crashes) with other vehicles travelling through this section (or with parked vehicles);
- Vehicles manoeuvring in and out of parking spaces can conflict with traffic on Mana Esplanade and/or generate queueing upstream that can lead to rear-end crashes;

The more significant crash type for the above factors relates to side-impact crashes between vehicles exiting driveways and traffic on SH59. The probability of this issue has been assessed as 'Unlikely' due to the low on-street parking usage observed during the site visit. Low on-street usage was also observed during the night-time visit when a high demand would be generally expected. Residents may have become used to the routine of ensuring their vehicle is not parked on the road at night (suppressed demand possible) to not get their vehicle towed away when the clearway commences early in the morning. Impact speeds of 50 km/h (or slightly above) could be expected in this area, potentially resulting in a 'Serious' outcome. Note that the Safe System speed for side-impact crashes is 50 km/h.

Table 5.4-4: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Unlikely	Restricted visibility due to parked vehicles
Severity	Serious	Impact speeds ≥ 50 km/h

Figure 5.4-8 – On-street parking spaces

Recommendation:

1. *Investigate if there is a demand for on-street parking throughout Mana Esplanade and remove on-street parking or provide protected parking areas solely where required;*
2. *Reconsider the requirement for a clearway along this section*

Probability Rating: ***The probability of a crash is*** **Unlikely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Serious**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. All recommendations have been noted and recommendations on the clearway and on-street parking will be reconsidered as part of the Strategic Plan.*	
Client Decision: *Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*	
Action Taken: *Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure

Supporting Rational: Reduced exposure to risk

5.4.5 Road cross-section **Serious**

The adjacent land use through Mana Esplanade is typically residential and commercial, including food shops, supermarkets and schools in the immediate vicinity. The existing road cross-section is very wide and accommodates, in general, a wide flush median or raised central island and two traffic lanes in each direction (14.8 m wide as per MobileRoad). The posted speed limit is 50 km/h.

The road environment is not considered in keeping with the adjacent urban land use, and the following safety issues have been identified:

- The road cross-section of Mana Esplanade adversely influences traffic operating speeds, given that drivers tend to increase their speeds on wide road cross-sections. Conversely, narrower road configurations tend to reduce speeds due to their more constrained nature. The straight alignment also influences this;
- The wide road configuration adversely affects decision-making for motorists turning to and from driveways and intersections. For instance, a vehicle turning right out of a driveway has to observe four lanes of traffic, making gap selection in traffic streams more demanding, requiring more attention and observation time, and potentially leading to poor decisions. It is noted that a high number of driveways are provided throughout Mana Esplanade, in keeping with the urban/semi-urban characteristics;
- The traffic operating speed potentially exceeds Safe System speeds for side-impact crashes (speeds near to or in excess of 50 km/h) that could typically occur at driveways and intersections. This is confirmed by radar speed data received, which recorded an 85th percentile speed of 55 km/h – the speed device records speeds for northbound traffic north of Acheron Road;
- The multiple-lane configuration may result in masking effects, in which vehicles can obscure the visibility toward other vehicles travelling in the same direction;

The more significant crash type for the above factors relates to side-impact crashes between vehicles exiting driveways and traffic on SH59, given the challenging gap selection, especially in peak periods. The probability of this issue has been assessed as 'Likely' due to high traffic volumes on Mana Esplanade and high driveway frequency. Impact speeds of 50 km/h (or slightly above) could be expected in this area, potentially resulting in a 'Serious' outcome. Note that the Safe System speed for side-impact crashes is 50 km/h.

Table 5.4-5: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Likely	Difficult decision-making, high traffic volumes and driveway frequency
Severity	Serious	Impact speeds ≥ 50 km/h

Figure 5.4-9 – Road cross-section on Mana Esplanade

Figure 5.4-10 – Road cross-section on Mana Esplanade

Recommendation:

1. *Consider the provision of a more urban road configuration that naturally assists speed management. For instance, consider a raised central median, one lane in each direction, mid-block raised safety platforms (for speed management and pedestrians), kerb build-outs, horizontal deflections. The combination of these interventions is likely to discourage heavy vehicles from this urbanised area;*
2. *Consider providing a central raised median with safe turnaround options (driveways to become left-in left-out) or provide one lane in each direction;*
3. *Consider additional traffic calming techniques;*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Serious**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. All recommendations have been noted and further improvements regarding the road environment and future form and function will be assessed will be reconsidered as part of the Strategic Plan. The character of this corridor varies significantly between the two roundabouts and the corridor characteristics need to be carefully considered in context to support the required user behaviour.*	
Client Decision: *Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*	
Action Taken: *Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk; remains unchanged
Supporting Rational: No change in operating environment or conflict exposure

5.4.6 Signalised Intersections — Significant

The intersections throughout Mana Esplanade are mainly signalised crossroads or T layout. The traffic volumes on side roads vary from low to high. The posted speed limit is 50 km/h on Mana Esplanade.

The issue related to this configuration relates to high impact angles that do not align with Safe System principles, for this is likely to generate more severe crash outcomes. Operating speeds exceeding 50 km/h can be expected at the intersections, particularly in the case of a green phase on the main road – this has the potential to generate 'Serious' injuries. The intervisibility between vehicles is also restricted by adjacent buildings/fences, meaning that impact speeds are likely to remain close to the operating speeds due to reduced reaction and braking time. It is recognised, however, that the probability of these side-impact crashes is low ('Unlikely') due to the fact that the risk is limited to the eventual disregard (distraction or non-compliance) for the traffic lights.

Table 5.4-6: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Unlikely	Risk is limited by late runners
Severity	Serious	Impact speeds ≥ 50 km/h

Recommendation:

1. *Consider providing speed management (raised platforms) at high-risk intersections;*
2. *Consider providing roundabouts with raised safety platforms for pedestrian crossing opportunities and to reduce vehicles' speeds and impact angles.*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Unlikely**	***Crashes are likely to be*** **Serious**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further improvements regarding the road environment and changes to signalised intersections will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan.*	

Client Decision:	*Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*
Action Taken:	*Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.4.7 Visibility from driveways **Minor**

The visibility towards pedestrians on the footpath for vehicles exiting driveways is restricted by properties' fences/walls. This condition can result in crashes involving these vulnerable road users.

Some footpath users could be travelling at relatively high speeds using cycles and scooters, which could increase the likelihood of safety issues. However, most vehicles are expected to exit driveways at slow speeds, especially where the visibility is restricted. This indicates an 'Unlikely' probability for this crash type. The slow speeds (≤ 20 km/h) also suggest that, at most, 'Minor' injury crashes are likely to occur.

Table 5.4-7: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians)
Probability	Unlikely	Slow speeds of vehicles exiting driveways
Severity	Minor	Impact speeds ≤ 20 km/h

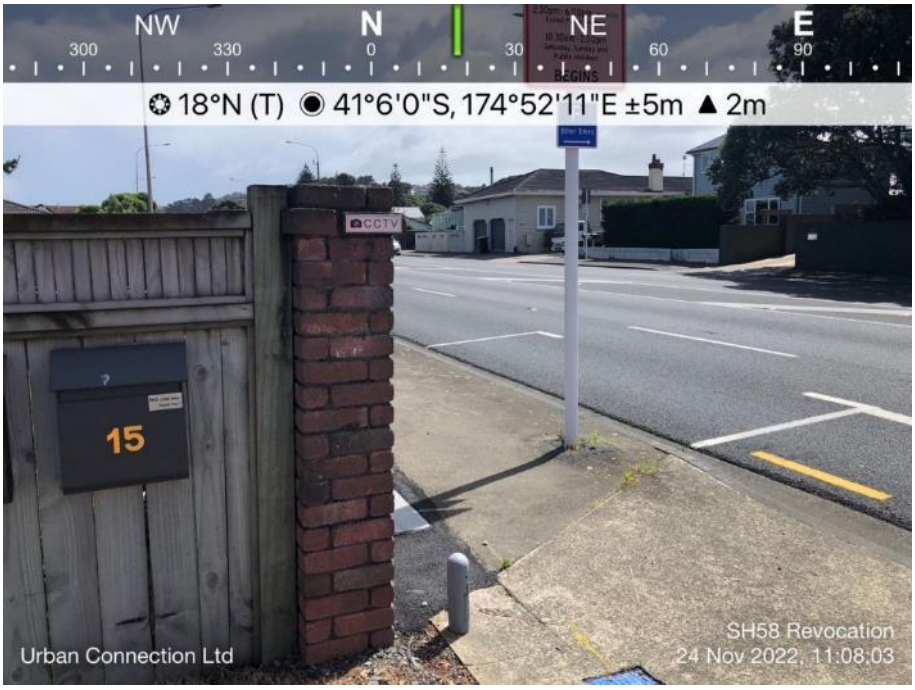


Figure 5.4-11 – Visibility from a driveway

Recommendation:

1. *Consider widening the footpath to provide more offset from properties' boundaries;*
2. *Consider undertaking consultation with landowners for visibility improvements or installing speed calming devices within private driveways.*

Probability Rating:	***Severity Outcome Rating:***
***The probability of a crash is* Unlikely**	***Crashes are likely to be* Minor**

Design Team Response: *N/A*

Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further improvements regarding the road environment and future form and function will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan.*

Client Decision: *All recommendations have been noted and further improvements regarding the road environment and future form and function will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*

Action Taken: *All recommendations have been noted and further improvements regarding the road environment and future form and function will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59*

Assessment Against TG Condition NZTA.83

Identified Issue: An existing risk benefited from reduced vehicle exposure

Supporting Rational: Reduced exposure to risk

5.5 SH59 – Section 3: Plimmerton Roundabout to Pukerua Bay

5.5.1 Median barrier extents **Serious**

The section between the Plimmerton Roundabout and Pukerua Bay (50-100 km/h speed threshold) is approximately 5 km long. Wire-rope median barrier is provided for approximately 4.15 km, with an unprotected section for approximately 850 m on the northern end of this section. The posted speed limit is 100 km/h.

This unprotected section results in an ongoing risk of head-on crashes throughout this section. Median barriers are a Primary Safe System treatment that significantly reduce the head-on risk for the corridor. Median barriers also are expected to address around 40-50% of run-off-road crashes (i.e. run-off-road crashes to the right).

In this instance, some mitigation is offered due to the fact that a wide flush median is provided, increasing the separation between opposing traffic flows. The unprotected section is relatively short, straight to moderately curved horizontal alignment, with wide traffic lanes and sealed shoulders. These factors result in an 'Unlikely' probability for this crash type. However, due to the high operating speeds of greater than 90 km/h, the resulting crash severity is likely 'Fatal'. The Safe System speed for head-on crashes is 70 km/h or less.

Table 5.5-1: Risk analysis

Prominent crash type		Head-on crash
Probability	Unlikely	Relatively short section with wide flush median, wide traffic lanes and sealed shoulders and straight to moderately curved horizontal alignment
Severity	Fatal	Impact speeds ≥ 90 km/h

Recommendation:

1. *Consider extending the median barrier north up to the Pukerua speed threshold;*
2. *Alternatively, consider reducing the speed limit throughout this section.*

Probability Rating: ***The probability of a crash is* Unlikely**	***Severity Outcome Rating:*** ***Crashes are likely to be* Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term median barrier improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. All recommendations have been noted and further long-term median barrier improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding*	
Action Taken: *All recommendations have been noted and further long-term median barrier improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.5.2 Airlie Road Intersection **Significant**

The SH59/Airlie Road intersection is a crossroads layout. Airlie Road has an AADT of 512 vpd (MobileRoad 2022). The intersection is give-way controlled on the west side and stop-controlled on the east side. Right-turn bays and acceleration lanes are provided for movements in and out of Airlie Road. A left-turn slip lane is provided for movements onto Airlie Road on the east side of the road. The posted speed limit is 100 km/h.

The following safety issues have been identified in relation to this existing intersection:

- Substandard visibility is achieved from Airlie Road (either side of the road) to both north and south. The achieved visibilities range from 180 to 220 m. A safe intersection sight distance of 248 m is required for a design speed of 100 km/h[2], excluding any grade correction necessary;
- High crash impact angles are expected to be generated considering the intersection layout, which does not align with Safe System principles;
- The visibility toward southbound traffic can be obscured by vehicles on the left-turn slip lane (i.e., masking effect). Very low volumes onto Airlie Road (East) result in a low probability of conflicts as a result of this issue;
- The visibility toward through traffic (either southbound or northbound) can be obscured by opposing right-turn vehicles. Low volumes onto Airlie Road (and U-turning at this point) result in a low probability of conflicts as a result of this issue;

The probability of crashes, in this case, is decreased as the available visibility that, although substandard, provides sufficient time for motorists to react and brake, reducing speeds to either generally avoid the collision or result in relatively low impact speeds. Relatively low traffic volumes on Arlie Road also contribute to a 'Very Unlikely' probability. However, in the worst-case scenario of a misjudgement or masking of through traffic, reaction and braking time would not be allowed, generating impact speeds greater than 90 km/h that could likely result in 'Fatal' injury crashes.

Table 5.5-2: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Very Unlikely	Risk is decreased by reaction and braking distance available and low traffic volumes on the side road
Severity	Fatal	Impact speeds > 90 km/h

[2] Austroads Guide to Road Design Part 4A – Table 3.2

Figure 5.5-1 – Intersection layout

Figure 5.5-2 – Visibility from Arlie Road (East)

Recommendation:

1. *Improve the visibility at the intersection by means of vegetation removal/trimming;*
2. *Remove the left-turn slip lane on the east side of the intersection;*
3. *A change in intersection layout to reduce vehicles' speeds and impact angles, i.e. remove right-turning traffic, realign left turns or introduce a roundabout.*

Probability Rating: *The probability of a crash is* **Very Likely**	*Severity Outcome Rating:* *Crashes are likely to be* **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted further long-term intersection improvements such as signage, markings and vegetation clearance will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *All recommendations have been noted further long-term intersection improvements such as signage, markings and vegetation clearance will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Action Taken: *All recommendations have been noted further long-term intersection improvements such as signage, markings and vegetation clearance will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.5.3 Roadside hazards **Serious**

During the site visit, the following roadside hazards were identified:

- 059-0000/14.800: a section with wooden bollards where the separation between the road and the shared off-road path (west side) is reduced (refer to Figure 5.5-3). The bollards represent a hazard, especially for motorcyclists, for being non-frangible. These wooden bollards also are likely to splinter if hit, with the risk of impaling vehicle occupants. The reduced separation also means shared path users are more susceptible to being hit by errant vehicles. In that case, requiring physical protection;
- 059-0000/15.650: a section of unprotected drop-off between the road and the shared off-road path (west side) (refer to Figure 5.5-4);

The probability of crashes against these hazards has been assessed as 'Unlikely' due to the predominantly straight to moderately curved alignment, with wide sealed shoulders. The unprotected sections are also relatively short in nature. However, impact speeds of over 90 km/h with these unprotected hazards could result in 'Fatal' crashes.

Table 5.5-3: Risk analysis

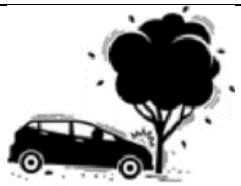
Prominent crash type		Against non-frangible objects and/or vulnerable road users
Probability	Unlikely	Straight to moderately curved and wide shoulders
Severity	Fatal	Impact speeds > 90 km/h

Figure 5.5-3 – Non-frangible wooden bollards

Figure 5.5-4 – Unprotected drop-off and trees hazard

Recommendation:

1. *Identify roadside hazards and either remove, relocate, underground, make them frangible or protect them with roadside barriers;*
2. *Consider providing roadside barriers where the shared path is close to the road;*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Unlikely**	***Crashes are likely to be*** **Fatal**

Design Team Response: *N/A*

Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term cycling and multi-modal improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*

Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*

Action Taken: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*

Assessment Against TG Condition NZTA.83

Identified Issue: An existing risk benefited from reduced vehicle exposure

Supporting Rational: Reduced exposure to risk

5.6 SH59 – Section 4: Pukerua Bay (Urban)

5.6.1 Pedestrian crossing opportunities **Serious**

The 2 km section through Pukerua Bay offers scarce safe crossing opportunities for pedestrians and cyclists. Only one safe crossing is provided, the pedestrian overpass at 059-0000/11.300. Furthermore, only one pedestrian refuge is offered along this section at 059-0000/11.540. The posted speed limit is 50 km/h through Pukerua Bay.

The pedestrian crossings provisions throughout this section of SH59 are considered unsafe due to the following:

- The single pedestrian refuge has poor intervisibility between pedestrians and vehicles on SH59 (refer to Figure 5.6-1);
- The scarce crossing opportunities indicate that pedestrians and cyclists are prone to crossing the road in locations where there is no appropriate treatment;
- The forward visibility through Pukerua Bay is restricted due to the windy horizontal alignment, expected to impact safe reaction and braking times;
- At most existing kerb cutdowns, no Tactile Ground Surface Indicators (TGSI) are provided, putting blind and vision-impaired people at risk;
- Kerb crossings are poorly designed (or constructed) with substandard design elements (landing areas, ramp gradients, etc.). Mobility-impaired users (on wheelchairs, mobility scooters) are expected to have difficulties or be unable to safely cross the road. These users are prone to lose their balance on transitions or accidentally rolling, resulting in injuries and potential conflicts with vehicles.

Due to the above factors, the probability of conflicts involving pedestrians crossing SH59, especially the elderly and mobility-impaired users, is assessed as 'Likely'. Impact speeds of 40 to 50 km/h could be expected in this area due to the reduced reaction and braking time, given the poor forward visibility. This exceeds the biomechanical tolerances of the human body for vulnerable road users (20 to 30 km/h), potentially resulting in a 'Fatal' outcome.

Table 5.6-1: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians)
Probability	Likely	Poor intervisibility, windy alignment, scarce crossing opportunities, no crossing treatment, no TGSI
Severity	Fatal	Impact speeds of 40-50 km/h

Figure 5.6-1 – Visibility to the north from the existing pedestrian refuge

Figure 5.6-2 – Cyclist waiting to cross the road (no crossing treatment)

Figure 5.6-3 – Existing kerb crossing

Figure 5.6-4 – Existing kerb crossing

Recommendation:

1. *Consider speed management (for example, raised safety platforms) on existing pedestrian crossings;*
2. *Consider providing additional pedestrian crossings where pedestrians are likely to cross the road (including speed management at these points);*
3. *Consider providing TGSIs on kerb cutdowns and crossings to guide and warn vision-impaired people;*

4. *Consider designing and constructing accessible kerb crossings;*
5. *Improve visibility in the vicinity of crossings where intervisibility is adversely affected.*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term pedestrian, cycling and multi-modal improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.	
Action Taken: Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.6.2 Walking and cycling paths **Serious**

Sections of shared-use paths (SUP) and footpaths run throughout Pukerua Bay. The shared off-road pathway, that south of Pukerua Bay runs offset from the main road, is adjacent to SH59 through this township. This section is part of the Te Araroa walking and cycling trail. The following safety concerns are observed in relation to the existing provision:

- The shared path is very narrow in some sections, being considered substandard for bidirectional shared use. This could lead to conflicts between pedestrians and cyclists when these users are required to share the same section simultaneously. The narrow configuration can also result in pedestrians and cyclists stepping onto the highway, putting them at risk of being struck by vehicles;
- The narrow nature of the path could encourage some cyclists to ride on the road carriageway. Very narrow sealed shoulders are provided on SH59 through this section, increasing the chances of conflicts with vehicles;
- Overgrown vegetation reduces the available width of the already narrow path;
- Some sections of the path are unlikely to meet accessibility standards, being unable to accommodate wheelchair and mobility scooter users.
- The vertical height between the road and the footpath (or shared path) is small in some sections due to successive resurfacing. This increases the chances of errant vehicles mounting the paths and striking vulnerable road users;
- No shared path treatment (road markings and signage) is provided at intersections. Therefore, users are not guided through the appropriate path to be followed, and the presence of vulnerable road users at these points is not highlighted to vehicles, increasing the likelihood of conflicts;
- Wayfinding signage is scarce and of poor quality, not guiding users appropriately. This increases the chances of confusing users, leading to poor decision-making and potential conflicts;
- A section of the shared path runs behind angle parking in front of stores at the north-western corner of the Teihana Road intersection. This could lead to vehicles reversing into VRUs;
- A section of the shared path between Teihana Road and Waikara Road is at the same level as the road, being separated by only white wooden sight rails. The rails do not provide adequate levels of protection for vulnerable road users on the shared path. If hit, the rails are easily broken, and vehicles could then hit vulnerable road users;
- Poor intervisibility is generally provided where the shared path crosses side roads.

The considered prominent crash type related to the factors presented above relates to the informal use of the carriageway by cyclists – this category can be expected to use the road due to the poor facilities available. The probability of conflicts involving pedestrians and cyclists is assessed as 'Likely'. Impact speeds of 40 to 50 km/h could be expected in this area due to the reduced reaction and braking time, given the poor forward visibility. This exceeds the biomechanical tolerances of the human body for vulnerable road users (20 to 30 km/h), potentially resulting in a 'Fatal' outcome.

Table 5.6-2: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians and cyclists)
Probability	Likely	Narrow paths, overgrown vegetation, no treatment on side roads, poor wayfinding signage, poor intervisibility
Severity	Fatal	Impact speeds of 40-50 km/h

Figure 5.6-5 – Cyclist on the carriageway

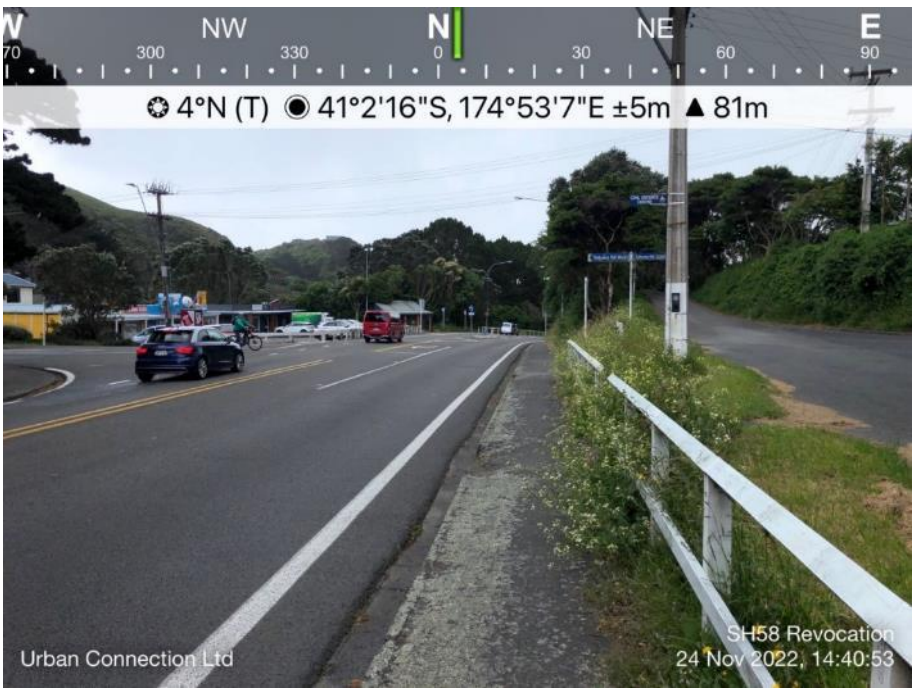


Figure 5.6-6 – Narrow path with overgrown vegetation

Figure 5.6-7 – Pinch pint at the Pukerua Bay Overbridge

Figure 5.6-8 – Successive resurfacing

Figure 5.6-9 – Treatment and visibility at the Waikara Road intersection

Recommendation:

1. *Consider widening shared paths to allow for bidirectional shared use;*
2. *Investigate if footpaths meet accessibility standards and upgrade them accordingly if standards are not met;*
3. *Trim/remove overgrown vegetation and maintain it regularly;*
4. *Consider highlighting shared path crossings at intersections;*
5. *Upgrade white sight rails between the shared path and the road to protective road barriers;*
6. *Consider upgrading the wayfinding signage throughout this section;*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term pedestrian, cycling and multi-modal improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance & local council's maintenance teams for action. Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan.	
Client Decision: We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance & local council's maintenance teams for action. Waka Kotahi will be considering the future form of SH59 as	

part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59
Action Taken: Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance & local council's maintenance teams for action. Waka Kotahi will be considering the future form of SH59 as part of the SH59 Strategic Plan. In the meantime, Waka Kotahi will not be making any changes to the form of SH59

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.6.3 Intersection control **Significant**

Some intersections throughout Pukerua Bay have incorrect intersection control. These are currently give-way controlled, whereas they must be stop-controlled for not having appropriate approaching visibility.

It is unsafe to approach an intersection at more than 10 km/h if, from a point 9 m from the intersection limit line on the controlled approach, a driver cannot see a vehicle on the uncontrolled approach at a distance (in metres) of 1.2 times the speed (in km/h) exceeded by 15% of the vehicles on the priority route[3].

Operating speeds of 40 to 50 km/h are expected through Pukerua Bay, requiring approaching visibility ranging from 48 to 60 m. This is not achieved at the following intersections:

- Pa Road (059-0000/10.395) (refer to Figure 5.6-10);
- Pukerua Beach Road (059-0000/10.950);
- Gray Street (059-0000/11.850) (refer to Figure 5.6-11);

The probability of crashes occurring as a result of this issue is assessed as 'Very Unlikely', given that vehicles would typically be expected to reduce their speeds and give way to traffic on SH59. However, in the event of a mistake, impact speeds of 40 to 50 km/h are expected to be generated, which could result in 'Serious' injury crashes considering the upper limit.

[3] Traffic Control Devices (TCD) Manual 4.1.2 or MOTSAM Section 3 3.10

Table 5.6-3: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Very Unlikely	Motorists are expected to approach at low speeds and give way to traffic on SH59
Severity	Serious	Impact speeds of 50 km/h

Figure 5.6-10 – Visibility from Pa Road

Figure 5.6-11 – Visibility from Gray Street

Recommendation:

1. *Consider upgrading the intersections to stop control;*
2. *Consider improving visibility in the vicinity of intersections;*
3. *Consider raised safety platforms to reduce vehicles' speeds and provide crossing opportunities for VRUs;*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Very Unlikely**	***Crashes are likely to be*** **Serious**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term multi-modal and vulnerable user improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance & local council's maintenance teams for action.*	
Client Decision: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance & local council's maintenance teams for action.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance & local council's maintenance teams for action.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.6.4 Roadside hazards **Serious**

During the site visit, the following roadside hazards were identified

- 059-0000/10.380 to 10.850 LHS: Non-frangible power poles adjacent to the road;
- 059-0000/11.180 RHS: unprotected drop-off. The existing steel fence is not expected to protect users/vehicle occupants in the event of a run-off-road crash;
- 059-0000/11.340 to 11.570 RHS: white wooden sight rails between the road and shared path. If hit, wooden rails are prone to splintering and piercing vehicles and occupants. In this instance, the wooden rails also do not protect pedestrians/cyclists on the shared path (Figure 5.6-12);
- 059-0000/11.600 LHS: white steel rails with unprotected ends. This is a non-frangible hazard prone to piercing vehicles and occupants if hit (refer to Figure 5.6-13);

The probability of crashes against these hazards has been assessed as 'Likely' due to the windy horizontal alignment with poor forward visibility and no sealed shoulders. Impact speeds of around 40 to 50 km/h with these unprotected hazards could result in 'Serious' crashes.

Table 5.6-4: Risk analysis

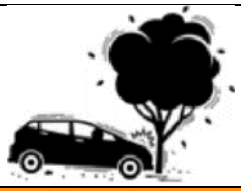
Prominent crash type		Against non-frangible objects and/or vulnerable road users
Probability	Likely	Windy horizontal alignment, very narrow sealed shoulders, poor forward visibility
Severity	Serious	Impact speeds of 40 to 50 km/h

Figure 5.6-12 – White wooden sight rails

Figure 5.6-13 – White steel rails

Recommendation:

1. *Identify roadside hazards and either remove, relocate, underground, or protect with roadside barriers;*
2. *Consider providing roadside barriers where the shared path is close to the road;*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Serious**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term multi-modal and vulnerable user improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.7 SH59 – Section 5: North of Pukerua Bay to Kapiti Coast District Council boundary

5.7.1 Walking and cycling paths **Serious**

A shared path is provided on the west side of SH59 throughout this section north of Pukerua Bay. Some pedestrians and cyclists could be expected to use this scenic section of shared path predominantly for leisure purposes. Moreover, this flatter section could be preferred by walkers and riders that aim to avoid the steeper section of the Te Araroa Trail that runs on the hill east of SH59. The posted speed limit is 80 km/h. The following safety concerns are observed in relation to the existing provision:

- The shared path is very narrow, typically less than 1.5 m wide, and considered substandard for bidirectional shared use. This could lead to conflicts between pedestrians and cyclists when these users are required to share the same section simultaneously. The narrow configuration can also result in pedestrians and cyclists stepping onto the highway, putting them at risk of being struck by vehicles;
- No protection (roadside barrier) between the shared path and the road carriageway is provided. The horizontal alignment is windy at a relatively high-speed area (operating speed likely 70 to 80 km/h). This condition puts vulnerable road users using the path at risk of being struck by vehicles if they lose control – it is noted that more than 60% of the crashes throughout this section are of the loss of control type;
- The narrow nature of the path indicates that some cyclists could be expected to ride on the road carriageway. Very narrow sealed shoulders are provided on SH59 through this section, increasing the chances of conflicts with vehicles. The risk is increased due to the fact that median barrier is provided throughout most of the section, constraining lateral movements of passing vehicles;
- The vertical height between the road and the footpath (or shared path) is small in some sections due to successive resurfacing. This increases the chances of errant vehicles mounting the paths and striking vulnerable road users;
- The path is unlikely to meet accessibility standards, being unable to accommodate wheelchair and mobility scooter users;
- At existing kerb crossings (cutdowns), no Tactile Ground Surface Indicators (TGSI) are provided, putting blind and vision-impaired people at risk;

The considered prominent crash types related to the factors presented above are linked to either the informal use of the carriageway by cyclists or vehicles losing control and striking vulnerable road users. The probability of conflicts involving pedestrians and cyclists is assessed as 'Likely'. Impact speeds of 70 to 80 km/h could be expected in this area due to the reduced reaction and braking time, given the

poor forward visibility. This exceeds the biomechanical tolerances of the human body for vulnerable road users (20 to 30 km/h), potentially resulting in a 'Fatal' outcome.

Table 5.7-1: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians and cyclists)
Probability	Likely	Narrow paths, narrow sealed shoulders, no protection between road and shared path, windy alignment, low height difference between road and shared path
Severity	Fatal	Impact speeds of 70-80 km/h

Figure 5.7-1 – Narrow shared path

Figure 5.7-2 – Typical configuration and cyclist on the shared path

Recommendation:

1. *Consider widening shared paths to allow for bidirectional shared use;*
2. *Investigate if footpaths meet accessibility standards and upgrade them accordingly if standards are not met;*
3. *Provide protection between the road and the shared path;*
4. *Provide TGSIs on kerb crossings (cutdowns);*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term pedestrian, cycling and multi-modal improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.7.2 Median barrier extents **Serious**

This section north of Pukerua Bay (50-80 km/h speed threshold) to the Kapiti Coast District boundary is approximately 4.15 km long. Wire-rope median barrier is provided for approximately 3.15 km, with an unprotected section for approximately 1 km on the southern end of this section. The posted speed limit is 80 km/h.

This unprotected section results in an ongoing risk of head-on crashes throughout this section. Three head-on crashes occurred in the last 10 years in the unprotected section, resulting in two serious injury crashes. Median barriers are a Primary Safe System treatment that significantly reduces the head-on risk for the corridor. Median barriers also are expected to address around 40-50% of run-off-road crashes (i.e. run-off-road crashes to the right).

In this case, the head-on crash risk for this section is increased due to the fact that no separation (flush median) is provided in the unprotected section. The windy horizontal alignment, narrow sealed shoulders and confined configuration (cutting bank on one side and wall on the other) also contribute to increasing the risk. These factors result in a 'Likely' probability for this crash type. With the operating speeds of 70 to 80 km/h, the resulting crash severity could be 'Fatal', especially if a heavy vehicle is involved. The Safe System speed for head-on crashes is 70 km/h or less.

Table 5.7-2: Risk analysis

Prominent crash type		Head-on crash
Probability	Likely	Windy horizontal alignment, narrow sealed shoulders and boxed-up configuration with no separation between opposing lanes
Severity	Fatal	Impact speeds of 70 to 80 km/h

Recommendation:

1. *Consider extending the median barrier south up to the Pukerua speed threshold;*
2. *Alternatively, consider reducing the speed limit throughout this section.*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term median barrier improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.7.3 Roadside hazards **Serious**

During the site visit, the following roadside hazards were identified throughout this section:

- 059-0000/9.330 to 9.433 RHS: Unprotected drop-off. White wooden sight rails are provided in this locality. This unprotected section is on the outside of a curve with a 75 km/h speed advisory, which could mean it is a high-risk location. Wooden rails are provided throughout the section – this type of rail is prone to splintering and piercing vehicles and occupants. (Figure 5.6-12);

The probability of crashes against these hazards has been assessed as 'Likely' due to the windy horizontal alignment with poor forward visibility and narrow sealed shoulders. Impact speeds of around 70 to 80 km/h with this unprotected drop-off could result in 'Fatal' crashes.

Table 5.7-3: Risk analysis

Prominent crash type		Against unprotected drop-off
Probability	Likely	Windy horizontal alignment, narrow sealed shoulders, poor forward visibility
Severity	Fatal	Impact speeds of 70 to 80 km/h

Figure 5.7-3 – Unprotected drop-off and white wooden sight rails

Recommendation:

1. *Identify roadside hazards and either remove, relocate, underground, or protect with roadside barriers;*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term median & side barrier as well as elimination of roadside hazards improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.8 SH58 – Section 1: Pauatahanui Roundabout to Postgate Drive Roundabout

5.8.1 Road delineation Serious

The road delineation through SH58, from Paekakariki Hill Road to Postgate Drive, is considered generally poor. Some of the safety issues identified are as follows:

- Some of the tight curves throughout the section do not provide sufficient curve warning signs (PW-66 and PW-67) to make road users aware of the out-of-context curves ahead;
- Edge marker posts (EMPs) are missing or broken, do not provide adequate levels of reflectivity or appear to have incorrect spacing from one another. This includes EMPs on existing roadside barriers;
- Delineation on existing roadside barriers is not uniform. Some barriers contain standard EMPs, while others contain LED strips;
- Existing reflective raised pavement markers (RRPMs) need maintenance/replacement.

Therefore, the existing delineation does not appropriately highlight the windy road alignment and the limits of the existing road cross-section. This safety issue is increased in dark conditions, where more guidance is necessary for motorists. Poor delineation can increase the likelihood of loss of control type crashes.

The probability of crashes due to poor delineation has been assessed as 'Likely' due to the windy horizontal alignment with poor forward visibility and very narrow sealed shoulders. As a substantial part of this section has no protection against the drop-off into the water, the resulting crashes could generate 'Fatal' outcomes.

Table 5.8-1: Risk analysis

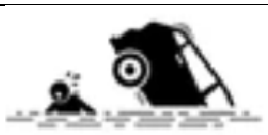
Prominent crash type		Loss of control/run-off-road into the water
Probability	Likely	Poor delineation combined with windy horizontal alignment, very narrow sealed shoulders, poor forward visibility
Severity	Fatal	Drop-off into the water

Figure 5.8-1 – Curve missing chevron board and indicators

Recommendation:

1. *Consider improving road delineation throughout SH58 by means of additional curve warning signage, additional/renewed EMPs and RRPMs;*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. There is currently an interim safety project under implementation as part of on-going safety improvements addressing safety deficiencies along the corridor. All recommendations have been noted and further long-term delineation, signage, median & side barrier improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. There is currently an interim safety project under implementation as part of on-going safety improvements addressing safety deficiencies along the corridor. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *There is currently an interim safety project under implementation as part of on-going safety improvements addressing safety deficiencies along the corridor. Recommendations*	

are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.

Assessment Against TG Condition NZTA.83

Identified Issue: An existing risk benefited from reduced vehicle exposure

Supporting Rational: Reduced exposure to risk

5.8.2 Speed Environment **Serious**

The posted speed limit throughout this section of SH58 is considered unsafe for the road's geometric alignment and environment. The existing road has the following posted speed limits and characteristics:

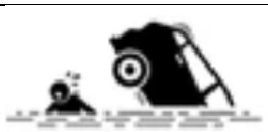
- The existing posted speed limit is 80 km/h;
- The road alignment is winding, containing curves with speed advisory ranging from 35 to 45 km/h;
- The road is within an urban fringe environment;
- The road cross-section accommodates two undivided traffic lanes with very narrow to narrow sealed shoulders;
- Delineation and drainage are typically poor;
- Most of the section has an unprotected roadside hazard (drop-off into the water);
- Driveway and intersection density is moderate;
- The mean operating speed is 57 km/h (MegaMaps);
- The operating speed exceeds Safe System boundary conditions for side-impact crashes at high angles that can occur at intersections and vehicle crossings.

It is assessed that the current posted speed limit is not in keeping with the road characteristics. This is mainly driven by the horizontal alignment, poor delineation, cross-section and roadside hazards. An out-of-context posted speed limit is expected to increase both the likelihood of crashes and the severity of crashes.

Due to the road characteristics described above, the probability of crashes with out-of-context speed as a factor is assessed as 'Likely'. The predominant crash type is expected to be the loss of control type. Head-on crashes could also be generated as a result of the incompatible speed. As a substantial part of this section has no protection against the drop-off into the water, the resulting crashes could generate 'Fatal' outcomes.

Indeed, the crash records, as shown in Figure 5.1-2, indicate a high number of fatal and serious crashes in this section. With reduced traffic volumes since the Transmission Gully, the crash frequency is likely to reduce. However, the high-risk crash trends are likely to remain unchanged, given that the infrastructure in place is also unchanged.

Table 5.8-2: Risk analysis

Prominent crash type		Loss of control/run-off-road into the water
Probability	Likely	Posted speed limit out of context with road characteristics
Severity	Fatal	Drop-off into the water

Recommendation:

1. *Consider reducing the posted speed limit throughout this section more in keeping with the road environment and characteristics and the Safe and Appropriate Speed;*
2. *Alternatively, consider providing median barriers and roadside barriers for the entire section.*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. There is currently an interim safety project under implementation as part of on-going safety improvements addressing safety deficiencies along the corridor. All recommendations have been noted and further long-term delineation, signage, median & side barrier improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *There is currently an interim safety project under implementation as part of on-going safety improvements addressing safety deficiencies along the corridor. We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *There is currently an interim safety project under implementation as part of on-going safety improvements addressing safety deficiencies along the corridor. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.8.3 Intersections Serious

The three intersections throughout this section of SH58 are of the T layout, all being stop-controlled. The intersections are made with Joseph Banks Drive, James Cook Drive and Spinnaker Drive. The traffic volumes on side roads vary from moderate to high (approximately 2,000 to 6,000 vpd). The posted speed limit is 80 km/h.

The following safety issues are observed using a Safe System view:

- The visibility at Joseph Banks Drive and Spinnaker Drive does not meet Safe Intersection Sight Distance (SISD) parameters for the design (posted) speed limit. The minimum SISD for an 80 km/h design speed is 181 m [4], which is not achieved;
- The traffic operating speed at the intersections is relatively high compared to the available visibility. A mean operating speed of 57 km/h is recorded in Megamaps, but this can be exceeded through intersections, which are typically on straighter parts of the corridor. This increases the probability of intersection crashes;
- The Safe System speed for side-impact crashes (i.e., crashes at high impact angles in excess of 50 km/h) can be exceeded at intersections. This could result in serious and fatal crashes;
- The left-turn slip lane onto Joseph Banks Drive can result in masking issues, in which a vehicle turning left onto Joseph Banks Drive can restrict/obscure visibility towards westbound vehicles;

The probability of crashes at intersections is assessed as 'Likely', given that substandard visibility reduces observation time and gap opportunities, adversely affecting decision-making. Given the potential for high speeds through intersections, impact speeds over 50 km/h could be generated. This could result in 'Serious' crash severity.

Table 5.8-3: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Likely	Substandard visibility adversely affects decision-making
Severity	Serious	Impact speeds ≥ 50 km/h

[4] Austroads Guide to Road Design Part 4A Table 3.2

Figure 5.8-2 – Visibility and left-turn slip lane at the Joseph Banks Drive intersection

Recommendation:

1. *Provide speed management (raised platforms and/or roundabouts) at high-risk intersections;*
2. *Provide visibility improvements at intersections where this can be achieved;*
3. *Alternatively, reduce the posted speed limit throughout this section.*

Probability Rating: *The probability of a crash is* **Likely**	*Severity Outcome Rating:* *Crashes are likely to be* **Serious**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. There is currently an interim safety project under implementation as part of on-going safety improvements addressing safety deficiencies along the corridor. All recommendations have been noted and further long-term intersection improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.8.4 Walking and cycling paths **Significant**

No walking and cycling infrastructure are provided throughout this section of SH58. It is acknowledged that this is a constrained section of road, with, typically, cutting banks on the left-hand side of the road and an estuary on the right-hand side. Therefore, facilities for pedestrians and cyclists are challenging to be constructed. On the other hand, this is a scenic part of SH58, where pedestrians and cyclists could benefit from infrastructure that would allow for safe leisure activities. The provision of appropriate walking and cycling facilities would also provide connectivity between recreational paths/trails in Paremata and Mana Esplanade. Commuting between these destinations by means of active transportation modes would also be offered.

The following safety concerns are observed in relation to the lack of walking and cycling infrastructure:

- The road carriageway has minimal-width sealed shoulders. Sealed shoulders are non-existent in some sections. Therefore, occasional pedestrians/cyclists are required to share the live lane with vehicles, which could lead to conflicts between them;
- Poor intervisibility is provided throughout this section due to the geometrically constrained alignment, increasing the risk of conflicts;

- The presence of pedestrians/cyclists could generate rear-end and head-on crashes due to slowing down or lateral movements toward the opposing lane, respectively;

The probability of crashes involving these users is assessed as 'Very Unlikely', given that the lack of infrastructure suggests very low vulnerable road users exposure, being limited to the rare activity for very confident users. However, relatively high impact speeds that exceed the biomechanical tolerances of the human body for vulnerable road users (20 to 30 km/h) could be expected to be generated in this area due to the reduced reaction and braking time, given the poor forward visibility. This could potentially result in a 'Fatal' outcome.

Table 5.8-4: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians and cyclists)
Probability	Very Unlikely	Very low exposure of vulnerable road users, the risk is limited to the rare confident user
Severity	Fatal	Impact speeds > 50 km/h

Recommendation:

1. *Consider providing walking and cycling infrastructure throughout this section of SH58;*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted and further long-term pedestrian, cycling and multi-modal improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure

Supporting Rational: Reduced exposure to risk

5.8.5 Roadside hazards **Serious**

During the site visit, the following roadside hazards were identified:

- Throughout most of the section on the right-hand side (RHS) of the road: Unprotected drop-off into the water/estuary;
- 058-0012/0.815 LHS, 1.610 RHS and 3.500 LHS: white wooden sight rails on the roadside. If hit, wooden rails are prone to splintering and piercing vehicles and occupants;

The probability of crashes against these hazards has been assessed as 'Likely' due to the windy horizontal alignment with poor forward visibility and no/very narrow sealed shoulders. An out-of-context posted speed limit and poor delineation also adversely contribute to crash probability. Roadside hazards have the potential to increase the severity of crashes. In this case, the unprotected drop-off into the water can be expected to result in 'Fatal' outcomes.

Table 5.8-5: Risk analysis

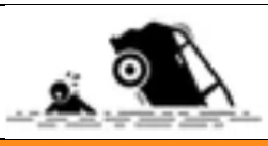
Prominent crash type		Loss of control/run-off-road into the water
Probability	Likely	Unprotected drop-off combined with out-of-context posted speed, poor delineation, windy horizontal alignment, very narrow sealed shoulders, poor forward visibility
Severity	Fatal	Drop-off into the water

Figure 5.8-3 – Unprotected drop-off into the water hazard

Figure 5.8-4 – Unprotected drop-off into the water hazard

Figure 5.8-5 – Existing white wooden sight rail

Recommendation:

1. *Identify roadside hazards and either remove, relocate, underground, or protect with roadside barriers;*
2. *Consider opportunities for additional roadside barrier protection by extending the length of existing barriers to close off roadside hazards further;*
3. *Replace white sight rails with roadside barriers;*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted further long-term median and side barrier systems as well as elimination of roadside hazards improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.9 SH58 – Section 2: Postgate Drive Roundabout to Paremata Roundabout

5.9.1 Pedestrian crossing opportunities **Serious**

The urban residential section on SH58 through Paremata is approximately 1.5 km long. Footpaths are typically provided on the north side of the road, with an isolated footpath section on the south side of the road between Oak Avenue and Bayview Road. A relatively high pedestrian activity can be expected in this section due to the residential land use. No safe crossing opportunities are provided throughout the road other than one pedestrian underpass at 058-0012/4.380, which connects the Ivey Bay Carpark and the Paremata Kindergarten. The posted speed limit is 50 km/h in this section.

The pedestrian crossings provisions throughout this section of SH58 are considered unsafe due to the following:

- The lack of crossing opportunities indicates that pedestrians and cyclists are prone to crossing the road in locations where there is no appropriate treatment;
- The forward visibility through the section is restricted due to the windy horizontal alignment, expected to result in less reaction and braking time;
- Kerb crossings are disconnected (i.e., provided on a single side of the road) and/or missing at intersections;
- No Tactile Ground Surface Indicators (TGSI) are provided on existing kerb crossings/cutdowns, putting blind and vision-impaired people at risk;
- Kerb crossings are poorly designed (or constructed) with substandard design elements (landing areas, ramp gradients, etc.). Mobility-impaired users (on wheelchairs, mobility scooters) are expected to have difficulties or be unable to safely cross the road. These users are prone to lose their balance on transitions or accidentally rolling, resulting in injuries and potential conflicts with vehicles.

Due to the above factors, the probability of conflicts involving pedestrians crossing SH58, especially the elderly and mobility-impaired users, is assessed as 'Likely'. Impact speeds of 40 to 50 km/h could be expected in this area due to the reduced reaction and braking time, given the poor forward visibility – note that operating speeds ranging from 53 to 57 km/h are recorded in Megamaps. This exceeds the biomechanical tolerances of the human body for vulnerable road users (20 to 30 km/h), potentially resulting in a 'Fatal' outcome.

Table 5.9-1: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians)
Probability	Likely	Lack of crossing opportunities, poor intervisibility due to windy alignment, no TGSIs and poor kerb crossings
Severity	Fatal	Impact speeds of 40-50 km/h

Figure 5.9-1 – Disconnected kerb crossing

Figure 5.9-2 – No pedestrian crossing treatment at Postgate Drive roundabout

Recommendation:

1. *Consider providing pedestrian crossings where pedestrians are likely to cross the road (including speed management at these points);*
2. *Consider designing and constructing accessible kerb crossings at intersections;*
3. *Consider providing TGSIs on kerb cutdowns and crossings to guide and warn vision-impaired people;*
4. *Improve visibility in the vicinity of crossings where intervisibility is adversely affected.*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted further long-term pedestrian safety improvements at intersections will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.9.2 Walking and cycling paths **Serious**

Sections of footpaths run throughout this urban section of SH58. Typically, a footpath is provided on the north side of the road between Postgate Drive and Paremata roundabout intersections. A short, isolated footpath section is provided on the south side of the road between Oak Avenue and Bayview Road. Pedestrian presence is expected to be relatively high, given the predominantly residential land use. Cycling activity is also expected mainly for commuting purposes, but the occasional recreational cycling activity could also occur. The following safety concerns are observed in relation to the existing provision:

- In some sections, the footpath is very narrow (approximately 1.2 m wide), being considered substandard for bidirectional use and the minimum width for wheelchair or mobility scooter use. This could lead to conflicts between pedestrians when these users are required to share the same section simultaneously. The narrow configuration can also result in pedestrians stepping onto the highway, putting them at risk of being struck by vehicles. As the footpath is provided predominantly on a single side of the road, the risk of conflicts is increased;
- No cycling facilities are provided throughout the section. Very narrow sealed shoulders are provided on the road carriageway. Therefore, cyclists are required to share the live lane with vehicles, which could lead to conflicts between them. Alternatively, some cyclists could feel safer riding on the narrow footpath, leading to conflicts with pedestrians;
- Overhung/overgrown vegetation reduces the available width of the already narrow path;
- Some sections of the path are unlikely to meet accessibility standards, being unable to accommodate wheelchair and mobility scooter users;
- The vertical height between the road and the footpath (or shared path) is small in some sections due to successive resurfacing. This increases the chances of errant vehicles mounting the paths and striking vulnerable road users;
- Footpaths have connectivity issues, finishing at unexpected locations where no crossing opportunities are offered, increasing the chances of conflicts with vehicles on SH58;
- Poor intervisibility is generally provided where the footpath crosses side roads.

The considered prominent crash type related to the factors presented above relates to the informal use of the carriageway by cyclists – this category can be expected to use the road due to the poor facilities available. Due to the above factors, the probability of conflicts involving pedestrians and cyclists is assessed as 'Likely'. Impact speeds of 40 to 50 km/h could be expected in this area due to the reduced reaction and braking time, given the poor forward visibility. This exceeds the biomechanical tolerances of the human body for vulnerable road users (20 to 30 km/h), potentially resulting in a 'Fatal' outcome.

Table 5.9-2: Risk analysis

Prominent crash type		Against vulnerable road users (pedestrians and cyclists)
Probability	Likely	Narrow paths, overgrown vegetation, no treatment on side roads, poor intervisibility and connectivity
Severity	Fatal	Impact speeds of 40-50 km/h

Figure 5.9-3 – Narrow path and overhung vegetation

Figure 5.9-4 – Connectivity issues with no crossing opportunity

Figure 5.9-5 – Cyclist riding on the footpath

Figure 5.9-6 – Typical configuration and child with a scooter

Recommendation:

1. *Consider widening the footpaths to allow for bidirectional use;*
2. *Consider providing adequate cycling facilities and/or shared paths;*
3. *Investigate if footpaths meet accessibility standards and upgrade them accordingly if standards are not met;*
4. *Trim/remove overhung/overgrown vegetation and maintain it regularly;*
5. *Improve connectivity by extending disconnected sections of footpaths;*
6. *Consider providing wayfinding signage for cyclists.*

Probability Rating: ***The probability of a crash is*** **Likely**	***Severity Outcome Rating:*** ***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted further long-term pedestrian, cycling and multi-modal improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. All maintenance requirements will be worked through with the Wellington Transport Alliance.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.9.3 Intersections **Moderate**

Four road intersections exist through this urban residential section of SH58. Two are stop-controlled – a T-intersection with Oak Avenue and a staggered crossroads intersection with Bayview and Seaview roads. At either end of the site, there are roundabouts with Postgate Drive and SH59/Paremata Crescent. The traffic volumes on side roads vary from low to high (approximately 300 to 11,300 vpd). The posted speed limit is 50 km/h.

The following safety issues are observed using a Safe System view:

- The visibility at Oak Avenue and Bayview and Seaview roads does not meet Safe Intersection Sight Distance (SISD) parameters for the design (posted) speed limit. The minimum SISD for a 50 km/h design speed is 97 m[5], which is not achieved;
- The traffic operating speed at the intersections is relatively high to the available sight distances, increasing the probability of intersection crashes;
- No safe turn treatment is provided at the Oak Avenue intersection, increasing the chances of rear-end type crashes;

The probability of crashes at intersections is assessed as 'Likely', given that substandard visibility reduces observation time and gap opportunities, adversely affecting decision-making. However, impact speeds under 50 km/h are likely to be generated for this section due to the posted speed limit of 50 km/h combined with the availability of some reaction and braking time. The curved horizontal alignment through these intersections also creates a more controlled speed environment likely to be near the posted speed limit. Therefore, crash severity is likely to be 'Minor'.

Table 5.9-3: Risk analysis

Prominent crash type		Side-impact at high impact angles
Probability	Likely	Substandard visibility adversely affecting decision-making
Severity	Minor	Impact speeds < 50 km/h

[5] Austroads Guide to Road Design Part 4A Table 3.2

Figure 5.9-7 – Visibility at the Oak Avenue intersection

Figure 5.9-8 – Visibility at the Seaview Road intersection

Recommendation:

1. *Consider providing speed management (raised platforms and/or roundabouts) at high-risk intersections;*
2. *Consider visibility improvements at intersections where this can be achieved;*

Probability Rating: *The probability of a crash is* **Likely**	*Severity Outcome Rating:* *Crashes are likely to be* **Minor**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted further long-term intersection improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding. All maintenance requirements will be worked through with the Wellington Transport Alliance.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs. All vegetation maintenance requirements will be worked through with the Wellington Transport Alliance*	

Assessment Against TG Condition NZTA.83
Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

5.9.4 Roadside hazards **Serious**

The following roadside hazards have been identified throughout this section of SH58:

- 058-0012/3.500 to 3.680 RHS: Unprotected drop-off into the water/estuary. A steel rail is provided for pedestrians between the footpath and drop-off. However, this rail is unlikely to hold vehicles in the case of an errant manoeuvre;
- Throughout most of the section on both sides: unprotected non-frangible power poles adjacent to the carriageway (i.e., within 2 m);
- 058-0012/4.390 to 4.450 LHS: white wooden sight rails on the roadside. If hit, wooden rails are prone to splintering and piercing vehicles and occupants;

The probability of crashes against these hazards has been assessed as 'Likely' due to the windy horizontal alignment with poor forward visibility and no/very narrow sealed shoulders. Roadside hazards have the potential to increase the severity of crashes. In this case, the riskier situation is related to the unprotected drop-off into the water, which could result in 'Fatal' outcomes.

Table 5.9-4: Risk analysis

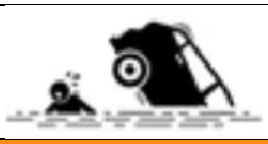
Prominent crash type		Loss of control/run-off-road into the water
Probability	Likely	Unprotected hazards combined with windy horizontal alignment, very narrow sealed shoulders and poor forward visibility
Severity	Fatal	Drop-off into the water

Figure 5.9-9 – Unprotected drop-off into the water hazard

Figure 5.9-10 – Unprotected power pole

Figure 5.9-11 – Unprotected power pole

Figure 5.9-12 – Existing white wooden sight rail

Recommendation:

1. *Identify roadside hazards and either remove, relocate, underground, or protect with roadside barriers;*
2. *Consider opportunities for additional roadside barrier protection by extending the length of existing barriers to close off roadside hazards further;*
3. *Replace white sight rails with roadside barriers;*

Probability Rating:	***Severity Outcome Rating:***
The probability of a crash is **Likely**	***Crashes are likely to be*** **Fatal**
Design Team Response: *N/A*	
Safety Engineer: *There will be a reduced risk exposure due to change in traffic patterns and reduction in traffic volumes since the opening of Transmission Gully. This may be further reduced with the implementation of the corridor speed management plan. All recommendations have been noted further long-term median and side barrier systems as well as elimination of roadside hazards improvements will be assessed and prioritised along with all other regional safety projects and implemented in accordance with allocated funding.*	
Client Decision: *We note that the auditor acknowledges the issues identified pre-date Transmission Gully. Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	
Action Taken: *Recommendations are noted and we will seek funding to implement any relevant changes, subject to prioritisation alongside other highway safety needs.*	

Assessment Against TG Condition NZTA.83

Identified Issue: An existing risk benefited from reduced vehicle exposure
Supporting Rational: Reduced exposure to risk

6 Safe System Audit Statement

We certify that we have examined the specified roads and their environment to identify features of the existing road environment we have been asked to look at that could represent a safety issue and could be changed, removed, or modified in order to improve safety. The problems identified have been noted in this report.

Signed: Saved on .pdf Date: 7 March 2023

Steve James, MET, CMEngNZ (Eng. Technician)
Principal Safety Engineer, Urban Connection Limited

Signed: Saved on .pdf Date: 7 March 2023

Matheus Boaretto, BEng (Civil), GradDipEng (Highways)
Transport Engineer, Urban Connection Limited

Designer:	*Name: N/A*	*Position: N/A*
	Signature N/A	*Date N/A*
Safety Engineer:	*Name: Errol Ritson*	*Position: Senior Safety Engineer*
	Signature 	*Date 27 March 2023*
Project Manager:	*Name: Hoana Turia*	*Position: Programme Manager*
	Signature HTuria……	*Date 27 March 2023*
Action Completed:	*Name: Errol Ritson*	*Position: Senior Safety Engineer*
	Signature 	*Date30 March 2023*

Project Manager to distribute audit report incorporating decision to the designer, Safety Audit Team Leader, Safety Engineer, and project file.

Date: 20 March 2023

Appendix A – Safe System Assessment Matrix – SH59

Table 5.9-1 – Safe System Assessment Matrix – Section 1 – SH59 – SH1 intersection to Paremata roundabout – Existing

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure comments:	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 23,300 vpd; AADT >10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 23,300 vpd; AADT >10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 23,300 vpd; AADT from MobileRoad 2021: - Mungavin Avenue: 24,853 vpd; - Titahi Bay Road: 56,233 vpd; - The Ramp: 19,356 vpd: - Whitford Brown Avenue: 17,879 vpd - Paremata Road (SH58): 6,091 vpd; Combined AADT >10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 23,300 vpd; AADT >10,000 vpd	Data is not available. However, pedestrians movements are limited to grade-separated (over and underpasses) pedestrian crossings providing access to the Paremata Station. Assumed > 100 pedestrians per day at these points.	Data is not available. Most cyclists would be expected to travel from side roads and use over/underpasses along SH59. However, some confident cyclists could ride along the highway. Assumed moderate exposure of 10-50 cyclists per day.	Assumed 1% of AADT as data is not available. Motorcyclists volumes > 100 units per day.
Exposure score:	4 / 4	4 / 4	4 / 4	4 / 4	4 / 4	2 / 4	4 / 4
Likelihood comments:	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - Roadside hazards (drop-offs, railway, non-frangible poles) near to the road (< 5 m); - Merge/diverge slowing down effect on mid-block; - Relatively high operating speeds (> 90 km/h); Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Generally flat and straight alignment; - Good delineation; - Access controlled; - Lighting;	Factors that increase the likelihood include: - None identified; Factors that decrease the likelihood include: - Moderate to wide median separation with barriers for the entire length; - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Generally flat and straight alignment; - Good delineation; - Access controlled; - Lighting;	Factors that increase the likelihood include: - High traffic volumes on side roads; - High operating speeds (>90 km/h) most of the section; - Traffic signals on high-speed area (rear-end); - Late runners at the signalised intersection; - Several conflict points at roundabout; - Dual-lane roundabout configuration; - Poor entry deflection at roundabout; Factors that decrease the likelihood include: - Grade-separated (2), signal-controlled (1) and roundabout (1) layouts; - 50% of intersections are grade separated; - Relatively low intersection frequency; - Long on-/off-ramps and merge/diverge tapers; - Speed limit is reduced before roundabout;	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - Merge/diverge slowing down effect on mid-block; - High operating speeds (>90 km/h) most of the section; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Generally flat and straight alignment; - Good delineation; - Access controlled; - Lighting;	Factors that increase the likelihood include: - Grade-separation results in longer (unnatural) walking distance; - Grade-separation results in uphill gradient; - High traffic volumes; - High operating speeds (>90 km/h) most of the section; Factors that decrease the likelihood include: - Grade-separation; - Crossings connect straight to parking areas or side-roads; - Limited pedestrian access to highway;	Factors that increase the likelihood include: - No dedicated cycling facility; - High traffic volumes; - High operating speeds (> 90 km/h); - No treatment at roundabouts/intersections; Factors that decrease the likelihood include: - Crossings are grade-separated; - Bike park on train stations; - Moderate to wide sealed shoulders; - Straight and flat alignment; - Access controlled (no vehicle crossings); - Relatively low intersection frequency; - Lighting;	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - Roadside hazards (drop-offs, railway, non-frangible poles) near to the road (< 5 m); - Merge/diverge slowing down effect on mid-block; - High operating speeds (> 90 km/h); Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Generally flat and straight alignment; - Good delineation; - Access controlled; - Lighting; - Median separation;
Likelihood score:	2.5 / 4	0 / 4	2.5 / 4	2.5 / 4	1 / 4	2 / 4	2.5 / 4
Severity comments:	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 30-40 km/h), likely > 90 km/h; - Unprotected sections; Factors that decrease the severity include: - Protection (roadside barriers) for most of the length;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 70 km/h), likely > 90 km/h; Factors that decrease the severity include: - Protection (median barriers) for the entire length;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 50 km/h), likely > 90 km/h; - High-impact angles at one intersection (1 signalised); Factors that decrease the severity include: - Impact speeds are reduced at the roundabout, likely < 50 km/h; - Most conflicts at intersections (3) are expected to have low impact angles;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundary (≥ 70 km/h), likely > 90 km/h; - Relatively high volumes of heavy vehicles (11.5%); Factors that decrease the severity include: - Low impact angles (rear-end, side swipe);	Factors that increase the severity include: - Impact speeds exceed Safe System boundaries (≥ 20-30 km/h), likely > 90 km/h; - Relatively high volumes of heavy vehicles (11.5%); Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h), likely > 90 km/h; - Relatively high volumes of heavy vehicles (11.5%); Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h), likely > 90 km/h; - Relatively high volumes of heavy vehicles (11.5%); - No MPRs (motorcyclist protection rails); Factors that decrease the severity include: - Protection (roadside barriers) for most of the length;
Severity score:	3 / 4	0 / 4	3 / 4	3 / 4	4 / 4	4 / 4	4 / 4
Product:	30 / 64	0 / 64	30 / 64	30 / 64	16 / 64	16 / 64	40 / 64
						TOTAL	162 / 448

Table 5.9-2 – Safe System Assessment Matrix – Section 2 – SH59 – Mana Esplanade from Paremata roundabout to Plimmerton roundabout – Existing

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure comments:	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59 (Mana Esplanade): 16,495 vpd; AADT >10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59 (Mana Esplanade): 16,495 vpd; AADT >10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59 (Mana Esplanade): 16,495 vpd; AADT from MobileRoad 2021: - Ulric Street: 212 vpd; - James Street: 125 vpd; - Grays Road: 6,942 vpd; - Steyne Avenue: 4,990 vpd; - Pope Street: 1,545 vpd; - Acheron Road: 1,506 vpd; - Dolly Varden Crescent: 2,220 vpd; - Mana View Road: 1,358 vpd; - Pascoe Avenue: 1,749 vpd; - Marina View: 163 vpd; Combined AADT >10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59 (Mana Esplanade): 16,495 vpd; AADT >10,000 vpd	Data is not available. However, this is an urban/semi-urban area where pedestrian presence is expected. Assumed > 100 pedestrians per day.	Data is not available. Most cyclists would be expected to travel through off-road paths west of SH59. However, some cyclists could ride along and/or cross the highway (east-west and vice-versa) from residential areas. Assumed moderate exposure of 50-100 cyclists per day.	Assumed 1% of AADT as data is not available. Motorcyclists volumes > 100 units per day.
Exposure score:	4 / 4	4 / 4	4 / 4	4 / 4	4 / 4	3 / 4	4 / 4
Likelihood comments:	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - No sealed shoulders; - High accessways frequency (incl. high-volume accessways); - Parking on live lane/clearway treatment (door openings, lateral displacements); - Roadside hazards (non-frangible poles, trees) near to the road (< 5 m); - In lane cyclists;	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - No sealed shoulders; - High accessways frequency (incl. high-volume accessways); - Parking on live lane/clearway treatment (door openings, lateral displacements);	Factors that increase the likelihood include: - Moderate to high traffic volumes on side roads; - Traffic signals slowing down effect (rear-end); - Several conflict points at roundabout; - Dual-lane roundabout configuration; - Two priority give-way controlled; - High intersection frequency; - Visibility is generally restricted by adjacent buildings;	Factors that increase the likelihood include: - Multiple lanes (lateral movements/lane changing); - No sealed shoulders; - High accessways frequency (incl. high-volume accessways); - Parking on live lane/clearway treatment (door openings, lateral displacements); - In lane cyclists; - Slowing down effect on mid-block due to frequent traffic signals;	Factors that increase the likelihood include: - High traffic volumes; - No safe mid-block pedestrian crossings; - High accessways frequency (incl. high-volume accessways); - Long crossing distance; - Long distance between safe crossing at signals; - Footpaths adjacent to the live lane; - No TGSIs; - Lack of cycle facilities represents potential conflicts between these users (shared use); - Footpath connectivity issues; - Poles/overhung vegetation reduce available width; - Restricted visibility at driveways;	Factors that increase the likelihood include: - No dedicated cycling facility; - No sealed shoulders; - No cycle treatment at intersections and high-volume accessways; - High traffic volumes; - High accessway frequency; - High intersection frequency; - Parked vehicles; - No mid-block cycle refuge; - Lack of cycle facilities represents potential conflicts between these users (shared use);	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - No sealed shoulders; - High accessways frequency (incl. high-volume accessways); - Parking on live lane/clearway treatment (door openings, lateral displacements); - Roadside hazards (non-frangible poles, trees) near to the road (< 5 m); - In lane cyclists; - Slowing down effect on mid-block due to frequent traffic signals;
	Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Predominantly flat and straight alignment; - Good delineation; - Lighting; - Mid-block speed is controlled by frequent intersections;	Factors that decrease the likelihood include: - Wide flush median or raised median island separation; - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Predominantly flat and straight alignment; - Good delineation; - Lighting; - Mid-block speed is controlled by frequent intersections;	Factors that decrease the likelihood include: - 6 out of 9 intersections are signal controlled; - One roundabout layout; - Mid-block speed is controlled by frequent intersections; - One priority control is left-in left-out layout; - Risk is limited to late runners at the signalised intersections;	Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Predominantly flat and straight alignment; - Good delineation; - Lighting; - Mid-block speed is controlled by frequent intersections;	Factors that decrease the likelihood include: - Relatively wide footpaths; - Footpaths in good condition; - Lighting; - Signalised crossing at intersections (pedestrian phase);	Factors that decrease the likelihood include: - Straight and flat alignment; - Lighting;	Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Predominantly flat and straight alignment; - Good delineation; - Lighting; - Mid-block speed is controlled by frequent intersections;
Likelihood score:	2 / 4	2 / 4	2.5 / 4	3 / 4	3 / 4	4 / 4	2.5 / 4
Severity comments:	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 30-40 km/h), likely 40-50 km/h; - No protection against hazards;	Factors that increase the severity include: - No physical barrier (median barrier);	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 50 km/h) at intersections, likely ≥ 50 km/h; - High impact angles at most intersections (signalised or priority);	Factors that increase the severity include: - None identified;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h) at intersections, likely ≥ 50 km/h;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h) at intersections, likely ≥ 50 km/h;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h) at intersections, likely ≥ 50 km/h;
	Factors that decrease the severity include: - None identified;	Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 40-50 km/h;	Factors that decrease the severity include: - Impact speeds are reduced at the roundabout, likely < 50 km/h; - Low impact angles at one intersection (roundabout);	Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 40-50 km/h; - Low impact angles (rear-end, side swipe);	Factors that decrease the severity include: - None identified;	Factors that decrease the severity include: - None identified;	Factors that decrease the severity include: - None identified;
Severity score:	2.5 / 4	2 / 4	2.5 / 4	2 / 4	3.5 / 4	3.5 / 4	3 / 4
Product:	20 / 64	16 / 64	25 / 64	24 / 64	42 / 64	42 / 64	30 / 64
						TOTAL	199 / 448

Table 5.9-3 – Safe System Assessment Matrix – Section 3 – SH59 – Plimmerton roundabout to Pukerua Bay – Existing

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure comments:	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT from MobileRoad 2021: - Arlie Road: 512 vpd; Combined AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT between 5,000 and 10,000 vpd	Data is not available. However, pedestrians are not expected to walk through this section as they are provided at shared off-road path on the west side of SH59. However, some pedestrians could cross in the vicinity of the single intersection throughout this section. Assumed low exposure of < 10 pedestrians per day.	Data is not available. Most cyclists would be expected to travel shared on the off-road path on the west side of SH59. However, some confident cyclists could ride along the highway. Assumed moderate exposure of 10-50 cyclists per day.	Assumed 1% of AADT as data is not available. Motorcyclists volumes between 50 and 100 units per day.
Exposure score:	3 / 4	3 / 4	3 / 4	3 / 4	1 / 4	2 / 4	3 / 4
Likelihood comments:	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - Roadside hazards (drop-offs, banks, trees) near to the road (< 5 m); - Relatively steep alignment; - Relatively high operating speeds (> 90 km/h); Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Straight/curved alignment; - Good delineation; - Low accessway frequency; - Some lighting;	Factors that increase the likelihood include: - Relatively steep alignment; - Relatively high operating speeds (> 90 km/h); - No median barriers for part of the length (1/5); Factors that decrease the likelihood include: - Moderate to wide median separation for the entire length; - Median barriers for most of the length (4/5); Flush-median separation through unprotected section; - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Straight/curved alignment; - Good delineation; - Low accessway frequency; - Some lighting;	Factors that increase the likelihood include: - High operating speeds (>90 km/h); - Priority control; - Several conflict points; - Visibility limited by adjacent curves and vegetation; Factors that decrease the likelihood include: - Low traffic volumes on side road; - Low intersection frequency (one intersection); - Right-turn bays; - Acceleration lanes; - Lighting;	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - Relatively steep alignment; - Relatively high operating speeds (> 90 km/h); Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Straight/curved alignment; - Good delineation; - Low accessway frequency; - Some lighting;	Factors that increase the likelihood include: - No pedestrian crossing facilities; - Moderate to high traffic volumes; - High operating speeds (> 90 km/h); - Long crossing distance; Factors that decrease the likelihood include: - Moderate to wide sealed shoulders; - Low intersection frequency; - Low accessway frequency; - Some lighting; - Dedicated shared user path;	Factors that increase the likelihood include: - No dedicated cycling facility; - Moderate to high traffic volumes; - High operating speeds (> 90 km/h); - No treatment at intersection; - No cycle crossing facilities; - Relatively steep alignment; Factors that decrease the likelihood include: - Dedicated shared user path; - Moderate to wide sealed shoulders; - Straight/curved alignment; - Low intersection frequency; - Low accessway frequency; - Some lighting;	Factors that increase the likelihood include: - Multiple lanes (lateral movements); - Roadside hazards (drop-offs, banks, trees) near to the road (< 5 m); - Relatively steep alignment; - Relatively high operating speeds (> 90 km/h); Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate to wide sealed shoulders; - Straight/curved alignment; - Good delineation; - Low accessway frequency; - Some lighting;
Likelihood score:	3 / 4	1 / 4	2 / 4	2.5 / 4	1.5 / 4	2.5 / 4	3 / 4
Severity comments:	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 30-40 km/h), likely > 90 km/h; - Some sections with unprotected hazards; Factors that decrease the severity include: - Protection (roadside barriers) on some curves and culverts;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 70 km/h), likely > 90 km/h; Factors that decrease the severity include: - Protection (median barriers) for most of the length;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 50 km/h), likely > 90 km/h; - High-impact angles; Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundary (≥ 70 km/h), likely > 90 km/h; - Relatively high volumes of heavy vehicles (11.5%); Factors that decrease the severity include: - Low impact angles (rear-end, side swipe);	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h), likely > 90 km/h; Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h), likely > 90 km/h; Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h), likely > 90 km/h; - Sections with unprotected hazards; - No MPRs (motorcyclist protection rails); Factors that decrease the severity include: - Protection (roadside barriers) on some curves and culverts;
Severity score:	3 / 4	4 / 4	4 / 4	3 / 4	4 / 4	4 / 4	4 / 4
Product:	**27 / 64**	**12 / 64**	**24 / 64**	**22.5 / 64**	**6 / 64**	**20 / 64**	**36 / 64**
						TOTAL	**147.5 / 448**

Table 5.9-4 – Safe System Assessment Matrix – Section 4 – SH59 – Pukerua Bay – Existing

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure comments:	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT from MobileRoad 2021: - Onepu Road: 112 vpd; - Toenga Road: 134 vpd; - Pa Road: 617 vpd; - Weku Road: 124 vpd; - Pukerua Beach Road: 1,024 vpd; - Te Ara Road: 196 vpd; - Waikara Road: 498 vpd; - Takutai Road: 152 vpd; - Te Kura Road: 402 vpd; - Teihana Road: 1,142 vpd; - Gray Street: 1,307 vpd; Combined AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to November 2022): - SH59: 7,256 vpd; AADT between 5,000 and 10,000 vpd	Data is not available. However, this is an urban/semi-urban area where pedestrian presence is expected. Assumed > 100 pedestrians per day.	Data is not available. Most cyclists would be expected to travel through shared paths adjacent to SH59 (west side). Some cyclists could ride along and/or cross the highway (east-west and vice-versa) from residential areas. Assumed moderate exposure of 50-100 cyclists per day.	Assumed 1% of AADT as data is not available. Motorcyclists volumes between 50 and 100 units per day.
Exposure score:	3 / 4	3 / 4	3 / 4	3 / 4	4 / 4	3 / 4	3 / 4
Likelihood comments:	Factors that increase the likelihood include: - No/narrow sealed shoulders; - High intersection frequency; - Roadside hazards (non-frangible poles, trees, drop-offs) near to the road (< 5 m); - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - Lighting is obscured by trees/vegetation; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate vertical gradient; - Good delineation; - Lighting; - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - Predominantly no separation; - No/narrow sealed shoulders; - High intersection frequency; - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - Lighting is obscured by trees/vegetation; Factors that decrease the likelihood include: - Flush median separation for part (1/3) of the length; - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate vertical gradient; - Good delineation; - Lighting; - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - Several conflict points; - Two priority give-way controlled; - High intersection frequency; - Poor intersection visibility; - Priority-control or uncontrolled layout; - No turn treatment at some intersections; Factors that decrease the likelihood include: - Low to moderate traffic volumes on side roads; - Operating/posted speed is relatively low (50 km/h); - Right-turn bays at most higher volume intersections; - Flush median provides for turning movements at some intersections;	Factors that increase the likelihood include: - No/narrow sealed shoulders; - High intersection frequency; - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - Lighting is obscured by trees/vegetation; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate vertical gradient; - Good delineation; - Lighting; - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - No safe mid-block pedestrian crossings; - Poor intervisibility between pedestrians and vehicles; - Narrow footpaths/shared-paths; - Footpaths adjacent to the live lane; - Minimal height difference between road and footpaths; - Poorly constructed kerb cutdowns; - No TGSIs; - Lack of cycle facilities represents potential conflicts between these users (shared use); - Footpath connectivity issues; - Overhung/overgrown vegetation reduce available paths width; - Lighting is obscured by trees/vegetation; - Drainage issues/water migrating onto paths; - No shared path treatment at intersections/side roads; - Moderate/high traffic volumes; Factors that decrease the likelihood include: - Some pedestrian/cyclist refuges; - One grade-separated crossing (overpass); - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - No dedicated cycling facility; - No/narrow sealed shoulders; - Narrow shared paths; - Poor intervisibility between cyclists and vehicles; - No cycle treatment at intersections; - High intersection frequency; - Refuges are narrow for cyclists; - Overhung/overgrown vegetation reduce available paths width; - Lighting is obscured by trees/vegetation; - Drainage issues/water migrating onto paths; - No shared path treatment at intersections/side roads; - Moderate/high traffic volumes; Factors that decrease the likelihood include: - Some pedestrian/cyclist refuges; - Moderate vertical gradient; - One grade-separated crossing (overpass); - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - No/narrow sealed shoulders; - High intersection frequency; - Roadside hazards (non-frangible poles, trees, drop-offs) near to the road (< 5 m); - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - Lighting is obscured by trees/vegetation; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Moderate vertical gradient; - Good delineation; - Operating/posted speed is relatively low (50 km/h);
Likelihood score:	3 / 4	3 / 4	3 / 4	3 / 4	3 / 4	4 / 4	3.5 / 4
Severity comments:	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 30-40 km/h), likely 50 km/h; - Most of the hazards are unprotected; Factors that decrease the severity include: - Some roadside barriers;	Factors that increase the severity include: - No physical barrier (median barrier); Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 50 km/h;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 50 km/h), likely 50 km/h; - High impact angles; Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - None identified; Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 50 km/h; - Low impact angles (rear-end, side swipe);	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h), likely 50 km/h; Factors that decrease the severity include: - Some sections with barrier between path and road;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h), likely 50 km/h; Factors that decrease the severity include: - Some sections with barrier between path and road;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h), likely 50 km/h; - Most of the hazards are unprotected; - No MPRs (motorcyclist protection rails); Factors that decrease the severity include: - Some roadside barriers;
Severity score:	3 / 4	2 / 4	2.5 / 4	2 / 4	3.5 / 4	3.5 / 4	3 / 4
Product:	**27 / 64**	**18 / 64**	**22.5 / 64**	**18 / 64**	**42 / 64**	**42 / 64**	**31.5 / 64**
						TOTAL	**201 / 448**

Table 5.9-5 – Safe System Assessment Matrix – Section 5 – SH59 – North of Pukerua Bay to the Kapiti Coast District Boundary – Existing

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure comments:	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH59: 6,081 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH59: 6,081 vpd; AADT between 5,000 and 10,000 vpd	No intersections - N.A.	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH59: 6,081 vpd; AADT between 5,000 and 10,000 vpd	Data is not available. This is an coastal area adjacent to townships that some pedestrian presence can be expected, predominantly for leisure purposes. Some pedestrians could also use this flatter section instead of the steeper Te Araroa Trail east of SH59. Assumed between 10 - 50 pedestrians per day.	Data is not available. Cyclists could be expected to travel through this coastal area between townships, predominantly for leisure/training purposes. Some cyclists could also use this flatter section instead of the steeper Te Araroa Trail east of SH59. Assumed high exposure of 50-100 cyclists per day.	Assumed 1% of AADT as data is not available. Motorcyclists volumes between 50 and 100 units per day.
Exposure score:	3 / 4	3 / 4	0 / 0	3 / 4	2 / 4	2 / 4	3 / 4
Likelihood comments:	Factors that increase the likelihood include: - Narrow sealed shoulders; - Roadside hazards (drop-offs, non-frangible vertical faces, banks) near to the road (< 5 m); - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - No lighting; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Flat vertical gradient; - Mostly good delineation;	Factors that increase the likelihood include: - Some length (1/4) has no median separation and barriers; - Narrow sealed shoulders; - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - Median barrier deflection if hit may exceed the median separation width; - No lighting; Factors that decrease the likelihood include: - Narrow/moderate width median separation with barriers for the most (3/4) of the length; - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Flat vertical gradient; - Mostly good delineation;	No intersections - N.A.	Factors that increase the likelihood include: - Narrow sealed shoulders; - Several accessways /lookouts; - Slowing down effect due to movements to/from lookouts; - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - No lighting; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Flat vertical gradient; - Mostly good delineation;	Factors that increase the likelihood include: - Very narrow shared-path; - Windy alignment; - Shared path width is insufficient for bidirectional shared use; - Lack of cycle facilities represents potential conflicts between these users (shared use); - Path adjacent to the live lane; - No protection between road and shared path; - Minimal height difference between road and shared path; - Poor intervisibility between pedestrians and vehicles; - Several accessways /lookouts; - Poorly constructed kerb cutdowns; - No TGSIs; - No lighting; - No shared path treatment at some accessways; - Moderate/high traffic volumes; Factors that decrease the likelihood include: - None identified;	Factors that increase the likelihood include: - No dedicated cycling facility; - Narrow sealed shoulders; - Very narrow shared-path; - Windy alignment; - Shared path width is insufficient for bidirectional shared use; - Lack of cycle facilities represents potential conflicts between these users (shared use); - Path adjacent to the live lane; - No protection between road and shared path; - Minimal height difference between road and shared path; - Poor intervisibility between cyclists and vehicles; - Several accessways /lookouts; - No lighting; - No shared path treatment at some accessways; - Moderate/high traffic volumes; Factors that decrease the likelihood include: - None identified;	Factors that increase the likelihood include: - Narrow sealed shoulders; - Roadside hazards (drop-offs, non-frangible vertical faces, banks) near to the road (< 5 m); - Several accessways /lookouts; - Slowing down effect due to movements to/from lookouts; - In lane cyclists; - Windy horizontal alignment; - Poor forward visibility; - No lighting; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Traffic lanes ≥ 3.5 m; - Flat vertical gradient; - Mostly good delineation;
Likelihood score:	3.5 / 4	2.5 / 4	0 / 0	2.5 / 4	3 / 4	4 / 4	3.5 / 4
Severity comments:	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 30-40 km/h), likely 70-80 km/h; - Some/few unprotected sections; Factors that decrease the severity include: - Most of the section has protection (roadside/median barriers) agains the hazards;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 70 km/h), likely 70-80 km/h; - Some length (1/4) has no median barriers; Factors that decrease the severity include: - Protection (median barriers) for most of the length;	No intersections - N.A.	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 70 km/h), likely 70-80 km/h; Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 40-50 km/h; - Low impact angles (rear-end, side swipe);	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h), likely 70-80 km/h; Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h), likely 70-80 km/h; Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds can exceed Safe System boundaries (≥ 20-30 km/h), likely 70-80 km/h; - Some/few unprotected sections; - No MPRs (motorcyclist protection rails); Factors that decrease the severity include: - Most of the section has protection (roadside/median barriers) agains the hazards;
Severity score:	2.5 / 4	3.5 / 4	0 / 0	2.5 / 4	4 / 4	4 / 4	4 / 4
Product:	**26.25 / 64**	**26.25 / 64**	**0 / 0**	**18.75 / 64**	**24 / 64**	**32 / 64**	**42 / 64**
						TOTAL	169.25 / 384

Appendix B – Safe System Assessment Matrix – SH58

Table 5.9-6 – Safe System Assessment Matrix – SH58 – Section 1 – Pauatahanui roundabout to Postgate Drive roundabout – Existing

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure comments:	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; AADT from MobileRoad 2021: - Joseph Banks Drive: 3,152 vpd; - James Cook Drive: 5,885 vpd; - Spinnaker Drive: 2,059 vpd; Combined AADT > 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; AADT between 5,000 and 10,000 vpd	Data is not available. However, pedestrians are generally not expected to walk along this section of SH58 due to no facilities and no shoulders. Assumed low exposure of less than 10 pedestrians per day	Data is not available. Some cyclists could be expected to travel through this coastal/estuary area on SH58, predominantly for leisure/training purposes. Assumed low exposure of less than 10 cyclists per day.	Assumed 1% of AADT as data is not available. Motorcyclists volumes between 50 and 100 units per day.
Exposure score:	3 / 4	3 / 4	4 / 4	3 / 4	1 / 4	1 / 4	3 / 4
Likelihood comments:	Factors that increase the likelihood include: - Roadside hazards (estuary, bank, drop-off into the water) in close proximity to the road (< 2 m); - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - No lighting; - In lane cyclists; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Flat vertical gradient;	Factors that increase the likelihood include: - No median separation; - No median barriers; - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - No lighting; - In lane cyclists; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Flat vertical gradient;	Factors that increase the likelihood include: - Priority controlled; - Inadequate sight distances; - Deficient delineation; - Poor drainage; - Left-turn slip lane onto Joseph Banks Drive; - Moderate/high traffic volumes to/from side roads; Factors that decrease the likelihood include: - All intersections have right-turn bays; - Lighting;	Factors that increase the likelihood include: - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - No lighting; - Accessways with poor visibility; - Stopping bays/localised widening; - In lane cyclists; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Flat vertical gradient;	Factors that increase the likelihood include: - No pedestrian facilities (footpaths, shared paths); - No pedestrian crossings; - Narrow/no sealed shoulders; - Windy alignment with tight curves; - Poor forward visibility and intervisibility between pedestrians and vehicles; - No lighting; - Moderate to high traffic volumes; Factors that decrease the likelihood include: - None identified;	Factors that increase the likelihood include: - No cycling facilities; - Narrow/no sealed shoulders; - Windy alignment with tight curves; - Poor forward visibility and intervisibility between cyclists and vehicles; - No lighting; - Moderate to high traffic volumes; Factors that decrease the likelihood include: - Flat vertical gradient;	Factors that increase the likelihood include: - Roadside hazards (estuary, bank, drop-off into the water) in close proximity to the road (< 1 m); - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - No lighting; - Accessways with poor visibility; - Stopping bays/localised widening; - In lane cyclists; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Flat vertical gradient;
Likelihood score:	4 / 4	4 / 4	3 / 4	3 / 4	4 / 4	4 / 4	4 / 4
Severity comments:	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 30-40 km/h), likely 50 km/h; - No protection (roadside barrier) for most of the length; - Water hazard; - White sight rails (piercing occupants); Factors that decrease the severity include: - Some roadside barrier;	Factors that increase the severity include: - No median barrier between opposing traffic; Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 60 km/h;	Factors that increase the severity include: - Impact speeds exceed Safe System boundary (≥ 50 km/h), likely 60 km/h; - High impact angles; Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds exceed Safe System boundary (≥ 70 km/h), likely 60 km/h; Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 60 km/h; - Low impact angles (rear-end, side swipe);	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h, likely 60 km/h); Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h, likely 60 km/h); Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h, likely > 60 km/h); - No MPRs (motorcyclist protection rails); Factors that decrease the severity include: - Some roadside barrier;
Severity score:	4 / 4	3 / 4	3 / 4	2.5 / 4	4 / 4	4 / 4	4 / 4
Product:	**48 / 64**	**36 / 64**	**36 / 64**	**22.5 / 64**	**16 / 64**	**16 / 64**	**48 / 64**
						TOTAL	**222.5 / 448**

Table 5.9-7 – Safe System Assessment Matrix – SH58 – Section 2 – Postgate Drive roundabout to Paremata roundabout – Existing

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure comments:	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; AADT between 5,000 and 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; - SH59 (Paremata Roundabout): 11,242 vpd; AADT from MobileRoad 2021: - Postgate Drive: 9,608 vpd; - Oak Avenue: 1,753 vpd; - Bayview Road: 334 vpd; - Seaview Road: 675 vpd; - Paremata Crescent: 3,009 vpd; Combined AADT > 10,000 vpd	AADT from Network Data post-TG opening (Average volumes from April to August 2022): - SH58: 6,091 vpd; AADT between 5,000 and 10,000 vpd	Data is not available. However, this is an urban/semi-urban section that passes through a residential area. Pedestrian presence can be expected. Assumed high exposure of more than 100 pedestrians per day.	Data is not available. However, some cyclists could be expected to travel through this section (residential/urban) for leisure and commuting purposes. Assumed moderate exposure of 10 to 50 cyclists per day.	Assumed 1% of AADT as data is not available. Motorcyclists volumes between 50 and 100 units per day.
Exposure score:	3 / 4	3 / 4	4 / 4	3 / 4	4 / 4	2 / 4	3 / 4
Likelihood comments:	Factors that increase the likelihood include: - Roadside hazards (non-frangible poles/fences, bank, drop-off, estuary) in close proximity to the road (< 5 m); - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - Scarce lighting; - In lane cyclists; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - No median separation; - No median barriers; - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - Scarce lighting; - In lane cyclists; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - Priority controlled; - Inadequate sight distances; - Deficient delineation; - Poor drainage; - Moderate/high traffic volumes to/from side roads; - Several conflict points; - No turning facilities (Bayview/Seaview Roads); - Compact roundabout layouts (less observation time); - High volume on side roads; Factors that decrease the likelihood include: - Two roundabouts; - Right-turn bay on Oak Avenue; - Lighting;	Factors that increase the likelihood include: - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - Scarce lighting; - High accessway frequency; - Accessways with poor visibility; - Vehicles reversing out of driveways; - In lane cyclists; - Parking area adjacent to road; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - No safe mid-block pedestrian crossings; - Poor intervisibility between pedestrians and vehicles; - Narrow footpaths; - Footpaths adjacent to the live lane; - Minimal height difference between road and footpaths; - Poorly constructed kerb cutdowns; - No TGSIs; - Lack of cycle facilities represents potential conflicts between these users (shared use); - Footpath connectivity issues; - Overhung/overgrown vegetation reduce available paths width; - Scarce lighting; - High accessway frequency; - Moderate/high traffic volumes; Factors that decrease the likelihood include: - Operating/posted speed is relatively low (50 km/h); - One underpass;	Factors that increase the likelihood include: - No dedicated cycling facility; - No/narrow sealed shoulders; - Narrow footpaths; - Poor intervisibility between cyclists and vehicles; - No cycle treatment at intersections; - High intersection frequency; - Overhung/overgrown vegetation reduce available paths width; - Scarce lighting; - Poor drainage; - Moderate/high traffic volumes; Factors that decrease the likelihood include: - Moderate vertical gradient; - Operating/posted speed is relatively low (50 km/h);	Factors that increase the likelihood include: - Roadside hazards (estuary, bank, drop-off into the water) in close proximity to the road (< 1 m); - Windy alignment with tight curves; - No/narrow sealed shoulders; - Narrow traffic lanes (<3.5 m) - Deficient delineation; - Poor drainage; - Poor forward visibility; - No lighting; - Accessways with poor visibility; - In lane cyclists; - High accessway frequency; - Vehicles reversing out of driveways; Factors that decrease the likelihood include: - Pavement appears to be mostly in good condition; - Operating/posted speed is relatively low (50 km/h);
Likelihood score:	4 / 4	4 / 4	4 / 4	3 / 4	3 / 4	4 / 4	4 / 4
Severity comments:	Factors that increase the severity include: - Impact speeds exceed Safe System boundaries (≥ 70 km/h), likely 50 km/h; - White sight rails (piercing occupants); Factors that decrease the severity include: - Some roadside barrier;	Factors that increase the severity include: - No median barrier between opposing traffic; Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 50 km/h;	Factors that increase the severity include: - Impact speeds exceed Safe System boundary (≥ 50 km/h), likely 50 km/h; - High impact angles at T or cross intersections; Factors that decrease the severity include: - Low impact angles at roundabouts;	Factors that increase the severity include: - None identified; Factors that decrease the severity include: - Impact speeds likely do not exceed Safe System boundaries (≥ 70 km/h), likely 50 km/h; - Low impact angles (rear-end, side swipe);	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h, likely 50 km/h); Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h, likely 50 km/h); Factors that decrease the severity include: - None identified;	Factors that increase the severity include: - Impact speeds likely exceed Safe System boundaries (≥ 20-30 km/h, likely 50 km/h); - No MPRs (motorcyclist protection rails); Factors that decrease the severity include: - Some roadside barrier;
Severity score:	3 / 4	2.5 / 4	2.5 / 4	2 / 4	3.5 / 4	3.5 / 4	3 / 4
Product:	**36 / 64**	**30 / 64**	**40 / 64**	**18 / 64**	**42 / 64**	**28 / 64**	**36 / 64**
						TOTAL	**230 / 448**

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