SH1B Telephone Road/Holland Road Intersection and Rail Crossing

Investigation Report

WSP New Zealand

3 March 2023

FINAL

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WAKA KOTAHI
NZ TRANSPORT AGENCY

Te Kāwanatanga o Aotearoa
New Zealand Government

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More information

Waka Kotahi NZ Transport Agency & WSP New Zealand

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If you have further queries, call our contact centre on 0800 699 000 or write to us:

Waka Kotahi NZ Transport Agency
Private Bag 6995
Wellington 6141

This document is available on Waka Kotahi NZ Transport Agency's website at www.nzta.govt.nz

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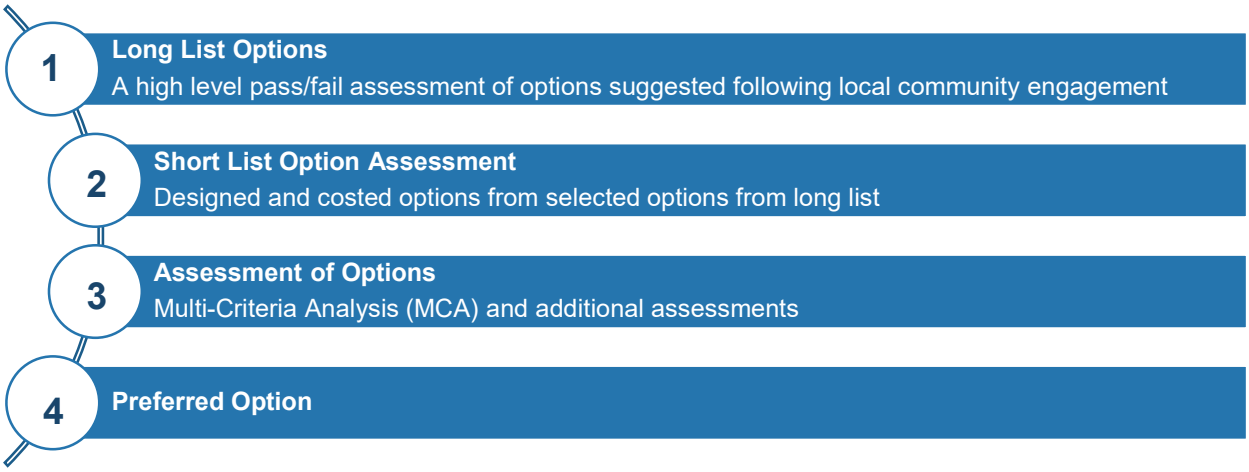
1.0	Final technical memo issued to Waka Kotahi.
2.0	Draft technical report issued to Waka Kotahi.
3.0	Final technical report issued to Waka Kotahi.
4.0	Final technical report issued to Waka Kotahi.

Contents

Executive Summary

In April 2022, a truck crossing the railway line at Telephone Road dislodged a section of rail track, which was the third time this type of incident has occurred since 2016. Due to the rail safety risk this presented, KiwiRail and Waka Kotahi NZ Transport Agency (Waka Kotahi) made the decision to immediately close the rail crossing to road traffic. Consequently, since April 2022, Telephone Road has been temporarily closed to SH1B road traffic and diverted via Holland Road, Waverley Road, and Seddon Road.

Following the decision to temporarily close the rail crossing at Telephone Road, WSP was commissioned by Waka Kotahi to undertake an updated assessment of the State Highway 1B Telephone Road/Holland Road intersection and rail crossing. This report aimed to deliver a recommended option for implementation, by reviewing the latest available data to understand existing traffic operation and safety issues, and developing and assessing options through an assessment process, as shown below.



Prior to considering options, the existing network, post the opening of the Hamilton Section of the Waikato Expressway, was considered.

- **Rail Safety:** For road traffic to resume operation over the rail crossing, KiwiRail requires existing rail safety problems to be resolved, namely the short stacking distance (Telephone Road southbound between the railway and intersection, causing vehicles to queue over the rail lines), and vehicles grounding out over the crossing (which severely damage the rail lines).
- **Traffic Volumes:** With the Waikato Expressway now open, whether Telephone Road remains closed or reopens, there is a significant reduction in traffic volumes in the wider local network (including heavy vehicle volumes), compared to traffic volumes prior to the Expressway opening.
- **Intersection Performance:** If Telephone Road was re-opened, there would be a minimal travel delay to road traffic in any direction through the intersection. Traffic growth would need to increase significantly for queues to regularly extend back to the rail line. From a traffic operation perspective, it is highly likely that the existing intersection layout will be sufficient for the long-term.
- **Road Safety:** If the intersection is re-opened to road traffic, the updated estimated risk based on the HRIG suggests that it is a high-risk intersection. However, further crash risk assessment is recommended due to the impact of emerging traffic patterns following the Expressway opening still being understood and the wider safety impacts of traffic following the diversion route. The impact of crash risks being shifted to other sites should also be considered.
- **Diversion Analysis:** Based on the high-level method used, this analysis suggested that only a small number of the local community is expected to be negatively impacted by the closure of Telephone Road. Therefore, if Telephone Road is closed, the diversion impact is largely isolated to a local scale, affecting people travelling north-south and vice versa.

Underlying the assessment is the fact that Waka Kotahi (the road controlling authority) must comply with KiwiRail (the underlying designation owner of the land over the rail crossing) requirements. Hence for Telephone Road to be re-opened, the level crossing must be adjusted to meet KiwiRail rail safety requirements. This means dealing with two issues;

- The vertical alignment of Telephone Road at the rail crossing, and
- The short distance between the rail lines and the intersection (to avoid vehicles queuing across te rail lines).

When considering these requirements, impacts should be carefully managed i.e. public and stakeholder buy-in, network productivity, community severance, and any consequential works. While the impact to the local community is a key risk, adequate diversion routes are available via the Expressway and the current diversion route. Adverse severance impacts can also be partially managed through a level pedestrian/cyclist (non-vehicle) rail crossing in agreement with KiwiRail requirements. There is also an opportunity to provide a safe permanent school bus stop at Holland Road.

An initial long list of options was created, based on suggestions from the local community and the options considered in the Revocation SSBC. These options were screened through a high-level pass/fail assessment. Options would only pass this screening if they met KiwiRail's two requirements, as above. A total of four options passed both criteria and were shortlisted for further assessment.

The opportunity to maintain the existing intersection arrangement and implement a management system was also briefly explored. However, there is no full-proof system to limit the size of vehicles, and the short stacking distance at the intersection would not be resolved. This option was not considered further.

The four options that passed the initial assessment and were considered in more detail were:

- Option 1: Permanent closure of Telephone Road
- Option 2: Vertical realignment of SH1B
- Option 3: Vertical realignment of SH1B and re-prioritised intersection
- Option 4: Roundabout

This project also identified opportunities to address safety on the Telephone Road diversion route. This includes $1.07M of safety improvements. However, it is difficult to solely attribute these costs to changes at the Telephone Road intersection when there are several other contributing factors such as changed traffic patterns from the Waikato Expressway. Therefore, these costs were associated with all options.

A Multi-Criteria Assessment (MCA) was undertaken by Waka Kotahi and WDC staff of these four options against nine criteria, including social impacts. To accurately represent the strengths and weaknesses of each option in the assessment, each option was assessed against a theoretical scenario "Reference Case" (Telephone Road re-opening to road traffic in its existing condition). This theoretical scenario is only used purely as a baseline for comparison, as it does not meet KiwiRail requirements.

Overall, the **MCA recommended Option 1 as the preferred option** (costing $2.25M, 95th %ile estimate, including capital expenditure costs). This was also tested against various sensitivity testing scenarios, to understand how options would score if criteria weightings were changed, especially social impact criteria.

In pursuing permanent closure, the impacts should be carefully managed such as public and stakeholder acceptance, network productivity, community severance, and any required road upgrades for Seddon Road, Waverley Road, and Holland Road. While the impact to the local community is a key risk, adequate diversion routes are available via the Expressway and the existing diversion route. Furthermore, updated cost estimates and high-level benefit calculations indicate that there is no other affordable, value for money alternative available that reopens Telephone Road while meeting KiwiRail's requirements.

1 Background

1.1 Purpose of this Report

WSP was commissioned by Waka Kotahi to prepare this report, which assesses options for the SH1B Telephone Road/Holland Road intersection in the Waikato Region. The objectives of this assessment were to review the latest available data to understand existing traffic operation and safety issues, investigate and assess options through an updated Multi-Criteria Analysis (MCA) process and recommend an appropriate option for implementation.

1.2 Context

Prior to the opening of the Hamilton section of the Waikato Expressway, Waka Kotahi investigated the necessary changes to the surrounding state highways through the State Highway 1B (SH1B) and State Highway 26 Revocation Single Stage Business Case (Revocation SSBC). Detailed option development was undertaken for several intersections along SH1B, including the SH1B Telephone Road/Holland Road intersection.

At this intersection, three options were considered:

1. Speed management/Rural Intersection Activated Warning Signs (RIAWS)
2. Roundabout
3. Closure of Telephone Road at the rail crossing.

The speed management option did not address KiwiRail rail safety requirements. The roundabout option was considered too costly and unlikely to have a fundable Benefit Cost Ratio (BCR). It would also be a significant improvement in the package of revocation works and could not realistically be achieved by 2023. Ultimately, the assessment determined that **closure of Telephone Road** was considered the preferred option that fully addressed rail safety issues.

Current Status

In April 2022, a truck crossing the railway line at Telephone Road dislodged a section of track for the third time since 2016. Due to the risk of further rail track damage and train derailment, KiwiRail and Waka Kotahi made the decision to immediately close the rail crossing to road traffic and Telephone Road has been temporarily closed to SH1B road traffic since this time. At the time of writing this report, road traffic continues to be diverted via Holland Road, Waverley Road, and Seddon Road (see Figure 1 below).

KiwiRail is the underlying designation owner for the land used by the East Coast Main Trunk (ECMT) Railway, including the Telephone Road level crossing. Therefore, for Telephone Road to re-open to road traffic, the level rail crossing would need to be adjusted to meet KiwiRail rail safety requirements.

There is significant public scrutiny around the future of this intersection. Waikato District Council did not formally endorse the recommendation to close Telephone Road in the Revocation SSBC and it is noted that the temporary closure in place has been poorly received by elected officials and the local community.

There is an opportunity to address safety issues at this rural intersection and the adjacent rail level crossing. Waka Kotahi is now seeking to review the situation, by undertaking an updated assessment to confirm whether closure of the level crossing is still the most appropriate long-term solution for the intersection, with the Expressway having been operational since July 2022.

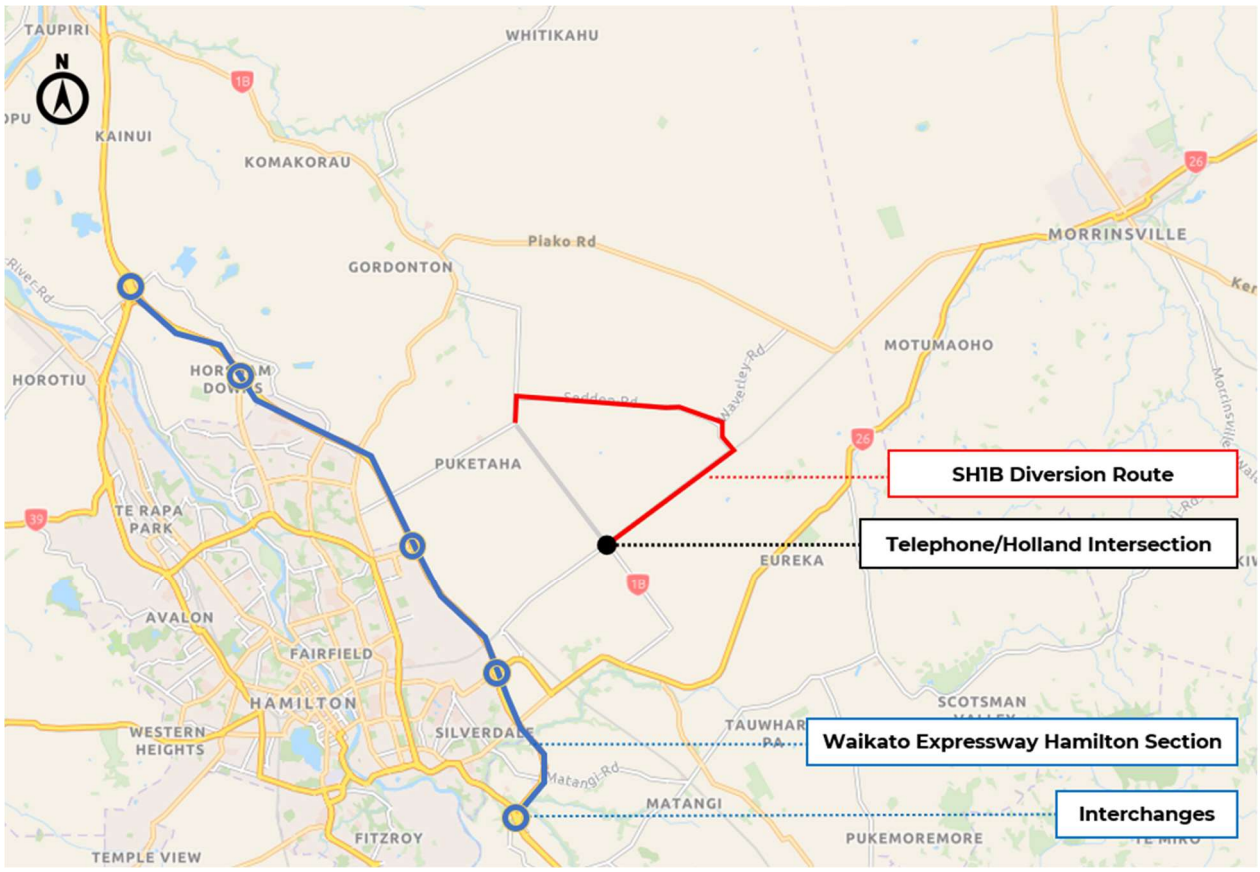


Figure 1. Illustration of SH1B Telephone Road/Holland Road intersection with diversion route

1.3 Site Description

The following are key features of the Telephone Road/Holland Road intersection:

- Location is approximately 9km east of Hamilton City in the Waikato Region
- Prior to the temporary closure of Telephone Road, the intersection was a staggered, stop-controlled intersection whereby Telephone Road (north) and Marshmeadow Road (south) must yield to Holland Road (east-west) traffic
- Holland Road provides an alternative connection to SH26 from the outer eastern suburbs of Hamilton City towards Morrinsville, east of Hamilton City
- The East Coast Main Trunk (ECMT) Railway runs parallel and north of Holland Road
- The surrounding area accommodates rural, residential and farming activity
- The intersection has a posted speed limit of 100km/h, with a variable speed limit of 70km/h at Holland Road
- Following the temporary closure of Telephone Road, the section of Telephone Road, south of the ECMT Railway, has been used as a marked school bus stop.

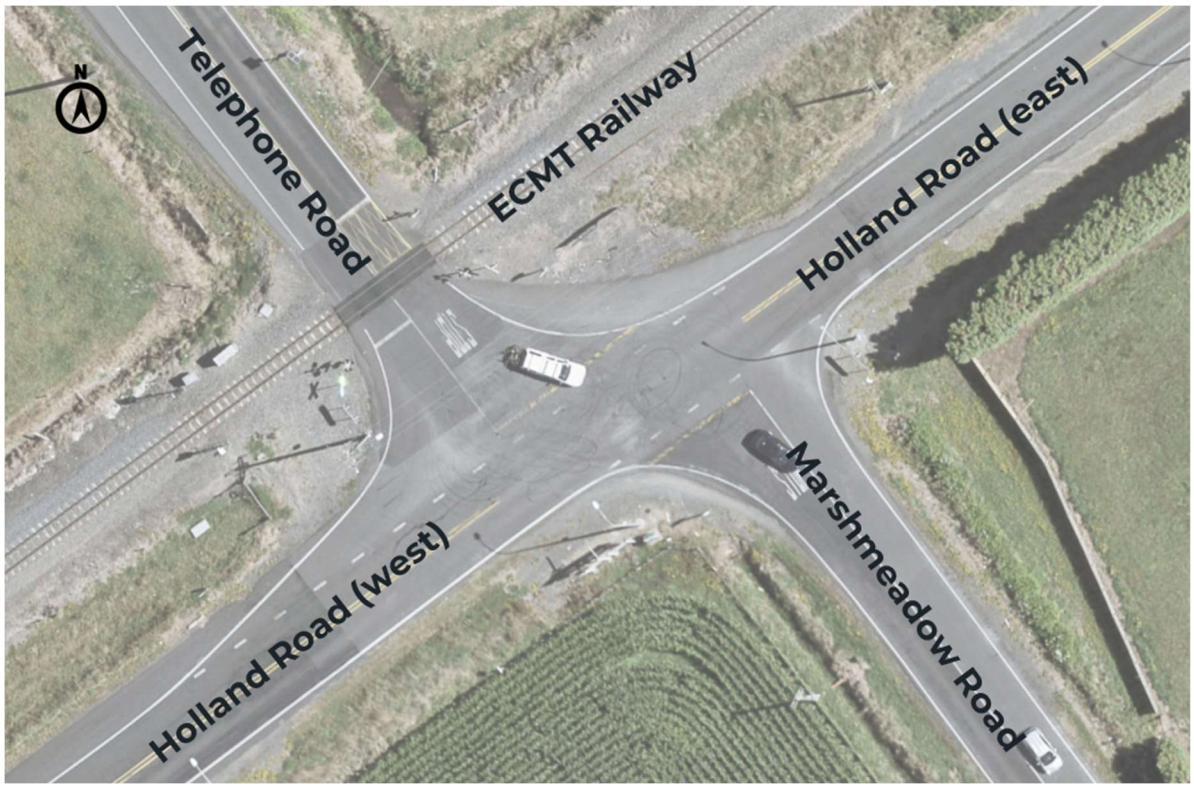


Figure 2. Location of SH1B Telephone Road/Holland Road intersection.

1.4 Assumptions and Exclusions

In undertaking the updated assessment and determining an appropriate way forward, the following assumptions and exclusions from this assessment should be noted:

- Site visits were undertaken to further investigate Option 1 (Permanent Closure of Telephone Road)
- MCA assessment and analysis of key risks are qualitative only
- Generally, more conservative assumptions have been used (e.g. higher traffic volumes)
- Further assumptions, in the methods used and development of options, are noted in the sections to follow.

2 Analysis of Evidence

With the Waikato Expressway now open, and Telephone Road temporarily closed, updated evidence was analysed to review the baseline for options to be assessed against in Sections 3 and 4. The evidence areas which were analysed include:

- Rail Safety
- Traffic Volumes
- Intersection Performance
- Road Safety
- Diversion Analysis

2.1 Baseline Scenarios

The baseline used to assess the options put forward in this report plays an important role in ensuring a robust comparative assessment. Typically, the existing situation is used as the baseline, however it has been necessary to consider two baselines for different purposes in this report (summarised in Table 1).

Baseline Scenario 1 (Do Minimum) is the existing situation, which is the minimum acceptable outcome agreed by KiwiRail and Waka Kotahi. However, this is not a long-term or permanent solution. Therefore, this baseline scenario is only used to help assess the option to **permanently close** Telephone Road, given that comparing this scenario with the permanent closure would demonstrate little difference.

Baseline Scenario 2 (Reference Case) is a hypothetical situation used as the main baseline for comparison in this assessment to represent the benefits and weaknesses of all options more accurately. If compared against the Do Minimum scenario, any option that re-opens the Telephone Road rail crossing is compared would perform poorly because they re-introduce both road and rail safety risks. This also ensures consistency with the previous assessment in the Revocation SSBC.

Overall, while the Reference Case would not be permitted by KiwiRail due to rail safety issues, it serves purely as a preferred basis for comparison rather than a potential design outcome. Therefore, **neither baseline scenario is considered an acceptable long-term outcome**.

Table 1. Summary of baseline scenarios in this assessment

Baseline Scenarios	Description	Use
Baseline Scenario 1: Do Minimum	Existing situation: **Telephone Road is temporarily closed** to road traffic and uses detour route	To assess the option to **permanently close** Telephone Road. Not a long-term or permanent solution, given the current road alignment and proximity of the intersection to the railway, KiwiRail would not permit the level crossing to be used by road vehicles
Baseline Scenario 2: Reference Case	Hypothetical situation: **Telephone Road is open** to road traffic now that the Waikato Expressway is open and with the current intersection arrangement	To compare against all other options and accurately understand the benefits and weaknesses of each option. Not an acceptable outcome.

2.2 Rail Safety

KiwiRail is the underlying designation owner for the land used by the ECMT, including the Telephone Road level crossing. Therefore, Waka Kotahi must comply with KiwiRail's rail safety requirements for any road activity to continue operating within their designation.

Method

In 2017, KiwiRail's Level Crossing Safety Impact Assessment (LCSIA) was conducted for the rail crossing at Telephone Road to determine existing rail safety risks. This informed the Revocation SSBC and KiwiRail has confirmed that this remains the most current rail safety assessment for this crossing.

The LCSIA includes a risk scoring system, the Level Crossing Safety Score (LCSS). This rates the level crossing from 0 to 60, with 60 being a very unsafe crossing. Any upgrades to an existing crossing are assessed against two criteria:

1. The crossing ideally should achieve a "LOW" or "MEDIUM-LOW" risk band, however, this must be weighed against the practicability and cost of providing a remedy
2. The crossing must score a lower Australian Level Crossing Assessment Model (ALCAM) score and LCSS than the existing situation.

Results

The 2017 LCSIA determined that:

- The road level crossing has an existing Level Crossing Safety Score of 51/60 (HIGH)
- Rail safety problems include SH1B vehicles ignoring flashing lights and bells, short stacking distance (Telephone Road southbound between the railway and intersection limit line) and grounding out incidents (which severely damage and compromise the rail lines)
- At a minimum, to achieve Criterion 2, a package of treatments, including half arm barriers and large passive advanced warning signs, would need to be installed
- However, to achieve Criterion 1, these rail safety problems must be resolved through more significant improvements and reconfiguration to the adjacent road network. It was recommended that grounding out and the short stacking problems are addressed by changing the vertical alignment and horizontal alignment of SH1B and Holland Road.

2.3 Traffic Volumes

Method

To determine the baseline changes in traffic volumes and heavy traffic volumes at the intersection since the opening of the Expressway and closure of Telephone Road, the following methodology was undertaken:

- Four Average Daily Traffic (ADT) scenarios were determined:
    - Historic ADT (from 2015-2019 counts extracted from available sources)
    - Pre-Expressway 2022 ADT (assumed conditions prior to the Expressway opening and closure of Telephone Road)
    - Do Minimum ADT (actual existing 2022 conditions after opening of Expressway and closure of Telephone Road)
    - Reference Case ADT (assumed post-Expressway and if Telephone Road was re-opened).
- Historic ADTs were extracted from the following sources:
    - Waikato District Council (WDC) Traffic Counts Database[1] for local roads. Seddon Road day counts were taken on 28th November 2015, Holland Road east from 28th November 2015, and Holland Road west from 10th August 2019. Heavy vehicle (HV) volumes for Holland Road west

[1] https://www.waikatodistrict.govt.nz/services-facilities/roads-travel-and-parking/roads-and-transport/our-road-strategy-and-partners/traffic-counts

were taken from an April 2021 estimate from WDC, as the 2015 count noted 0% HV traffic, which is assumed to be non-representative of typical HV volumes

- Abley 2015 Traffic Counts database[2] for SH1B Marshmeadow Road.

- To determine pre-Expressway 2022 ADT, historic ADTs were adjusted to include 2% annual growth on Waikato local roads. This 2% annual growth assumption is relatively conservative, when compared against actual traffic growth based on historical WDC ADT data above
- To determine the Do Minimum ADTs, 2022 7-day Average Daily Traffic (ADT) counts were provided by Waka Kotahi via MetroCount traffic data for the week between 9-16 September 2022 (while Telephone Road is closed) at three locations on Seddon Road and Holland Road east and west (see Figure 3)
- To estimate the Reference Case ADTs, the potential total 2022 ADT of all approaches was determined by using the 2022 ADTs for the Do Minimum, with the Seddon Road volumes reduced to only include the difference between the Pre-Expressway 2022 ADT and 2022 Post- Expressway counts (this was assumed to be the volumes that would otherwise use Telephone Road if open). Then, the average proportions for each approach were applied to this total ADT from a hypothetical 2022 model (2018 Waikato Regional Transport Model (WRTM) adjusted to 2% annual growth).
- The four traffic scenarios were compared, and results are outlined below.

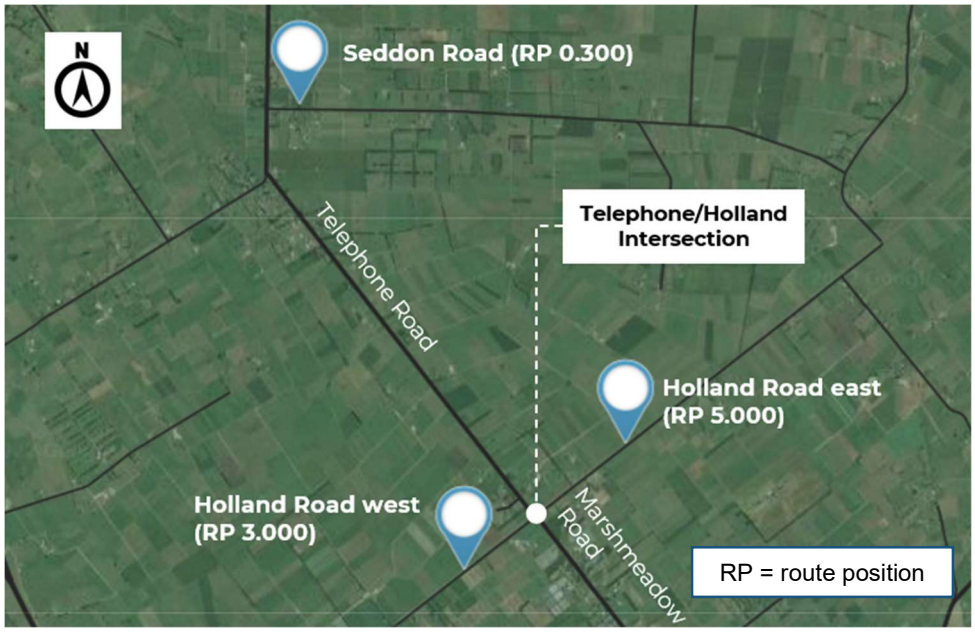


Figure 3. Location of 2022 traffic counters.

Results – Do Minimum

As seen in Figures 4 and 5, the following assumptions and conclusions can be made with the available data:

- **Seddon Road ADT** – Traffic volumes on Seddon Road (new diversion route) **increased** by about 30% (from about 2500 vehicles per day (vpd) to 3300 vpd). This suggests that up to a third of the additional volume (roughly 750-800 vpd) may be diverted traffic that would otherwise travel through SH1B if Telephone Road were open (not accounting for the traffic growth). Seddon Road may also now be a connector route to the Expressway and attracting more traffic than expected pre-Expressway.

[2] http://www.trafficcounts.co.nz/

- **Holland Road ADT** – Traffic volumes on Holland Road (east and west) **decreased** by about 50-60% (from about 2500 vpd to 1000 vpd)
- **Telephone Road ADT** – Assumed to be less than 100 vpd, as it is reduced to a cul-de-sac serving only visitors and residents of properties on this road
- **Marshmeadow Road ADT** – Assumed to be approximately 1830 vpd. 2022 Marshmeadow Road ADT was unavailable and was instead estimated using pre-Expressway 2022 ADT (WDC 2021 Waka Kotahi SH AADT counts + 2% annual growth) reduced by 50% (to represent the potential impact of the Expressway, similar to Holland Road). This is likely a conservative estimate, so may not fully represent traffic changes since the opening of the Expressway
- **Heavy vehicle traffic** – Heavy vehicle traffic **decreased** on all three roads; on Holland Road it decreased by 42-48% (from 3-6% to 1.7-3.1%) and on Seddon Road by about 40% (from 4% to 2.4%). This suggests that heavy vehicle traffic has largely diverted to other routes, likely the new Hamilton Expressway section. This suggests that, in the Reference Case, if Telephone Road was reopened with its current design, heavy vehicle traffic is likely to be low (average 2.4% of all traffic).

Results – Reference Case

As seen in Figures 4 and 5, the following assumptions and conclusions can be made with available data:

- **Telephone Road ADT** – Assumed to be around 1560 vpd, 68% less than the 2022 pre-Expressway scenario (over 4800 vpd to around 1500 vpd)
- **Marshmeadow Road ADT –** Assumed at around 1800 vpd, about 50% less than 2022 pre-Expressway scenario (over 3670 vpd to around 1800 vpd). This is likely a conservative/high estimate, so may not fully represent traffic changes since the opening of the Expressway.
- **Holland Road ADT** – Assumed around 200 (west) and 780 (east) vpd, about 70-90% less than 2022 pre-Expressway scenario (2300-2800 vpd to around 200-780 vpd).

Overall, both Do Minimum and Reference Case scenarios see a significant drop in traffic volumes at the intersection, compared to the traffic volumes present pre-Expressway.

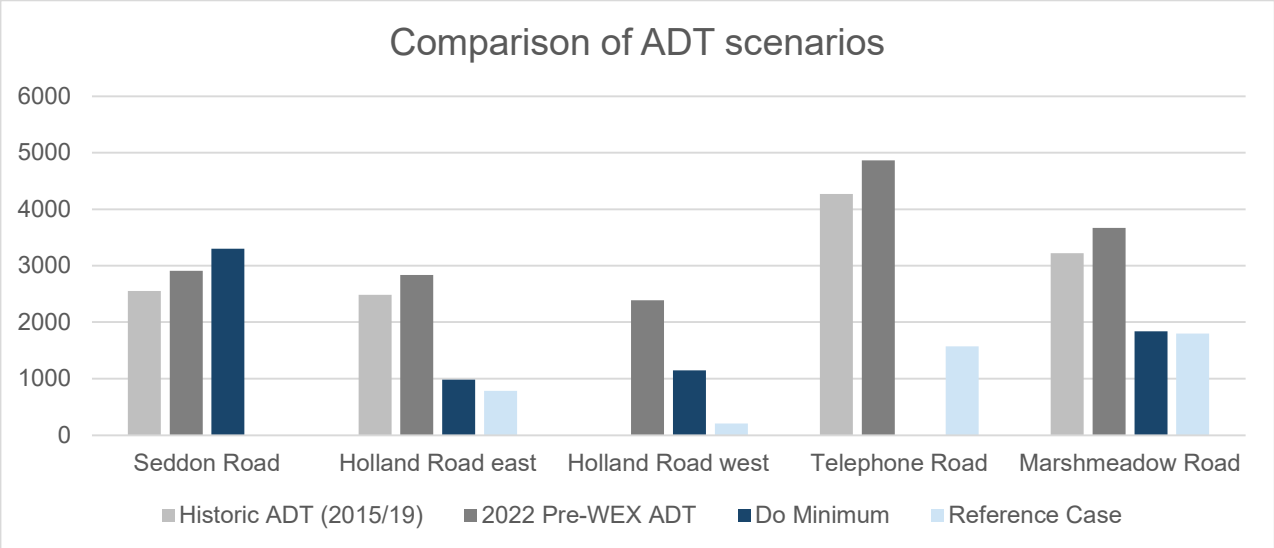


Figure 4. Comparison of Historic and 2022 Average Daily Traffic Volumes

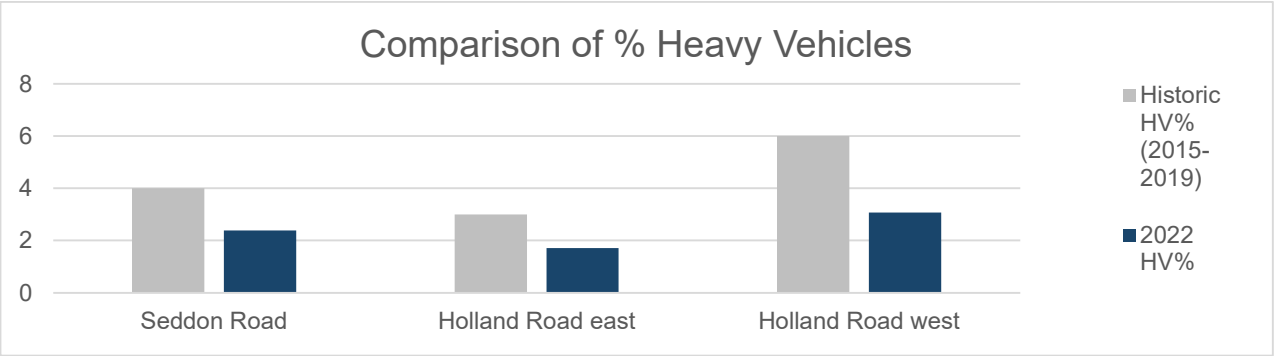


Figure 5. Comparison of Historic and 2022 Heavy Vehicles Volumes

2.4 Intersection Performance

Method

The performance of the intersection can be understood through existing delays and queue lengths. Typically, approach volumes and turning volumes would typically be used. However, this data was unavailable at the time of this assessment. Therefore, to determine intersection performance, a series of hypothetical scenarios were tested via SIDRA Intersection 9.0 Modelling Software, to determine the "Worst Case Scenario". The Worst Case Scenario is compared to the Reference Case, to identify whether the Reference Case presents a traffic performance issue.

The "Worst Case Scenario" is considered when delays are over two minutes long, and maximum approach volumes would adversely affect the wider transport network performance (i.e. queue lengths would encroach the next intersection i.e. 230m long on Telephone Road to reach the Amber Lane intersection).

Assumptions

- Approach volumes and turning volumes were determined by extrapolating the modelled Waikato Regional Transport Model (WRTM) proportions and applying these to the collected 2022 ADT data
- Reference Case approach volumes and turning volumes were extrapolated from proportions of modelled 2022 volumes from the 2018 post-Expressway scenario of the Waikato Regional Transport Model (WRTM), adjusted for 8% growth (2% annual growth)
- 2% heavy vehicle traffic applied to all approaches
- Only AM peak volumes were tested, as the 2022 ADT data showed that these volumes were greater than PM peak volumes, providing a conservative analysis of intersection performance.

Results

Overall, as shown in Table 2 and **Appendix A**, this analysis highlighted that in the Reference Case (if Telephone Road was re-opened), there would be minimal travel delays through the intersection in any direction (up to 10 seconds) and queue lengths (normally only around 2m long). Furthermore, traffic growth would need to increase by 7.5 times today's volumes (e.g. Telephone Road and Marshmeadow Road volumes have at least 600 vehicles during the morning peak hour) to reach the worst-case scenario, where the average delay on Marshmeadow Road reaches over three minutes and 95% of queue lengths on Telephone Road reach the intersection at Amber Lane.

Given that it is highly unlikely that traffic growth will reach this level, especially as the Expressway becomes the primary high volume traffic route following SH revocation, it can be reasonably assumed that the existing intersection layout will be sufficient for long-term operational performance.

Table 2. SIDRA outputs for Reference Case and Worst Case Scenario

Scenario	Approach	Total approach volume (veh)	Approach average delay (sec)	Approach 95th%ile queue lengths (veh)	Approach 95th%ile queue lengths (m)
Reference Case (1 hour AM Peak)	Telephone Rd	86	9.5	0.3	2
	Marshmeadow Rd	88	9.5	0.3	2.1
	Holland Rd (east)	69	1.5	0	0.3
	Holland Rd (west)	6	2	0	0.1
Worst Case Scenario (1 hour AM peak with 7.5x traffic growth)	Telephone Rd	641	49.2	32	**227.6 ***
	Marshmeadow Rd	660	**185.8**	86.5	616.0
	Holland Rd (east)	428	1.6	0.4	2.8
	Holland Rd (west)	47	0.4	0	0.1

*** Reaches Amber Lane intersection.**

2.5 Road Safety

2.5.1 Safe System Assessment

Stantec undertook an independent Safe System Assessment (SSA) including a daytime site inspection on 13 December 2022 and noted the following road safety features common between the Do Minimum route (diversion route if Telephone Road is closed) and Reference Case route (Telephone Road if re-opened). More details are provided in **Appendix F**.

Both routes are similar in nature, with:

- Posted 100km/h speed limit;
- Chipseal pavement, with seal in good condition but some deformation, especially on the approach to both rail level crossings (Telephone Road and Waverley Road);
- Flat and straight road alignments;
- Road markings at the centre and edge line, with centre white Reflectorised Raised Pavement Marker (RRPMs);
- 3.5m lanes but narrow or no sealed shoulders;
- Steep roadside drop off to very deep drains (up to approximately 4m) immediately next to the pavement;
- frequent residential access (less so on Waverley Road and Holland Road) with often large, non-mountable culvert ends;
- One rail level crossing on each route;
- Each requires 3 intersection turns (2 left turns and 1 right turn southbound for both);

However, the key physical difference is length of each route, which is discussed in Section 2.6.

2.5.2 10-year Reported Crash History

Method

To determine existing road safety risk, a review of the 10-year reported crash history between 2011 and 2021 at the Telephone Road/Holland Road intersection[3] was undertaken through the Waka Kotahi Crash Analysis System (CAS), as illustrated in **Appendix B** and assessed through the Waka Kotahi High Risk Intersection Guide (HRIG). The CAS query was extracted on 29 September 2022 and represents the historical data up to this date. This CAS data was reviewed in mid-January 2023 and remains correct.

[3] Intersection crashes are within 50m radius from the centre of the intersection (HRIG). The search area was also expanded to 250m and found no additional crashes.

Results

- There were 49 total reported crashes in the last 10 years. Of these, six crashes were fatal or serious injury crashes (six serious, zero fatal), which classifies the intersection as high-risk according to the HRIG:
    - Four were crossing (right angle) type crashes, involving cars travelling south on Telephone Road
    - Two were merging (left turn in) type crashes, involving cars colliding with cars travelling south on Telephone Road.
- Two crashes involved motorcyclists
- There were no reported crashes involved pedestrians or cyclists.

Reported crashes in 2022:

- In total, there have been three recorded crashes in 2022, all of which were injury crashes (two serious, one minor)
- Two of these crashes involved drivers losing control/moving off the carriageway, either due to fatigue or a suspected medical event. One serious crash involved a vehicle travelling south on Telephone Road failing to stop while crossing Holland Road, colliding with a vehicle travelling eastbound on Holland Road
- There were no reported crashes since the temporary closure of Telephone Road in April, 2022 and the opening of the Expressway section in July, 2022

Overall, the reported crash history over the past 10 years indicates that the intersection prior to the opening of the Expressway and the closure of Telephone Road was a relatively high-risk intersection. However, since these changes, the intersection has had no reported crashes, suggesting a reduced risk. This can likely be attributed to reduced volumes, due to traffic moving to the Expressway or the diversion route, mitigating existing road safety risks.

2.5.3 High Risk Intersection Assessment

Method

To understand the intersection crash risk, the Revocation SSBC calculated DSI[4] equivalents based on the 2018-21 NLTP method and the Crash Estimation Compendium 2018.[5] Using previous traffic volume and WRTM data, 2015-2019 reported crash data, and a predicted post-Expressway crash rate of 0.4 injury crashes per year, the Revocation SSBC assessment in 2020 found that the existing intersection (allowing for road traffic on Telephone Road) was considered a high-risk site prior to the Expressway opening, with an estimated risk of 2.32 DSI equivalents. However, once the Expressway was operational, the intersection would have reduced the estimated risk to 0.47-0.74 DSI equivalents, due to a major reduction in traffic flows on both major and minor roads. Therefore, it was determined that the intersection would no longer be a high-risk intersection once the Expressway was operational, provided that volumes were greatly reduced.

To better understand the current intersection crash risk for the Reference Case, an updated assessment was done using the original methodology. This included updated 2022 traffic data, 2017-2021 reported

[4] Deaths and serious injuries

[5] https://www.nzta.govt.nz/planning-and-investment/planning-and-investment-knowledge-base/archive/201821-nltp/assessment-of-activities-by-activity-class/assessment-of-local-road-regional-and-state-highway-improvement-activities/safety-risk-definitions/#calculating-dsi-casualty-equivalents

crash data, and an updated predicted crash rate of 0.7 injury crash rates per year.[6] Note: ADT data was used rather than AADT data required for the DSI calculator, as AADT data was not available at the time.

Results – Reference Case

Updated data suggests that there would be an estimated risk of 0.84-1.35 DSI equivalents[7] if Telephone Road was re-opened. This indicates that it is a high-risk intersection according to the HRIG and that there is a slightly higher road safety risk at this intersection, compared to the previous Revocation SSBC assessment. This is likely due to slightly higher volumes used in this updated assessment and more serious crashes (including new, high severity crash types like head-on type) reported in the new crash analysis period, compared to the previous assessment. However, a further crash risk assessment is likely needed, due to the impact of post-Expressway traffic volumes and the wider safety impacts of traffic following the diversion route. Potential crash migration measures (e.g. safety barriers) should also be considered.

2.6 Diversion Analysis

Method

To determine the impacts of diversion created by the closure of Telephone Road, a desktop review of travel distance and time was undertaken the Reference Case (where Telephone Road is open) and Do Minimum (Telephone Road is closed). Travel distances were extracted via Google Maps. Travel time was estimated through a manual calculation using mean operating speeds indicated by MegaMaps (Road to Zero Edition 1). Where mean operating speeds vary along a route, the lowest speed was used to provide a conservative travel time estimate. For instance, MegaMaps indicated that the lowest operating speed along the diversion route is 70km/h.

Two origin-destination routes were tested (routes that would likely use Telephone Road if it were open and the diversion route if Telephone Road is closed). These routes also represent the most common commuter (work and education) trips in the local area, as suggested by the Stats NZ Commuter Waka tool[8]:

- **North-south:** SH1B/Puketaha Road intersection to Telephone/Holland Road intersection – a north-south route likely used by most commuters in the local area, both for local trips in the immediate area and commuter trips between Eureka-Tauwhare and Kainui-Gordonton.
- **East-west:** Eureka Road/Holland Road intersection to Puketaha Road/Gordonton Road intersection – an east-west route likely used for local trips in the immediate area and trips to destinations in western Hamilton e.g. Te Rapa.

This method is considered the best method at the time of this report due to lack of other readily available data and resources available.

Results

As shown in Table 3 below, if Telephone Road remains closed to road traffic (Do Minimum), for north-south trips there is an additional travel distance of 6.1km via the existing diversion route and an additional travel time of at least five minutes for routes travelling north-south along SH1B, compared to Telephone Road being open to road traffic (Reference Case).

Meanwhile, the impact for east-west routes is minimal. If Telephone Road remains closed to road traffic (Do Minimum), there is a similar travel distance (slightly reduced by 300m, given the diversion route is a shorter route than via Telephone Road) and similar travel time (slightly longer by about one minute, due to

[6] These findings were also tested against calculations using recent methodology for the Speed and Infrastructure Programme (Manu Tāiko DSI calculator methodology 2021), which showed consistent results.
[7] From a range of potential crash type compositions, using reported crash types from 2017-2021.
[8] Based on SA2-to-SA2 commuter data retrieved from https://commuter.waka.app/. This assessment considers the "local area" as the area represented by Statistical Area 2 (SA2s) areas immediately adjacent to the intersection and Telephone Road; Eureka-Tauwhare (to the west), Hamilton Park (to the east) and Kainui-Gordonton (to the north).

operating speed on diversion route), compared Telephone Road being open to road traffic (Reference Case).

Table 3. Results of diversion analysis scenario tests.

Origin-Destination	Telephone Road Scenario	Assumed operating speed	Travel Distance	Estimated Travel Time
North-south	Open (Reference Case)	85 km/h	4.9 km	3.4 mins
	Closed (Do Minimum)	70 km/h	11 km	9.4 mins
East-west	Open (Reference Case)	80 km/h	13.1 km	9.8 mins
	Closed (Do Minimum)	70 km/h	12.8 km	10.9 mins

Based on this analysis and discussion with Waikato District Council, it is understood that closure to Telephone Road affects a range of local trips, such as school-related trips (school buses)[9] and movement of farming stock. However, these are largely local trips, with origins and destinations within the same or immediately neighbouring geographic area, rather than regional freight trips.

According to Commuter Waka[10], about 1,500 people live and work in the local area; Eureka-Tauwhare (to the west), Hamilton Park (to the east), and Kainui-Gordonton (to the north). Of this population, data suggests that just over 140 commuters travel north-south between the areas south of Telephone Road (Eureka-Tauwhare and Hamilton Park) and to the north of Telephone Road (Kainui-Gordonton). Based on this diversion analysis, it can be assumed that approximately 140 commuters are likely to be adversely impacted by the closure of Telephone Road. However, since the Commuter Waka data represents quite broad geographic areas, it is possible that not all of these trips would typically travel through Telephone Road or the diversion route, so the actual number of commuters impacted may be less than 140.

Overall, this suggests that less than 10% of the local community (less than 140 of the 1,500 people based on Commuter Waka data) are expected to be negatively impacted by the closure of Telephone Road. Therefore, if Telephone Road is closed, the diversion impact is largely isolated to a local scale, affecting people travelling north south and vice versa.

2.7 Overall Summary of Evidence

This updated assessment highlighted the following key findings:

- There are existing rail safety problems at the road level crossing, including SH1B vehicles ignoring flashing lights and bells, short stacking distance, and vehicle grounding out incidents. These problems must be resolved for KiwiRail to permit the operation of road traffic.
- Now that the Expressway is open, whether Telephone Road is open or closed, there is a significant drop in traffic volumes (including heavy vehicle volumes) at the intersection than the traffic volumes present before the opening of the Expressway.
- If Telephone Road were reopened, there would be minimal travel delay and queue lengths. Traffic growth would need to increase by an unlikely proportion to reach the worst-case scenario with three minutes-long delays and traffic queues spilling back into adjacent intersections. Therefore, the existing intersection layout is likely sufficient from a long-term traffic operation perspective.
- The intersection is no longer considered a high-risk intersection due to virtually no reported crash risk since the opening of the Expressway and closure of Telephone Road in 2022. In contrast, if the

[9] According to Ministry of Education School Bus Route Maps, the intersection is used by Route D030502 (34 students from Gordonton School and Puketaha School), which travels through Telephone Road. Route D030515 (62 students from Newstead Model Country School, Sacred Heart Girls' College, Berkley Normal Middle School and Hillcrest High School), which turns left on Holland Road west from Marshmeadow Road.
[10] https://commuter.waka.app/

intersection in re-opened to road traffic, the updated estimated risk in accordance with the HRIG suggests that it is a high-risk intersection. A further crash risk assessment is recommended, due to the emerging impact of the Expressway on traffic patterns and the wider safety impacts of traffic following the diversion route. Potential crash migration should also be considered.

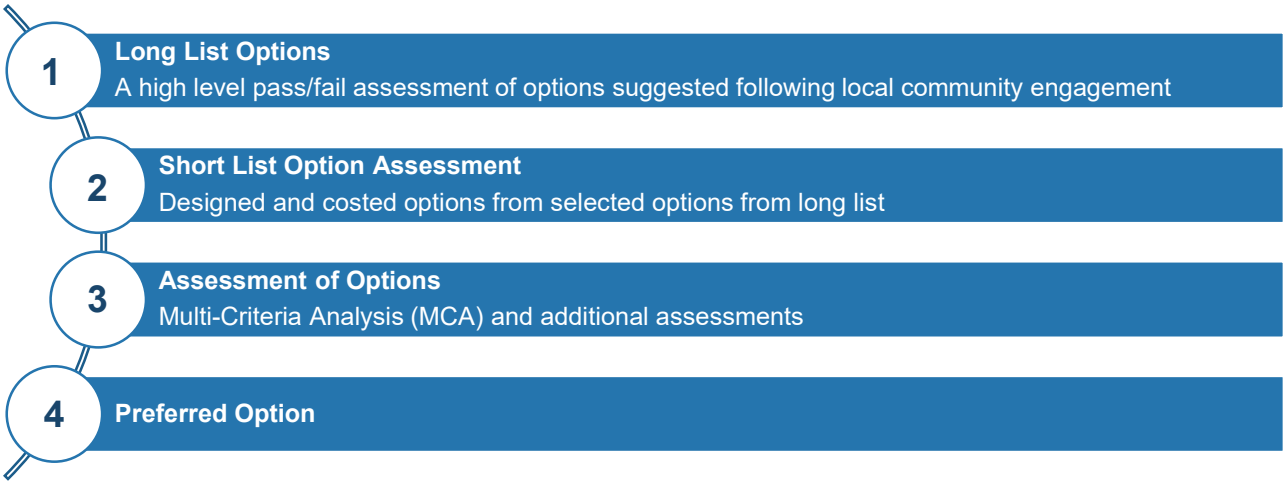
- The diversion analysis suggests that less than 10% of the local community are expected to be negatively impacted by the closure of Telephone Road. Therefore, if Telephone Road is closed, the diversion impact is largely isolated to a local scale, affecting people travelling north south and vice versa.

3 Option Development

This section summarises the step-by-step option development process to determine the preferred option for this intersection.

3.1 Option Development Process

Options were developed using the following process:



3.2 Long List Options

An initial long list of options was created, based on suggestions from the local community and the options considered in the Revocation SSBC (see **Appendix C**). Waka Kotahi consulted the local community through an information session on 27 June 2022 and an email feedback form. The feedback received was complied, analysed, and approximately 30 consolidated options were taken into consideration.

These options were screened through a high-level pass/fail assessment. Options would only pass this screening if they met KiwiRail's two requirements to allow the rail level crossing to continue to operate i.e. avoided vehicles grounding out the railway line and removal of the stacking distance issue. As a result, four options passed both criteria and were shortlisted for further assessment.

The opportunity to maintain the existing road arrangement and implement a management system was also briefly explored. However, following discussions between Waka Kotahi and KiwiRail in 2022, KiwiRail confirmed that, for road traffic to continue to operate with the road's current horizontal and vertical alignment at the rail crossing, KiwiRail will require any traffic management system to provide certainty that only single unit vehicles will use the route and longer, multi-unit vehicles, trailers, and agricultural vehicles are prevented from crossing the rail corridor. However, KiwiRail are not aware of any low-cost and effective traffic management system that would provide sufficient certainty, as existing systems rely on enforcement and driver compliance. Therefore, this option was not given further consideration.

3.3 Short List Options

Four options were developed by WSP with Waka Kotahi, KiwiRail, and technical specialists in road safety design and cost estimation:

- Option 1: Permanent closure of Telephone Road
- Option 2: Vertical realignment of SH1B
- Option 3: Vertical realignment of SH1B and re-prioritised intersection
- Option 4: Roundabout

The cost estimate breakdowns for each option are included in **Appendix D**.

3.3.1 Design and Cost Estimate Assumptions

The following assumptions have been made in the development of these short list options:

- Conservative design of each option e.g. conservative road realignment used in all options.
- Updated designs and cost estimates were only created for significantly changed designs since the Revocation SSBC. Therefore, an updated concept design was not prepared for Option 4 and its 2021 cost estimate is still considered reliable for the purposes of this report
- Concept designs and quantities are based on LiDAR data, rather than more detailed survey data
- Property take/land costs are indicative only.
- Cost estimates are based on capital expenditure costs only. Other costs, such as safety improvements, have been considered separately. See **Section 3.3.2** for further discussion.

3.3.2 Safety Costs to Resolve

During the development of the options, additional safety costs were identified to be potentially associated with all the options.

Telephone Road and the diversion route both have safety issues. Traffic volumes since the temporary closure of Telephone Road suggest that additional traffic is travelling through the diversion route than before (see **Section 2.3**). This additional traffic is seen to warrant additional safety improvements to bring this diversion route to the same standard as Telephone Road if the diversion route was to become permanent (as required by Option 1).

Safety improvements were investigated through a Safe System Assessment (SSA) by Stantec (see **Appendix E**). The SSA recommended the following safety works on Seddon Road, Waverley Road, and Holland Road:

- Road widening at intersections to allow for vehicle tracking;
- Install and replace roadside barriers for protection from roadside drains;
- Roadside vegetation maintenance;
- Road marking maintenance;
- Road sign installation;
- Additional assessments and reviews such as reviews of vehicle tracking at intersections, Traffic Control Devices Manual compliance, and LCSIA.

The total estimated cost of these recommended safety works is $1.07M. Each safety improvement and their individual costs (estimated by WSP) are itemised in **Appendix F**.

However, the following safety works have not been costed:

- Install roadside barriers next to roadside drains on Seddon Road – these were considered above the standard that currently exists on Telephone Road.
- Undertake LCSIA at the Waverley Road rail crossing & Holland corner – KiwiRail advised that there are no current safety issues at this site.
- Level pedestrian crossing facility at the Telephone Road – This has been included in Option 1 as a capital expenditure cost.
- Overall, these safety works are considered necessary regardless of what happens at the Telephone Road intersection. This is because it is unclear whether the closure of Telephone Road is the direct cause of any increased safety risk on the diversion route. As explained in **Section 2.3**, increased traffic on the diversion route may be partly attributed to the opening of the WEx. Therefore, these safety improvements on the diversion route have been considered separately from the costs of each option

3.3.3 Option 1 – Permanent Closure of Telephone Road

2023 95th Percentile Cost Estimate:

$2.25M + $1.07M for safety works

Figure 6. Option 1 indicative design

Option 1 is based on an existing design from the Revocation SSBC, whereby Telephone Road is converted to a cul-de-sac, completely separating rail and road traffic. The intersection becomes a T-intersection with Holland Road (priority) and Marshmeadow Road.

To mitigate adverse impacts such as severance (communities being disconnected from key destinations), this option also includes a level pedestrian/cyclist (non-vehicle) crossing, as per KiwiRail requirements. The cost of this was provided by KiwiRail, based on similar projects undertaken.

3.3.4 Option 2 – Vertical Realignment of SH1B

2022 95th Percentile Cost Estimate:

$8.88M + $1.07M for safety works

Figure 7. Option 2 indicative design

Option 2 is a new option, not considered in the Revocation SSBC, involving vertical realignment of the road to allow 30m stacking from the centre of rail line to the intersection limit line, with Holland Road retaining priority. Key features include:

- Design speed 80km/h
- 3.5m lane widths maintained
- 1m shoulder (slightly wider at corner radius to allow tracking for bigger vehicles)
- 30m long with 1:10 taper provided at left turn approaches
- Diverging taper on Holland Road, 300m east and west
- Telephone Road from 50m north of railway line to be reconstructed to improve approach slope to railway from 5% to 25%
- Intersection raised to improve slope to railway from 8% to 2.5% and allow existing swale next to railway for drainage

- 2.5% slope either side of railway, to ensure proper clearance for low bed vehicles
- Approximately 30m of Marshmeadow Road approach to intersection to be reconstructed, due to raised intersection
- Estimated total private property take - 5000sqm.

3.3.5 Option 3 – Vertical Realignment of SH1B + Re-prioritised Intersection

2022 95th Percentile Cost Estimate:

$9.35M + $1.07M for safety works

Figure 8. Option 3 indicative design

Option 3 is a new option, not considered in the Revocation SSBC, involving vertical realignment of the road to allow 30m stacking from the centre of rail line to limit line, with SH1B having priority over Holland Road. Key features include:

- Design speed 80km/h
- 3.5m lane widths maintained
- 1m shoulder (slightly wider at corner radius to allow tracking for bigger vehicles)
- 30m long with 1:10 taper provided at left turn approaches
- Diverging taper on Holland Road, 220m east and west
- Telephone Road – from 100m north of railway line to provide gentle gradient to raised flat area through railway and intersection
- Horizontal realignment of Marshmeadow Road – reverse curves 250m radius with 60m straight section between curves
- Estimated total private property take - 4700sqm.

3.3.6 Option 4 – Roundabout

2021 95th Percentile Cost Estimate:

$10.58M + $1.07M for safety works

Figure 8. Option 3 indicative design

Note: *Image does not show realignment of Holland Road to allow for 30m stacking space.*

Option 4 is based on the existing design from Revocation SSBC, with some minor adjustments. Key features are largely the same as Option 3, except:

- Design speed 60km/h
- Diverging taper on Holland Road, 160m east (slightly less than previous options, due to lower design speed)
- Horizontal realignment of Holland Road to allow 30m stacking from centre of rail line to limit line
- Horizontal realignment of Marshmeadow Road – reverse curves 250m radius, with 60m straight section between curves
- Total private property take, slightly less than Option 3 (estimated at 4500sqm).

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4 Option Assessment

4.1 Assessment Methodology

To assess the shortlisted options, an updated Multi-Criteria Analysis (MCA) process was undertaken. Initial provisional scoring was provided by WSP specialists, then moderated through a virtual MCA Workshop on 14 October 2022, attended by representatives from Waka Kotahi, WSP, and Waikato District Council.

As explained in Section 2, all options are compared against a baseline i.e. Reference Case (theoretical scenario where Telephone Road is open to road traffic without major works). The Do Minimum (Telephone Road is temporarily closed) has been used as a basis for assessment of Option 2 (Permanent Closure of Telephone Road).

4.2 MCA Framework

Nine criteria, including two investment objectives (road safety and rail safety) and seven critical success factors, were used to analyse the options. These options were then scored using the seven-point scale in Table 4 below. Options were then compared against the baseline (Reference Case), which assumes a neutral score of '0' for all criteria.

Table 4. MCA Seven-Point Effects Scale

-3	-2	-1	0	1	2	3
Major adverse effect	Moderate adverse effect	Slight adverse effect	Neutral/no change	Slight positive effect	Moderate positive effect	Major positive effect

4.3 MCA Results

Following the MCA Workshop attended by representatives from Waka Kotahi, WSP, and Waikato District Council, the MCA results shown in Table 5 were agreed. Overall, with equal weighting across all criteria, the MCA scored the Reference Case as the best scoring/ranked option. This is likely because any intervention incurs extensive costs and risks. However, the Reference Case is an unacceptable outcome because it cannot achieve KiwiRail safety outcomes, placing the next best option, **Option 1: Permanent Closure of Telephone Road,** as the recommended option by the MCA.

A detailed MCA is available in **Appendix F**.

Table 5. MCA Scores

Criteria		Ref Case	1	2	3	4
Investment Objectives	**IO1: Improve road user safety** Reduce DSI for road users, including general traffic, pedestrians/cyclists and heavy vehicles	0	1	1	1	3
	IO2: Improve rail safety (GPS requirement) Reduce risk of derailment, grounding out, and avoid further damage to the ECMT Railway	0	3	1.5	2	1.5
Critical Success Factors	**C1: Achievability** Can this option be technically delivered? Does this option have technical/practical risks? Does this option have Safety in Design or maintenance risks?	0	2	-2	-2	-2
	C2: Consentability/Legal How complex/difficult is this option to meet consent/legal requirements? Are there any	0	-1	-2	-1	-1.5

	impacts on property take and can the necessary properties be acquired?					
	C3: Affordability Does this option provide value for money?	0	-0.5	-3	-3	-3
	C4: Network productivity How will the option impact movement of freight (by road or rail) and other key traffic movements for economic productivity? How will the option impact travel times?	0	-2	0.5	1	0.5
	C5: Perceived social impacts How well perceived i.e. accepted will the option be by the local community and stakeholders?	0	-2	1	1.5	2
	C6: Social and cultural impacts How will the option impact community access (i.e. severance) to social/economic opportunities e.g. work/recreation/school? How will the option impact neighbouring property owners?	0	-2	-1	-1	-1.5
	C7: Climate Change How will the option impact long-term carbon emissions (embodied and operational carbon emissions)? Will the option be adversely affected by climate change risk or other natural hazards over time?	0	-1	-2	-2	-2
	Total MCA Score	N/A	**-2.7**	-6.6	-3.8	-3.3
	Total MCA Ranking	N/A	**1**	4	3	2

4.4 Additional Assessment

Further assessment was done to challenge and test the outcome of the MCA:

4.4.1 Sensitivity Testing

The above MCA assumed that all MCA criteria would be weighted equally. As agreed by stakeholders at the MCA Workshop, sensitivity testing was undertaken, to understand the sensitivity and significance/materiality of the different criterion, particularly around social impacts. The following tests were completed with corresponding results:

Table 6. MCA Sensitivity Tests and Results

Sensitivity Tests	Score / Rank for each Option			
	1	**2**	**3**	**4**
Scenario 1: 15% weighting for investment objectives, 10% for Critical Success Factors	**-0.5** **1**	-4.8 4	-2.0 3	-0.8 2
Scenario 2: 15% weighting for social impact criteria (C5 and C6), 10% for other criteria	-4.5 3	-6.0 4	-3.3 2	**-2.8** **1**
Scenario 3: Score social impacts of Option 1 more severely (from -2 to -2.5)	-3.9 2	-6.6 4	-3.9 2	**-3.3** **1**

Results of the sensitivity tests suggest that the MCA recommendation can change in response to slight changes in weighting and scoring of criteria. However, in the neutral-weight original MCA, social impacts collectively contribute a significant component of the criteria (i.e. represented in two criteria) and Option 1 still performs the best (excluding the Reference Case). Furthermore, in Sensitivity Test Scenario 1, when investment objectives criteria are weighted slightly more greatly than other criteria, Option 1 remains the best performing option.

While Sensitivity Test Scenarios 2 and 3 suggest that Option 4 (roundabout) may be preferable, these scenarios likely overstate the social impact considering its local scale, while also understating the low value for money of these high-cost interventions and other factors such as climate change and technical achievability.

4.4.2 Indicative Efficiency Rating (IER)

The IER tool was used to test the high-level benefits of each option, with higher IER ranges being more favourable. Safety improvement benefits were considered the only relevant benefit of this investment, but this tool is limited, as it relies on approximate factors such as DSI reduction. This found:

- **Option 1** likely has a medium IER range (3-5.9), assuming that DSI reduction is around 10-15%. Even if DSI reduction is lessened to 5%, Option 1 provides some benefit with a low IER range 1-2.9).
- **Options 2 and 3** both have a very low IER range (<1). This is likely due to the cost of these options for very minimal DSI reduction (assumed to be less than 30%)
- **Option 4** is a Standard Safety Intervention (SSI), so the IER tool advises using the SSI Toolkit for an estimated benefit cost ratio (BCR). According to the SSI Toolkit, a roundabout costing at least $6M has a very poor BCR ranging, from less than 0 to 0.5.

Overall, all options perform relatively poorly, in terms of benefits due to their high cost relative to safety benefit. However, Option 1 is the most favourable (in terms of benefits) compared to all other options.

4.4.3 Key Risks

The following key risks were identified during option development and assessment:

Table 7. Key risks for each option.

Options	Key Risks
Option 1	• Poor local and stakeholder acceptance, based on current temporary closure • Some adverse impact on network productivity, due to changes in movement of local freight, commuters (including school bus routes) and farming activities • Further consideration needed for the temporary school bus stop in place • Associated temporary traffic management for safety improvements to the permanent diversion route.
Option 2	• Limited safety improvements/benefits for very high cost • Potential consenting/property issues that need to be explored further.
Option 3	• Limited safety improvements/benefits for very high cost • Potential consenting/property issues that need to be explored further.
Option 4	• Limited safety improvements/benefits for very high cost • Technically challenging and costly to implement, given presence of rail line, high speed environment and the need to reduce speed significantly on approach • Potential consenting/property issues that need to be explored further.

5 Conclusions & Recommendation

Overall, through an analysis of updated evidence and MCA, this assessment confirmed that **Option 1: Permanent Closure of Telephone Road** is the recommended option for the SH1B Telephone Road/Holland Road intersection and rail crossing. This option is estimated to cost $2.25M (95th percentile project estimate, only including capital expenditure costs).

However, in pursuing this option, its impacts should be carefully managed i.e. public and stakeholder buy-in, network productivity, community severance, and additional road upgrades for Seddon Road, Waverley Road, and Holland Road. While the impact to the local community is a key risk, adequate diversion routes are available via the Expressway and the diversion route. Adverse severance impacts can be accounted for through a level pedestrian/cyclist (non-vehicle) rail crossing in agreement with KiwiRail requirements. There is also an opportunity to provide a safe permanent school bus stop at Holland Road.

Parties involved will need to resolve the outstanding $1.07M safety cost issues identified during this project. However, it is difficult to solely attribute these costs to changes at the Telephone Road intersection when there are several other contributing factors such as changed traffic patterns from the Waikato Expressway.

While permanently closing Telephone Road has adverse impacts, this assessment emphasises that alternatives which re-open Telephone Road and meet KiwiRail's requirements are unable to provide higher value for money, lesser adverse climate change impacts, and higher technical achievability.

Glossary

Average Daily Traffic (ADT)	Measure for traffic volumes expressed by vehicles per day (vpd).
Crash migration	Crashes are reduced at the site but may move to another different site.
Do Minimum	A baseline scenario, which is the existing situation of Telephone Road being temporarily closed to road traffic, with traffic diverted through Seddon Road, Waverley Road and Holland Road. See Section 2.1.
DSI equivalents	Estimation of the number of deaths and serious injuries likely to occur at an intersection or on a corridor, based on the total number of injury crashes that have occurred.
High Risk Intersection Assessment	A nationally consistent method for crash risk analysis of intersection documented in the Waka Kotahi High Risk Intersection Guide.
Indicative Efficiency Rating (IER)	A Waka Kotahi industry-wide tool can be used to test the high-level benefits of interventions/options. Higher IER ranges are more favourable. This tool is limited as it relies on approximate factors such as DSI reduction.
Multi-Criteria Analysis (MCA)	A method used to assess multiple criteria, both quantitative and qualitative, to compare different alternatives and options.
Reference Case	A theoretical baseline scenario to support decision-making. For this report, the Reference Case is that Telephone Road is open to road traffic post-Waikato Expressway with the current intersection arrangement. See Section 2.1.
Sensitivity testing	Analysis to enable the robust examination of the results by exploring their responsiveness to weighted changes to different criteria in a Multi-Criteria Analysis.
State Highway 1B (SH1B) and State Highway 26 Revocation Single Stage Business Case (Revocation SSBC)	A project investigation by Waka Kotahi and WSP into the recommended way forward for State Highways 1B and 26 in Waikato, as a result of the opening of the Waikato Expressway.

Appendix A – SIDRA 9.0 Modelling Outputs

MOVEMENT SUMMARY

Site: 101 [Reference Case (1 hour AM Peak) (Site Folder: Existing AM)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marshmeadow														
1	L2	1	2.0	1	2.0	0.081	9.8	LOS A	0.3	2.1	0.16	0.97	0.16	72.0
2	T1	83	2.0	83	2.0	0.081	9.5	LOS A	0.3	2.1	0.16	0.97	0.16	71.7
3	R2	5	2.0	5	2.0	0.081	9.8	LOS A	0.3	2.1	0.16	0.97	0.16	71.6
Approach		89	2.0	89	2.0	0.081	9.5	LOS A	0.3	2.1	0.16	0.97	0.16	71.7
East: Holland east														
4	L2	5	0.0	5	0.0	0.030	7.8	LOS A	0.0	0.3	0.01	0.13	0.01	85.4
5	T1	45	2.0	45	2.0	0.030	0.0	LOS A	0.0	0.3	0.01	0.13	0.01	95.9
6	R2	6	2.0	6	2.0	0.030	7.5	LOS A	0.0	0.3	0.01	0.13	0.01	83.9
Approach		56	1.8	56	1.8	0.030	1.5	NA	0.0	0.3	0.01	0.13	0.01	93.4
North: Telephone														
7	L2	7	2.0	7	2.0	0.077	9.7	LOS A	0.3	2.0	0.09	1.01	0.09	71.8
8	T1	76	2.0	76	2.0	0.077	9.5	LOS A	0.3	2.0	0.09	1.01	0.09	71.5
9	R2	3	2.0	3	2.0	0.077	9.8	LOS A	0.3	2.0	0.09	1.01	0.09	71.4
Approach		86	2.0	86	2.0	0.077	9.5	LOS A	0.3	2.0	0.09	1.01	0.09	71.5
West: Holland west														
10	L2	1	2.0	1	2.0	0.004	8.0	LOS A	0.0	0.1	0.04	0.16	0.04	83.3
11	T1	6	2.0	6	2.0	0.004	0.0	LOS A	0.0	0.1	0.04	0.16	0.04	94.5
12	R2	1	2.0	1	2.0	0.004	7.6	LOS A	0.0	0.1	0.04	0.16	0.04	82.8
Approach		8	2.0	8	2.0	0.004	2.0	NA	0.0	0.1	0.04	0.16	0.04	91.3
All Vehicles		239	2.0	239	2.0	0.081	7.4	NA	0.3	2.1	0.10	0.76	0.10	76.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [7.5x Worst Case (1 hour AM Peak) (Site Folder: Existing AM)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marshmeadow														
1	L2	1	2.0	1	2.0	1.083	181.7	LOS F	86.5	616.0	1.00	3.94	13.61	16.1
2	T1	619	2.0	619	2.0	1.083	184.1	LOS F	86.5	616.0	1.00	3.94	13.61	16.1
3	R2	40	2.0	40	2.0	1.083	211.7	LOS F	86.5	616.0	1.00	3.94	13.61	16.1
Approach		660	2.0	660	2.0	1.083	185.8	LOS F	86.5	616.0	1.00	3.94	13.61	16.1
East: Holland east														
4	L2	40	2.0	40	2.0	0.227	8.0	LOS A	0.4	2.8	0.04	0.13	0.04	84.0
5	T1	342	2.0	342	2.0	0.227	0.0	LOS A	0.4	2.8	0.04	0.13	0.04	95.4
6	R2	46	2.0	46	2.0	0.227	7.6	LOS A	0.4	2.8	0.04	0.13	0.04	83.5
Approach		428	2.0	428	2.0	0.227	1.6	NA	0.4	2.8	0.04	0.13	0.04	92.8
North: Telephone														
7	L2	51	2.0	51	2.0	0.971	42.8	LOS E	32.0	227.6	0.69	1.79	4.11	40.9
8	T1	571	2.0	571	2.0	0.971	48.9	LOS E	32.0	227.6	0.69	1.79	4.11	40.8
9	R2	19	2.0	19	2.0	0.971	75.8	LOS F	32.0	227.6	0.69	1.79	4.11	40.8
Approach		641	2.0	641	2.0	0.971	49.2	LOS E	32.0	227.6	0.69	1.79	4.11	40.8
West: Holland west														
10	L2	1	2.0	1	2.0	0.025	8.7	LOS A	0.0	0.1	0.03	0.03	0.03	86.5
11	T1	45	2.0	45	2.0	0.025	0.0	LOS A	0.0	0.1	0.03	0.03	0.03	98.7
12	R2	1	2.0	1	2.0	0.025	8.8	LOS A	0.0	0.1	0.03	0.03	0.03	86.0
Approach		47	2.0	47	2.0	0.025	0.4	NA	0.0	0.1	0.03	0.03	0.03	98.1
All Vehicles		1776	2.0	1776	2.0	1.083	87.2	NA	86.5	616.0	0.63	2.14	6.55	28.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix B – Waka Kotahi Crash Analysis System Outputs

NZ TRANSPORT AGENCY WAKA KOTAHI CAS

SH1B Telephone/Holland

Crash severity

Fatal Crash, Serious Crash, Minor Crash, Non-Injury Crash

Crash year

2011 — 2021

Saved sites

SH1B Telephone/Holland 50m

Site details report

Fatal crashes: 0 | **Injury crashes:** 20 | **Non-injury crashes:** 29 | **Total crashes:** 49

Overall crash statistics

Crash severity

Crash severity	Number	%	Social cost $(m)
Fatal	0	0	0
Serious	6	12.24	4.25
Minor-injury	14	28.57	1.54
Non-injury	29	59.18	1.21
TOTAL	49	100	7.00

Crash numbers

Year	Fatal	Serious	Minor	Non-injury
2011	0	0	0	7
2012	0	0	1	2
2013	0	2	3	2
2014	0	0	3	2
2015	0	0	1	0
2016	0	0	1	1
2017	0	0	1	5
2018	0	1	1	4
2019	0	1	1	2
2020	0	1	1	4
2021	0	1	1	0
TOTAL	0	6	14	29
Percent	0	12.24	28.56	59.17

Overall casualty statistics

Injury severity

Injury severity	Number	% all casualties
Fatal	0	0.00
Serious Injured	7	21.88
Minor Injured	25	78.13
TOTAL	32	100.00

Casualty numbers

Year	Fatal	Serious Injured	Minor Injured
2011	0	0	0
2012	0	0	3
2013	0	3	11
2014	0	0	3
2015	0	0	1
2016	0	0	1
2017	0	0	1
2018	0	1	1
2019	0	1	1
2020	0	1	2
2021	0	1	1
TOTAL	0	7	25
Percent	0.00	21.88	78.13

Note: Last 5 years of crashes shown (unless query includes specific date range).

Crash type and cause statistics

Crash type

Crash type	Crash numbers	% All crashes
Overtaking crashes	3	6.12
Straight road lost control/head on	1	2.04
Bend - lost control/Head on	2	4.08
Rear end/obstruction	5	10.2
Crossing/turning	36	73.47
Pedestrian crashes	0	0
Miscellaneous crashes	2	4.08
TOTAL	49	100

Casualty types

Casualty types	Fatalities	Serious injuries	Minor injuries
Cyclists	0	0	0
Drivers	0	2	13
Motorcycle pillions	0	0	1
Motorcycle riders	0	2	0
Passengers	0	3	11
Pedestrians	0	0	0
Other	0	0	0
TOTAL	0	7	25

Note: Motorcycle stats include Mopeds.

Driver and vehicle statistics

Crash factors

Crash factors	Crash numbers	% All crashes
#N/A	16	32.65
Alcohol	1	2.04
Disabled, old age or illness	2	4.08
Failed to give way or stop	35	71.43
Fatigue	2	4.08
Incorrect lanes or position	4	8.16
Miscellaneous factors	2	4.08
Overtaking	2	4.08
Pedestrian factors	0	0.00
Poor handling	2	4.08
Poor judgement	8	16.33
Poor observation	28	57.14
Position on Road	1	2.04
Road factors	3	6.12
Travel Speed	4	8.16
Unknown	0	0.00
Vehicle factors	0	0.00
Weather	2	4.08
TOTAL	112	228.57

Crashes with:

Factor groups	Crash numbers	% All crashes
All road user factors	19	38.78
Driver only factors	49	100.00
Pedestrian factors	0	0.00
Vehicle factors	0	0.00
Road factors	3	6.12
Environment factors	2	4.08
No identifiable factors	0	0.00
Retired codes - no future use	1	2.04
TOTAL	74	151.02

Notes: Factors are counted once against a crash - i.e. two fatigued drivers count as one fatigue crash factor.

Driver/vehicle factors are not available for non-injury crashes for Northland, Auckland, Waikato and Bay of Plenty before 2007. This will influence numbers and percentages.

% represents the % of crashes in which the cause factor appears.

Drivers at fault or part fault in injury crashes - by age

Age	Male	Female	Unknown	Total	Percentage (%)
0-4	0	0	0	0	0.00
5-9	0	0	0	0	0.00
10-14	0	0	0	0	0.00
15-19	0	1	0	1	5.00
20-24	2	2	0	4	20.00
25-29	2	0	0	2	10.00
30-34	2	1	0	3	15.00
35-39	0	0	0	0	0.00
40-44	1	0	0	1	5.00
45-49	1	0	0	1	5.00
50-54	0	2	0	2	10.00
55-59	0	0	0	0	0.00
60-64	0	0	0	0	0.00
65-69	1	0	0	1	5.00
70-74	2	0	0	2	10.00
75-79	2	0	0	2	10.00
80-84	1	0	0	1	5.00
85-89	0	0	0	0	0.00
90-94	0	0	0	0	0.00
95-99	0	0	0	0	0.00
100+	0	0	0	0	0.00
Unknown	0	0	0	0	0.00
TOTAL	14	6	0	20	–
Percent	70.00	30.00	0.00	100.00	–

Note: Driver information is not calculated for non-injury crashes.

Number of parties in crash

Party type	All crashes	% All crashes
Single party	2	4.08
Multiple party, including pedestrian	0	0.00
Multiple party, excluding pedestrian	47	95.92
TOTAL	49	100

Vulnerable road users

Crash types	Number	Percentage (%)
Cyclist crashes	0	0.00
Pedestrian crashes	0	0.00
Motorcycle crashes	2	4.08
All other crashes	47	95.92

Note: Some crashes involve more than one vulnerable road user type.

Note: Motorcycle stats include Mopeds.

Road environment statistics

Road type

Road type	State highway	Local road	Unknown	N/A	Total	Percentage (%)
Urban	6	0	0	0	6	12.24
Open	36	7	0	0	43	87.76
Unknown	0	0	0	0	0	0.00
TOTAL	42	7	0	0	49	–
Percent	85.71	14.29	0.00	0.00	100.00	–

Natural light conditions

Conditions	Injury	Non-injury	Total	%
Light/overcast	17	23	40	81.63
Dark/twilight	3	6	9	18.37
Unknown	0	0	0	0.00
TOTAL	20	29	49	100

Drivers at fault or part fault in injury crashes - by licence

Licence	Male	Female	Unknown	Total	Percentage (%)
Full	11	4	0	15	75.00
Learner	0	0	0	0	0.00
Restricted	0	2	0	2	10.00
Overseas	3	0	0	3	15.00
Wrong class	0	0	0	0	0.00
Never Licensed	0	0	0	0	0.00
Unknown	0	0	0	0	0.00
Forbidden	0	0	0	0	0.00
TOTAL	14	6	0	20	–
Percent	70.00	30.00	0.00	100.00	–

Note: Driver information is not calculated for non-injury crashes.

Vehicles involved in injury crashes (vehicle count)

Vehicle type	No. of vehicles	% of vehicles in injury crashes
Car/Wagon	30	73.17
SUV	6	14.63
Van	2	4.88
Ute	0	0.00
Truck	0	0.00
Truck HPMV	0	0.00
Bus	0	0.00
Motorcycle	2	4.88
Moped	0	0.00
Train	1	2.44
Cycle	0	0.00
Other	0	0.00
Unknown	0	0.00
50 Max	0	0.00
Left scene	0	0.00
Uncoupled towed vehicle	0	0.00
TOTAL	41	100.00

Conditions

Conditions	Injury	Non-injury	Total	%
Dry	16	26	42	85.71
Ice or Snow	0	0	0	0.00
Wet	4	3	7	14.29
Null	0	0	0	0.00
TOTAL	20	29	49	100

Intersection/midblock

Intersection/mid-block	Total	%
Intersection	49	100.00
Midblock	0	0
TOTAL	49	100

Vehicles involved in injury crashes (crash count)

Vehicle type	Injury crashes	% of injury crashes
Car/Wagon	20	100.00
SUV	6	30.00
Van	2	10.00
Ute	0	0.00
Truck	0	0.00
Truck HPMV	0	0.00
Bus	0	0.00
Motorcycle	2	10.00
Moped	0	0.00
Train	1	5.00
Cycle	0	0.00
Other	0	0.00
Unknown	0	0.00
50 Max	0	0.00
Left scene	0	0.00
Uncoupled towed vehicle	0	0.00
TOTAL	31	155.00

Objects struck

Objects struck	Injury crashes	%	Non-injury crashes	%
Crashes w/obj struck	4	8.16	9	18.37

Object struck	Injury crashes	%	Non-injury crashes	%
Animals	0	0.00	0	0.00
Bridges/Tunnels	0	0.00	0	0.00
Cliffs	0	0.00	0	0.00
Debris	0	0.00	0	0.00
Embankments	0	0.00	0	0.00
Fences	2	4.08	1	2.04
Guide/Guard rails	0	0.00	1	2.04
Houses	0	0.00	0	0.00
Traffic Islands	0	0.00	0	0.00
Street Furniture	0	0.00	0	0.00
Kerbing	0	0.00	0	0.00
Landslips	0	0.00	0	0.00
Parked vehicle	0	0.00	0	0.00
Trains	0	0.00	1	2.04
Sight Rails	0	0.00	0	0.00
Poles	2	4.08	2	4.08
Stationary Vehicle	0	0.00	0	0.00
Roadwork	0	0.00	0	0.00
Traffic Sign	0	0.00	1	2.04
Trees	0	0.00	0	0.00
Drainage Structures	0	0.00	0	0.00
Ditches	0	0.00	5	10.20
Other	0	0.00	0	0.00
Thrown or dropped objects	0	0.00	0	0.00
Water	0	0.00	0	0.00
TOTAL	4	–	11	–

Note: % represents the % of crashes in which the object is struck.

Vehicle usage in injury crashes

Vehicle usage	Fatal Crash	Serious Crash	Minor Crash	Total	Percentage (%)
Private	0	7	4	11	26.83
Attenuator Truck	0	0	0	0	0.00
Agricultural	0	0	0	0	0.00
Ambulance	0	0	0	0	0.00
Campervan	0	0	0	0	0.00
Concrete mixer	0	0	0	0	0.00
Fire	0	0	0	0	0.00
Logging truck	0	0	0	0	0.00
Mobile crane	0	0	0	0	0.00
Police	0	0	0	0	0.00
Rental	0	0	1	1	2.44
Road Working	0	0	0	0	0.00
Scheduled service Bus	0	0	0	0	0.00
School bus	0	0	0	0	0.00
Tanker	0	0	0	0	0.00
Taxi	0	0	0	0	0.00
Tour Bus	0	0	0	0	0.00
Trade person	0	0	0	0	0.00
Work travel	0	0	0	0	0.00
Work vehicle	0	0	0	0	0.00
Other	0	0	0	0	0.00
Null	0	6	23	29	70.73
TOTAL	0	13	28	41	–
Percent	0.00	31.71	68.29	100.00	–

Time period statistics

Month by injury/ non-injury crashes

Month	Injury crashes	%	Non-injury crashes	%	Total	%
Jan	2	10	5	17.24	7	14.29
Feb	0	0	1	3.45	1	2
Mar	2	10	4	13.79	6	12.24
Apr	0	0	2	7	2	4
May	0	0	4	13.79	4	8.16
Jun	2	10	3	10.34	5	10.2
Jul	2	10	1	3.45	3	6.12
Aug	1	5	5	17.24	6	12.24
Sep	0	0	2	7	2	4
Oct	3	15	1	3.45	4	8.16
Nov	1	5	0	0	1	2
Dec	7	35	1	3.45	8	16.33
TOTAL	20	100	29	100	49	100

Day/period

Day/Period	All crashes	% All crashes
Weekday	29	59.18
Weekend	20	40.82
TOTAL	49	100

Day/period by hour

Day/Period	00:00 - 02:59	03:00 - 05:59	06:00 - 08:59	09:00 - 11:59	12:00 - 14:59	15:00 - 17:59	18:00 - 20:59	21:00 - 23:59	Total
Weekday	0	0	6	6	7	7	3	0	29
Weekend	0	0	0	3	4	7	5	1	20
TOTAL	0	0	6	9	11	14	8	1	49

Day/period by hour DOW

Day/Period	00:00 - 02:59	03:00 - 05:59	06:00 - 08:59	09:00 - 11:59	12:00 - 14:59	15:00 - 17:59	18:00 - 20:59	21:00 - 23:59	Total
Mon	0	0	1	1	1	1	2	0	6
Tue	0	0	0	3	3	1	0	0	7
Wed	0	0	2	1	1	1	0	0	5
Thu	0	0	2	1	1	2	1	0	7
Fri	0	0	1	0	1	2	5	0	9
Sat	0	0	0	2	2	3	0	1	8
Sun	0	0	0	1	2	4	0	0	7
TOTAL	0	0	6	9	11	14	8	1	49

SH1B Telephone/Holland

Crash severity

Fatal Crash, Serious Crash, Minor Crash, Non-Injury Crash

Crash year

2022

Saved sites

SH1B Telephone/Holland 50m

Crash date

Site details report

Fatal crashes: 0 | **Injury crashes:** 3 | **Non-injury crashes:** 0 | **Total crashes:** 3

Overall crash statistics

Crash severity

Crash severity	Number	%	Social cost $(m)
Fatal	0	0	0
Serious	2	66.67	1.42
Minor-injury	1	33.33	0.11
Non-injury	0	0	0
TOTAL	3	100	1.53

Crash numbers

Year	Fatal	Serious	Minor	Non-injury
2022	0	2	1	0
TOTAL	0	2	1	0
Percent	0	66.67	33.33	0

Overall casualty statistics

Injury severity

Injury severity	Number	% all casualties
Fatal	0	0.00
Serious Injured	2	50.00
Minor Injured	2	50.00
TOTAL	4	100.00

Casualty numbers

Year	Fatal	Serious Injured	Minor Injured
2022	0	2	2
TOTAL	0	2	2
Percent	0.00	50.00	50.00

Note: Last 5 years of crashes shown (unless query includes specific date range).

Crash type and cause statistics

Crash type

Crash type	Crash numbers	% All crashes
Overtaking crashes	0	0
Straight road lost control/head on	2	66.67
Bend - lost control/Head on	0	0
Rear end/obstruction	0	0
Crossing/turning	1	33.33
Pedestrian crashes	0	0
Miscellaneous crashes	0	0
TOTAL	3	100

Casualty types

Casualty types	Fatalities	Serious injuries	Minor injuries
Cyclists	0	0	0
Drivers	0	2	2
Motorcycle pillions	0	0	0
Motorcycle riders	0	0	0
Passengers	0	0	0
Pedestrians	0	0	0
Other	0	0	0
TOTAL	0	2	2

Note: Motorcycle stats include Mopeds.

Driver and vehicle statistics

Crash factors

Crash factors	Crash numbers	% All crashes
#N/A	1	33.33
Alcohol	2	66.67
Disabled, old age or illness	1	33.33
Failed to give way or stop	1	33.33
Fatigue	0	0.00
Incorrect lanes or position	2	66.67
Miscellaneous factors	0	0.00
Overtaking	0	0.00
Pedestrian factors	0	0.00
Poor handling	0	0.00
Poor judgement	0	0.00
Poor observation	0	0.00
Position on Road	0	0.00
Road factors	0	0.00
Travel Speed	0	0.00
Unknown	0	0.00
Vehicle factors	0	0.00
Weather	0	0.00
TOTAL	7	233.33

Crashes with:

Factor groups	Crash numbers	% All crashes
All road user factors	3	100.00
Driver only factors	3	100.00
Pedestrian factors	0	0.00
Vehicle factors	0	0.00
Road factors	0	0.00
Environment factors	0	0.00
No identifiable factors	0	0.00
Retired codes - no future use	0	0.00
TOTAL	6	200.00

Notes: Factors are counted once against a crash - i.e. two fatigued drivers count as one fatigue crash factor.

Driver/vehicle factors are not available for non-injury crashes for Northland, Auckland, Waikato and Bay of Plenty before 2007. This will influence numbers and percentages.

% represents the % of crashes in which the cause factor appears.

Drivers at fault or part fault in injury crashes - by age

Age	Male	Female	Unknown	Total	Percentage (%)
0-4	0	0	0	0	0.00
5-9	0	0	0	0	0.00
10-14	0	0	0	0	0.00
15-19	0	1	0	1	25.00
20-24	0	0	0	0	0.00
25-29	0	0	0	0	0.00
30-34	0	0	0	0	0.00
35-39	1	0	0	1	25.00
40-44	0	0	0	0	0.00
45-49	0	0	0	0	0.00
50-54	0	0	0	0	0.00
55-59	1	0	0	1	25.00
60-64	1	0	0	1	25.00
65-69	0	0	0	0	0.00
70-74	0	0	0	0	0.00
75-79	0	0	0	0	0.00
80-84	0	0	0	0	0.00
85-89	0	0	0	0	0.00
90-94	0	0	0	0	0.00
95-99	0	0	0	0	0.00
100+	0	0	0	0	0.00
Unknown	0	0	0	0	0.00
TOTAL	3	1	0	4	–
Percent	75.00	25.00	0.00	100.00	–

Note: Driver information is not calculated for non-injury crashes.

Number of parties in crash

Party type	All crashes	% All crashes
Single party	2	66.67
Multiple party, including pedestrian	0	0.00
Multiple party, excluding pedestrian	1	33.33
TOTAL	3	100

Vulnerable road users

Crash types	Number	Percentage (%)
Cyclist crashes	0	0.00
Pedestrian crashes	0	0.00
Motorcycle crashes	0	0.00
All other crashes	3	100.00

Note: Some crashes involve more than one vulnerable road user type.

Note: Motorcycle stats include Mopeds.

Road environment statistics

Road type

Road type	State highway	Local road	Unknown	N/A	Total	Percentage (%)
Urban	0	0	0	0	0	0.00
Open	2	1	0	0	3	100.00
Unknown	0	0	0	0	0	0.00
TOTAL	2	1	0	0	3	–
Percent	66.67	33.33	0.00	0.00	100.00	–

Natural light conditions

Conditions	Injury	Non-injury	Total	%
Light/overcast	2	0	2	66.67
Dark/twilight	1	0	1	33.33
Unknown	0	0	0	0.00
TOTAL	3	0	3	100

Drivers at fault or part fault in injury crashes - by licence

Licence	Male	Female	Unknown	Total	Percentage (%)
Full	3	0	0	3	75.00
Learner	0	0	0	0	0.00
Restricted	0	1	0	1	25.00
Overseas	0	0	0	0	0.00
Wrong class	0	0	0	0	0.00
Never Licensed	0	0	0	0	0.00
Unknown	0	0	0	0	0.00
Forbidden	0	0	0	0	0.00
TOTAL	3	1	0	4	–
Percent	75.00	25.00	0.00	100.00	–

Note: Driver information is not calculated for non-injury crashes.

Vehicles involved in injury crashes (vehicle count)

Vehicle type	No. of vehicles	% of vehicles in injury crashes
Car/Wagon	3	75.00
SUV	0	0.00
Van	0	0.00
Ute	0	0.00
Truck	1	25.00
Truck HPMV	0	0.00
Bus	0	0.00
Motorcycle	0	0.00
Moped	0	0.00
Train	0	0.00
Cycle	0	0.00
Other	0	0.00
Unknown	0	0.00
50 Max	0	0.00
Left scene	0	0.00
Uncoupled towed vehicle	0	0.00
TOTAL	4	100.00

Conditions

Conditions	Injury	Non-injury	Total	%
Dry	3	0	3	100.00
Ice or Snow	0	0	0	0.00
Wet	0	0	0	0.00
Null	0	0	0	0.00
TOTAL	3	0	3	100

Intersection/midblock

Intersection/mid-block	Total	%
Intersection	2	66.67
Midblock	1	33.33
TOTAL	3	100

Vehicles involved in injury crashes (crash count)

Vehicle type	Injury crashes	% of injury crashes
Car/Wagon	2	66.67
SUV	0	0.00
Van	0	0.00
Ute	0	0.00
Truck	1	33.33
Truck HPMV	0	0.00
Bus	0	0.00
Motorcycle	0	0.00
Moped	0	0.00
Train	0	0.00
Cycle	0	0.00
Other	0	0.00
Unknown	0	0.00
50 Max	0	0.00
Left scene	0	0.00
Uncoupled towed vehicle	0	0.00
TOTAL	3	100.00

Objects struck

Objects struck	Injury crashes	%	Non-injury crashes	%
Crashes w/obj struck	2	66.67	0	0.00

Object struck	Injury crashes	%	Non-injury crashes	%
Animals	0	0.00	0	0.00
Bridges/Tunnels	0	0.00	0	0.00
Cliffs	0	0.00	0	0.00
Debris	0	0.00	0	0.00
Embankments	0	0.00	0	0.00
Fences	2	66.67	0	0.00
Guide/Guard rails	0	0.00	0	0.00
Houses	0	0.00	0	0.00
Traffic Islands	0	0.00	0	0.00
Street Furniture	0	0.00	0	0.00
Kerbing	0	0.00	0	0.00
Landslips	0	0.00	0	0.00
Parked vehicle	0	0.00	0	0.00
Trains	0	0.00	0	0.00
Sight Rails	0	0.00	0	0.00
Poles	0	0.00	0	0.00
Stationary Vehicle	0	0.00	0	0.00
Roadwork	0	0.00	0	0.00
Traffic Sign	0	0.00	0	0.00
Trees	0	0.00	0	0.00
Drainage Structures	0	0.00	0	0.00
Ditches	0	0.00	0	0.00
Other	0	0.00	0	0.00
Thrown or dropped objects	0	0.00	0	0.00
Water	0	0.00	0	0.00
TOTAL	2	–	0	–

Note: % represents the % of crashes in which the object is struck.

Vehicle usage in injury crashes

Vehicle usage	Fatal Crash	Serious Crash	Minor Crash	Total	Percentage (%)
Private	0	2	1	3	75.00
Attenuator Truck	0	0	0	0	0.00
Agricultural	0	0	0	0	0.00
Ambulance	0	0	0	0	0.00
Campervan	0	0	0	0	0.00
Concrete mixer	0	0	0	0	0.00
Fire	0	0	0	0	0.00
Logging truck	0	0	0	0	0.00
Mobile crane	0	0	0	0	0.00
Police	0	0	0	0	0.00
Rental	0	0	0	0	0.00
Road Working	0	0	0	0	0.00
Scheduled service Bus	0	0	0	0	0.00
School bus	0	0	0	0	0.00
Tanker	0	1	0	1	25.00
Taxi	0	0	0	0	0.00
Tour Bus	0	0	0	0	0.00
Trade person	0	0	0	0	0.00
Work travel	0	0	0	0	0.00
Work vehicle	0	0	0	0	0.00
Other	0	0	0	0	0.00
Null	0	0	0	0	0.00
TOTAL	0	3	1	4	–
Percent	0.00	75.00	25.00	100.00	–

Time period statistics

Month by injury/ non-injury crashes

Month	Injury crashes	%	Non-injury crashes	%	Total	%
Jan	0	0	0	0	0	0
Feb	1	33.33	0	0	1	33.33
Mar	2	66.67	0	0	2	66.67
Apr	0	0	0	0	0	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
TOTAL	3	100	0	0	3	100

Day/period

Day/Period	All crashes	% All crashes
Weekday	0	0
Weekend	3	100
TOTAL	3	100

Day/period by hour

Day/Period	00:00 - 02:59	03:00 - 05:59	06:00 - 08:59	09:00 - 11:59	12:00 - 14:59	15:00 - 17:59	18:00 - 20:59	21:00 - 23:59	Total
Weekday	0	0	0	0	0	0	0	0	0
Weekend	1	0	0	0	1	1	0	0	3
TOTAL	1	0	0	0	1	1	0	0	3

Day/period by hour DOW

Day/Period	00:00 - 02:59	03:00 - 05:59	06:00 - 08:59	09:00 - 11:59	12:00 - 14:59	15:00 - 17:59	18:00 - 20:59	21:00 - 23:59	Total
Sat	1	0	0	0	1	0	0	0	2
Sun	0	0	0	0	0	1	0	0	1
TOTAL	1	0	0	0	1	1	0	0	3

Appendix C – Long List Options & Assessment

Options suggested by community	KiwiRail criteria to be met		Assessment - does it meet the KiwiRail criteria?	
	Grounding out	Stacking distance	Progress?	Comments
Permanently close Telephone Road or convert the intersection to a safer T-intersection with reduced traffic volumes	Pass	Pass	Yes - **Option 1**	Road and rail movements are completely separated reducing all risks of grounding out and stacking.
Close Telephone Road but leave it open for bikes, walkers	Pass	Pass	Yes - **combined with Option 1**	Combined with permanent closure option. Can be combined with permanent closure of Telephone Road. Will require additional work via ped/cycling crossing as required by KiwiRail.
Vertical realignment of SH1B (raise roads around rail crossing)	Pass	Pass	Yes - **Option 2**	Assuming that SH1B realignment also includes shifting Holland Road to allow for longer distance between intersection and railway, this addresses both grounding out and stacking distance.
Vertical realignment of SH1B (raise roads around rail crossing) and prioritise SH1B over Holland Road (give way/stop to SH1B traffic)	Pass	Pass	Yes - **Option 3**	Assuming that SH1B realignment also includes shifting Holland Road to allow for longer distance between intersection and railway, this addresses both grounding out and stacking distance.
Roundabout	Pass	Pass	Yes - **Option 4**	Only passes if addressed by realigning Holland Road to allow stacking distance
Keep Telephone Road open but restrict/manage heavy vehicles on Telephone Road e.g. Weight/height limit, redirect trucks to the Waikato Expressway, only allow cars/light vehicles, close road to cars and install cameras to alert when a truck passes	Fail	Fail	No	Only meets KiwiRail requirements if road users are compliant i.e. Enforcement required. KiwiRail are unlikely to support as they are not aware of any solution that provides complete certainty of compliance.
Keep Telephone Road Road Open	Fail	Fail	No	Does not address either rail safety problem.
Barrier arms on the crossing	Fail	Fail	No	May slightly improve situation but does not meet criteria. Compliance may be an issue.
Major speed restrictions/speed humps	Fail	Fail	No	Does not prevent grounding out at the rail track or prevent stacking over the rail track. May worsen issue.
Traffic light intersection	Fail	Fail	No	Not appropriate for rural context and would need enforcement.
Bridge or tunnel	Fail	Fail	No	Not appropriate for context.
Lower rail crossing and raise the road	Pass	Fail	No	Does not address issue of stacking.
Install cameras to monitor the rail crossing	Fail	Fail	No	Not a feasible option; cameras are not a preventative measure for preventing trucks from using the route.
Reduce intersection speed to 30km/h with traffic lights	Fail	Fail	No	Does not meet criteria. Traffic lights do not address both grounding out and stacking issues. Speed limits do not ensure compliance.

Options suggested by community	KiwiRail criteria to be met		Assessment - does it meet the KiwiRail criteria?	
	Grounding out	Stacking distance	Progress?	Comments
Station someone permanently to check the tracks for three months	Fail	Fail	No	Not a permanent solution. Does not meet both KiwiRail criteria and does not address grounding out and stacking issue. Does not ensure compliance.
Lower rail crossing	Pass	Fail	No	Does not address stacking distance.
Add a right turn in bay or allow traffic to pass (note: unclear what road)	Fail	Fail	No	Does not meet criteria for stacking and grounding out.
Install barrier arms, bells and lights at the crossing	Fail	Fail	No	On its own does not meet criteria; does not ensure compliance.
Close road to cars and install cameras to alert when a truck passes	Fail	Fail	No	Does not meet criteria; may not guarantee trucks will not use the route - complaince issue.
Install a stop sign with a speed bump to cross the crossing slowly	Fail	Fail	No	Does not prevent speeding over the speed bump and crossing. Signage does not guarantee compliance.
Only allow heavy vehicles on Telephone Rd if they are servicing Telephone Road residents	Fail	Fail	No	There is still a risk of stacking over the crossing. Does not meet criteria; does not guarantee compliance from heavy vehicle users.
Put juddar bars on Holland road to slow traffic	Fail	Fail	No	Does not meet criteria for stacking and grounding out.
Raise road and put steel sheets between either side of the track to be the same height as the rail	Fail	Fail	No	Does not meet criteria for stacking and grounding out.
Install a 5 way light system to no truck can block the railway	Fail	Pass	No	Not appropriate for context. Does not address grounding out.
Reprofile the road at the crossing and align Telephone and Marshmeadow	Pass	Fail	No	This option alone does not address stacking issue. Should be combined with horizontal realignment (moving Holland Road) to address stacking.
Install chicanes or traffic islands	Fail	Fail	No	Not appropriate for context; does not meet criteria also. Slowing traffic will not completely remove risk of grounding out or stacking.

Appendix D – Short List Option Cost Estimates

Project Estimate

Project Name: Telephone/Holland Road - Option 1

PBE

Programme Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Nett Project Property Cost**	**1,500,000**	**300,000**	**450,000**
	Project Development Phase			
	- Consultancy Fees	0		
	- Client Managed Costs	0		
B	**Total Project Development**	-	-	-
	Pre-Implementation Phase			
	- Consultancy Fees	313,000		
	- Client Managed Costs	98,000		
C	**Total Pre-implementation**	**411,000**	**41,000**	**123,000**
	Implementation Phase			
	Implementation Fees			
1.1	**- Consultancy Fees**	195,000		
1.2	**- Client Managed Costs**	68,000		
1.3	**- Consent Monitoring Fees**	10,000		
	Sub Total Base Implementation Fees	**273,000**	**55,000**	**54,000**
	Physical Works			
1	Environmental Compliance	27,000		
2	Earthworks	508,000		
3	Ground Improvements	99,000		
4	Drainage	54,000		
5	Pavement and Surfacing	1,135,000		
6	Bridges	0		
7	Retaining Walls	0		
8	Traffic Services	177,000		
9	Service Relocations	330,000		
10	Landscaping	336,000		
11	Traffic Management and Temporary Works	462,000		
12	Preliminary and General	781,000		
13	Extraordinary Construction Costs	0		
	Sub Total Base Physical Works	**3,909,000**	**758,000**	**1,012,000**
D	**Total construction**	**4,182,000**	**813,000**	**1,066,000**
E	**Project base estimate** (A+C+D)	**6,093,000**		
F	**Contingency** (Assessed/Analysed)	**(A+C+D)**	**1,154,000**	
G	**Project expected estimate**	**(E+F)**	**7,247,000**	
	Nett Project Property Cost Expected Estimate		1,800,000	
	Project Development Phase Expected Estimate		0	
	Pre-implementation Phase Expected Estimate		452,000	
	Implentation Phase Expected Estimate		4,995,000	
H	**Funding risk** (Assessed/Analysed)		**(A+C+D)**	**1,639,000**
I	**95th percentile Project Estimate**		**(G+H)**	**8,886,000**
	Project property cost 95th percentile estimate			2,250,000
	Investigation and reporting 95th percentile estimate			0
	Design and project documentation 95th percentile estimate			575,000
	Construction 95th percentile estimate			6,061,000

Date of estimate	**13/10/2022**	**Cost Index (Qtr/Year)**	**01/22**
Estimate prepared by	**Joshua Braithwaite**	**Signed**	
Estimate internal peer review by	**Bob Burrows**	**Signed**	
Estimate external peer review by		**Signed**	
Estimate accepted by the NZTA		**Signed**	

Note: (1) These estimates are exclusive of escalation and GST.

Project Estimate

Project Name: Telephone/Holland Road - Option 2

PBE

Programme Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Nett Project Property Cost**	**1,410,000**	**282,000**	**423,000**
	Project Development Phase			
	- Consultancy Fees	0		
	- Client Managed Costs	0		
B	**Total Project Development**	-	-	-
	Pre-Implementation Phase			
	- Consultancy Fees	342,000		
	- Client Managed Costs	107,000		
C	**Total Pre-implementation**	**449,000**	**45,000**	**135,000**
	Implementation Phase			
	Implementation Fees			
1.1	**- Consultancy Fees**	214,000		
1.2	**- Client Managed Costs**	75,000		
1.3	**- Consent Monitoring Fees**	11,000		
	Sub Total Base Implementation Fees	**300,000**	**61,000**	**59,000**
	Physical Works			
1	Environmental Compliance	54,000		
2	Earthworks	856,000		
3	Ground Improvements	137,000		
4	Drainage	54,000		
5	Pavement and Surfacing	1,124,000		
6	Bridges	0		
7	Retaining Walls	0		
8	Traffic Services	177,000		
9	Service Relocations	330,000		
10	Landscaping	225,000		
11	Traffic Management and Temporary Works	462,000		
12	Preliminary and General	854,000		
13	Extraordinary Construction Costs	0		
	Sub Total Base Physical Works	**4,273,000**	**824,000**	**1,091,000**
D	**Total construction**	**4,573,000**	**885,000**	**1,150,000**
E	**Project base estimate** (A+C+D)	**6,432,000**		
F	**Contingency** (Assessed/Analysed)	**(A+C+D)**	**1,212,000**	
G	**Project expected estimate**	**(E+F)**	**7,644,000**	
	Nett Project Property Cost Expected Estimate		1,692,000	
	Project Development Phase Expected Estimate		0	
	Pre-implementation Phase Expected Estimate		494,000	
	Implentation Phase Expected Estimate		5,458,000	
H	**Funding risk** (Assessed/Analysed)		**(A+C+D)**	**1,708,000**
I	**95th percentile Project Estimate**		**(G+H)**	**9,352,000**
	Project property cost 95th percentile estimate			2,115,000
	Investigation and reporting 95th percentile estimate			0
	Design and project documentation 95th percentile estimate			629,000
	Construction 95th percentile estimate			6,608,000

Date of estimate	13/10/2022	**Cost Index (Qtr/Year)**	01/22
Estimate prepared by	Joshua Braithwaite	**Signed**	
Estimate internal peer review by	Bob Burrows	**Signed**	
Estimate external peer review by		**Signed**	
Estimate accepted by the NZTA		**Signed**	

Note: (1) These estimates are exclusive of escalation and GST.

Project Estimate

Holland Rd Roundabout Estimate for SH1B SH26 Revocation Project

DBE

SH26 Corridor

Detailed Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Nett Project Property Cost**	555,000	111,000	111,000
	Project Development Phase			
	- Consultancy Fees			
	- NZTA Managed Costs			
B	**Total Project Development**	-	-	-
	Pre-Implementation Phase			
	- Consultancy Fees	538,000		
	- NZTA Managed Costs	135,000		
C	**Total Pre-implementation**	673,000	135,000	135,000
	Implementation Phase			
	Implementation Fees			
1.1	- Consultancy Fees	538,000		
1.2	- NZTA Managed Costs	108,000		
1.3	- Consent Monitoring Fees	27,000		
	Sub Total Base Implementation Fees	673,000	135,000	168,000
	Physical Works			
2	Environmental Compliance	52,000		
3	Earthworks	277,000		
4	Ground Improvements	0		
5	Drainage	62,000		
6	Pavement and Surfacing	1,781,000		
7	Bridges	0		
8	Retaining Walls	0		
9	Traffic Services	1,494,000		
10	Service Relocations	125,000		
11	Landscaping	192,000		
12	Traffic Management and Temporary Works	422,000		
13	Preliminary and General	969,000		
14	Extraordinary Construction Costs	0		
	Sub Total Base Physical Works	5,374,000	1,075,000	1,437,000
D	**Total construction**	6,047,000	1,210,000	1,605,000
E	**Project base estimate** (A+C+D)	7,275,000		
F	**Contingency** (Assessed/Analysed) (A+C+D)		1,456,000	
G	**Project expected estimate** (E+F)		8,730,000	
	Nett Project Property Cost Expected Estimate		666,000	
	Project Development Phase Expected Estimate		0	
	Pre-implementation Phase Expected Estimate		808,000	
	Implentation Phase Expected Estimate		7,257,000	
H	**Funding risk** (Assessed/Analysed) (A+C+D)			1,851,000
I	**95th percentile Project Estimate** (G+H)			10,580,000
	Project property cost 95th percentile estimate			777,000
	Investigation and reporting 95th percentile estimate			0
	Design and project documentation 95th percentile estimate			943,000
	Construction 95th percentile estimate			8,862,000

Date of estimate	12/04/2021	**Cost Index (Qtr/Year)**	04/20
Estimate prepared by	Bob Burrows/Joshua Braithwaite	**Signed**	
Estimate internal peer review by	Simon Drummond	**Signed**	
Estimate external peer review by		**Signed**	
Estimate accepted by the NZTA		**Signed**	

Note: (1) These estimates are exclusive of escalation and GST.

(2) Project Development Phase Estimates are set to Nil as these are now sunk costs.

Appendix E – Stantec Safe System Assessment Report

SH1B TELEPHONE ROAD SAFETY ASSESSMENT

A Safe System Assessment of Telephone Road and an alternative route via Waverley Rd

25 January 2023

Prepared for:
WSP

Prepared by:
Kirsty Horridge

Project Number:
310205622

Revision	Description	Author	Date	Quality Check	Date	Review	Date
V1	Report for clients review	KH	Jan 2023	JW	Jan 2023	JW	Jan 2023

The conclusions in the Report titled SH1B Telephone Road Safety Assessment are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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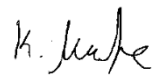
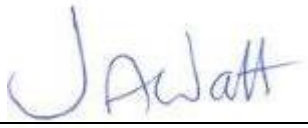
Prepared by: 

Signature

Kirsty Horridge

Printed Name

Reviewed by: 

Signature

James Watt

Printed Name

Approved by: 

Signature

Kirsty Horridge

Printed Name

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

Stantec have been requested by WSP to undertake an independent Road Safety Assessment comparing two routes in the Waikato region on the eastern edge of Hamilton City.

The routes are:

- Puketaha Road to Holland Road via Telephone Rd (the original SH1B route until April 2022),
- Puketaha Road to Holland Road via Seddon, Waverley, and Holland Roads, (known as the Alternative route).

Both Routes shown below in Figure 1-1 below.

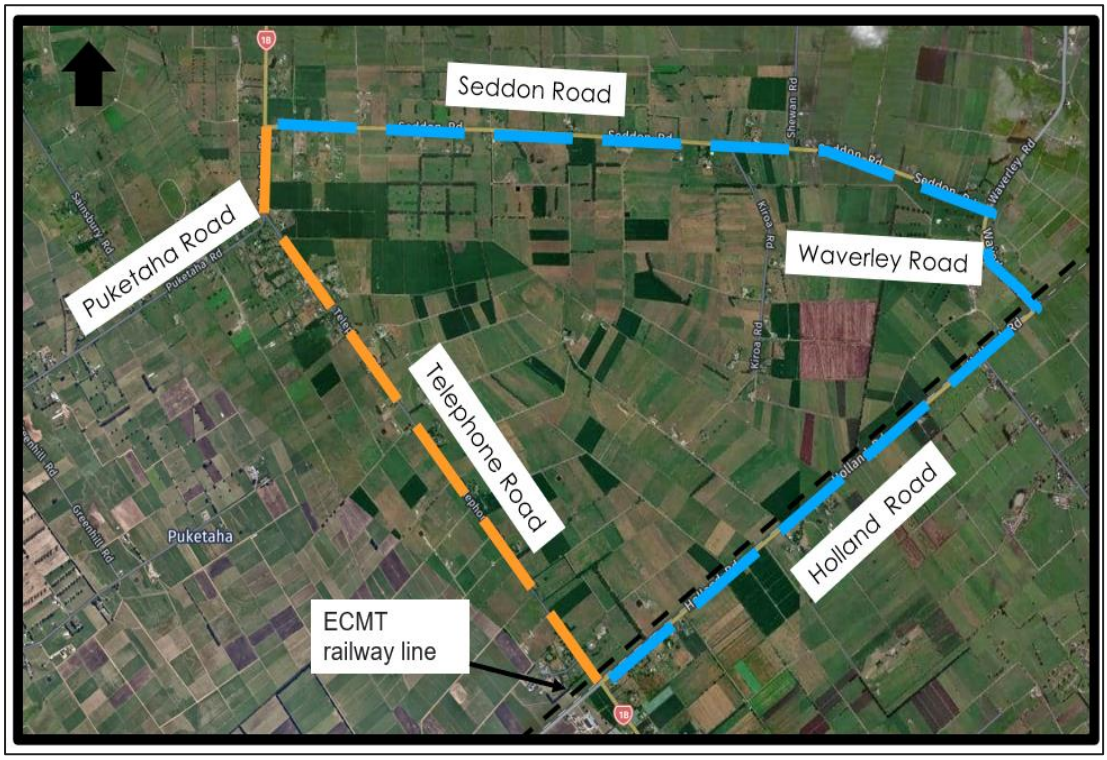


Figure 1-1: Telephone Road (orange) and the Alternative Route (blue)

Telephone Road was until 2022 part of SH1B, an alternative route to SH1 for north-south travelling heavy vehicles bypassing Hamilton. Telephone Road was closed to vehicle traffic in April 2022 at the intersection of Holland Road due to damage to the East Coast Main Trunk (ECMT) railway line level crossing caused by a heavy vehicle bellying onto the track. Since this date, much of the traffic previously using the route has transferred to the Hamilton Expressway, which opened in May 2022. Any residual SH1B vehicle through-traffic has been re-directed through the 'alternative route' as a Temporary Traffic Management detour.

Pedestrians and cyclists are still able to cross the railway line at Telephone Road. Telephone Road is still accessible for resident vehicle traffic as a no-exit road from the Puketaha Road end.

This report will compare the two routes in terms of Road Safety for all modes of transport. The safety team will use the Austroads Safe System Assessment framework during the assessment.

The full Assessment is available in Appendix A. However the overall scores are in section 1.1 of this report.

Acronyms / Abbreviations

LCSIA	Level Crossing Safety Impact Assessment
ECMT	East Coast Main Trunk

1 Summary

Waka Kotahi has closed SH1B Telephone Road between Holland Road intersection and Amber Lane, including the adjacent East Coast Main Truck (ECMT) level crossing. The level crossing is a sharply defined hump with a steep drop on the southern side from the tracks down to the adjacent Holland Road. The constrained vertical geometry exposes the tracks to the threat of damage by low vehicles.

The closure followed damage that occurred in April 2022 and has remained closed with an alternative route in place via Seddon and Waverley Roads. A contributing factor to the continued closure was the opening of the Waikato Expressway, Hamilton section in May 2022 and subsequent transfer of heavy vehicles from SH1B to the expressway, thereby reducing overall demand for SH1B.

Waka Kotahi, Waikato District Council and KiwiRail have shared concerns over the operation of the crossing for some time. Issues include:

1. SH1B vehicles ignoring flashing lights and bells, referenced in the KiwiRail IRIS,

2. Short stacking on the southern approach to the level crossing, queuing back onto Holland Road,

3. Grounding out, by low loader trucks,

4.The high crash rate of the SH1B and Holland Road intersection, and

5.The close proximity of the railway line and the intersection.

A Level Crossing Safety Impact Assessment (LCSIA) was undertaken in 2017 by Waka Kotahi Safe Roads. The assessment identifies a number of alterations that could be made to level crossing to improve safety:

1. Install Half Arm Barriers;

2. Install large passive advanced warning signs;

3. Improve the vertical alignment over the crossing, to reduce the risk of grounding out.

Due to the recent opening of the Waikato Expressway and the expectation that demand will decrease as traffic transfers to the Expressway, no improvements have been made to the crossing since the 2017 assessment.

This report will provide an independent review of the closure and subsequent detour of Telephone Road. It will also review the effects of some potential high-level improvements to both Telephone Road and the alternative route.

2 Introduction

2.1 Site description

Telephone Road, Holland Road, Waverley Road and Seddon Road are all to the east of Hamilton City and provide a rural link between the villages of Newstead, Puketaha and Eureka. The roads are also part of a direct link between northern Hamilton (Rototuna) and the town of Morrinsville to the east.

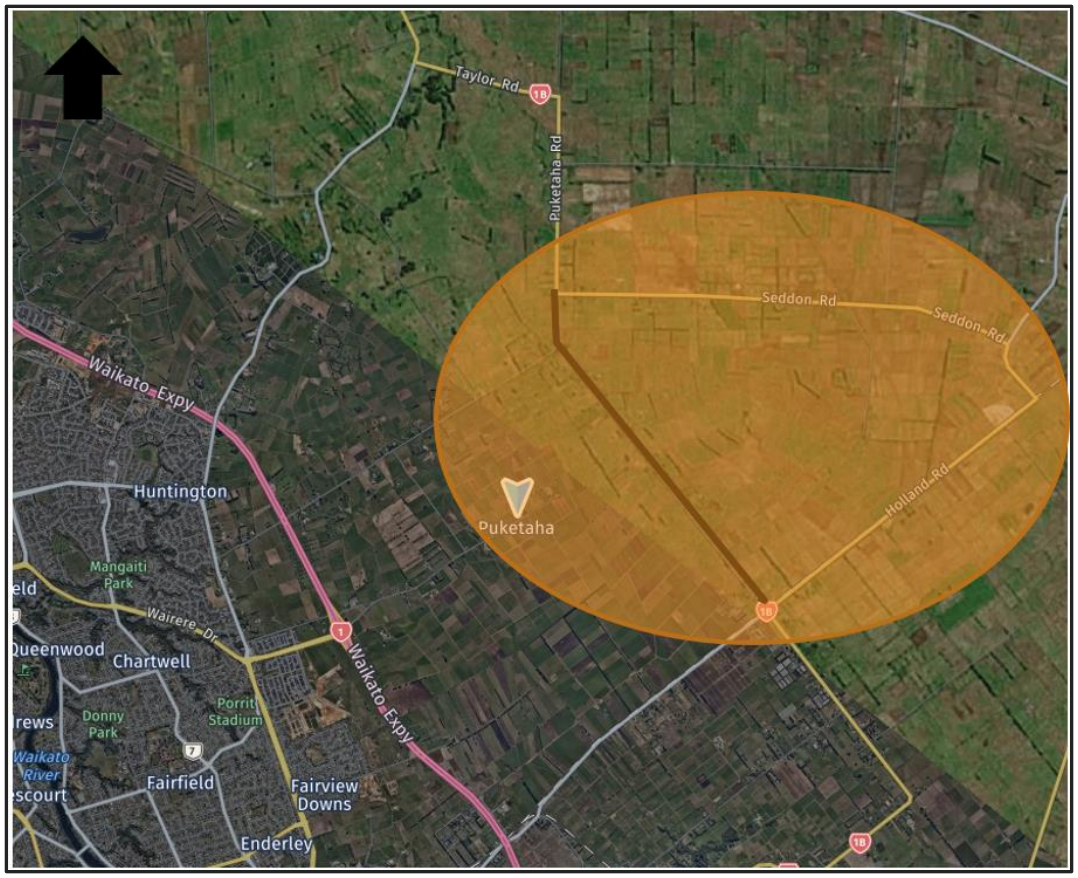


Figure 2-1: Study Area (shown in Orange)

All four of the affected roads have a similar road layout; chipseal surfacing with a 7.5 to 8.5m carriageway and one lane in each direction separated by a white line supplemented with reflective road markers. All have shoulders that vary between 0-1.0m in width with a painted edge line. The alignments are flat, and mostly straight or gently curving.

Some sections on both routes have deep road side drains, with the majority un-protected by road side barrier.

Power poles line all of the roads on at least one side, typically 2-4m off the seal edge.

There are frequent private accesses, mostly servicing farms and/or lifestyle block property. Both routes have a number of low volume, no-exit side roads.

Figure 2-2: Typical Road layout

The two routes discussed in this report are:

- Telephone Road, from Puketaha Road to Holland Road
- The 'Alternative Route', comprising of Seddon Road, Waverley Road and Holland Road.

Table 1: Route Characteristics

Route	Road name	Route Information					
		Length km	Average Traffic Volume 2020	Average Traffic Volume Sept 2022	% difference	Number of Major Intersections	Number of Railway Crossings
Telephone Rd	**Telephone Rd (SH1B)**	4.8	4800	1560	-67%	3	1
Alternative route	**Seddon Rd**	5.76	2500	3300	32%	2	0
	Holland / Waverley Rd)*	5.14	2117	780	-63%	1	1

- Waverley Road is a continuation of Holland Rd, and is assumed to have the same characteristics

Overall the routes are of similar character, although Telephone Road is only half the length of the Alternative Route.

If Telephone Road had closed with no other network changes, we would expect the volume on Telephone Road to drop significantly and the volumes on Seddon, Waverley, and Holland Roads to

increase correspondingly. However, the closure has coincided (within 3 months) with the opening of the Waikato Expressway - Hamilton Section, which has significantly impacted local network travel patterns and appears to have significantly reduced demand on Waverley and Holland Roads.. As the opening of the Expressway, on the 12 July 2022 and the closure of Telephone Road, on the 27 April 2022 , happened within 3 months of each other, it will be combination of both changes, in why there has been a decrease in traffic on Telephone Road, and Holland Road, however an increase in traffic on Seddon Road.

2.2 Road Safety Data

The team have reviewed the crashes from 2016-2021. The majority of crashes are minor or non-injury however a few serious crashes have occurred along both routes.

Midblock crashes are typically loss of controls on straights (17% of all crashes) and loss of control on corners (26%). At the intersections the majority of crashes are turning versus the same direction (10%) and crossing, with no turning (10%).

The crash data reflects the crash risk on each route before the diversion was installed. There has not been enough time since the diversion to generate meaningful crash data that represents the influence of the diversion on crashes.

The data shows more crashes on Telephone Road compared to the alternate route, but this may reflect the higher pre-diversion traffic volume exposure on Telephone Road.

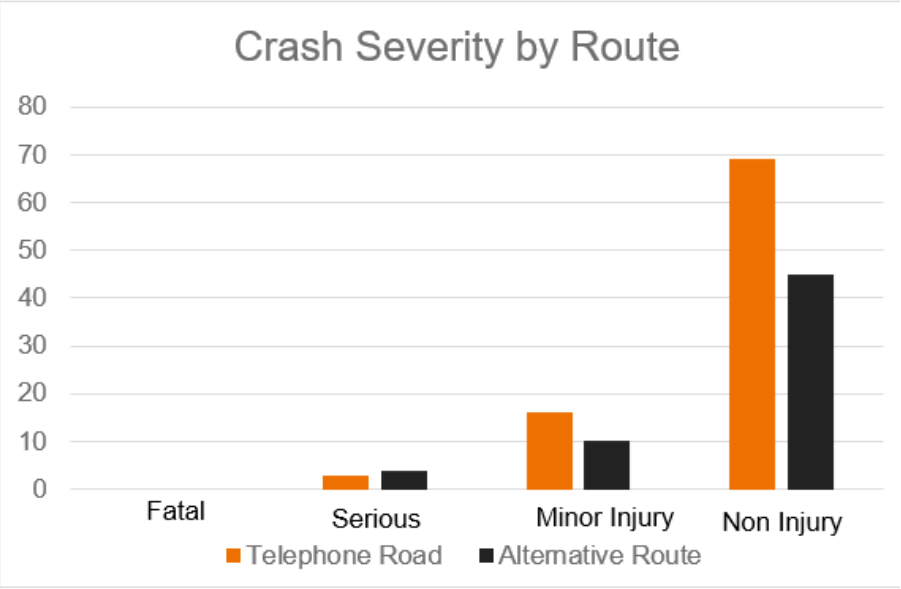


Figure 2-3: Road crash severity

KiwiRail gathers level crossing event information. This provides data on the number of near misses and strikes that occur at the two level crossings.

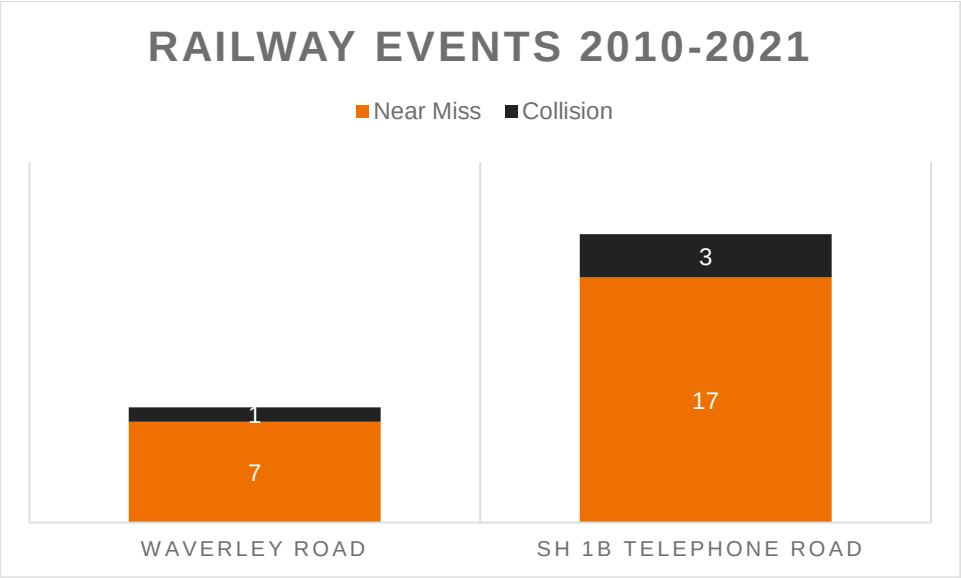


Figure 2-4: Railway events

Railway event data observed by locomotive engineers show that whilst both level crossing have their own near hits and collisions, the Telephone Rd crossing has a significant number more.

2.3 Alternative Users

2.3.1 CYCLISTS

The area is used regularly by recreational cyclists. From Strava cycle map data available, both routes are still used by cyclists even with the closure of Telephone Road.

Figure 2-5: Strava Heat Maps, of the study area (White high use, yellow -moderate use)

The maps show the white routes as busier. Waverley and the eastern end of Seddon Road appear the busiest routes.

Figure 2-6: Cyclist on Waverley Road during the site inspection

The Majority of rides will fall into the ‘fast and furious ‘category, who are confident is being on the road.

Any changes or improvements need to ensure they cater for cyclists through this area.

2.3.2 PEDESTRIANS

The area is relatively rural, with little pedestrian demand apart from school bus activity. Following the closure of Telephone Road a bus stop has been installed within the disused Holland/Telephone intersection splay, which allows pedestrians to cross the railway line to access Telephone Road. Demand at the bus stop, and the subsequent pedestrian crossing activity generated has not been measured, or assessed.

Figure 2-7: Bus Stop shown at the closed level crossing

It's likely this bus stop will stay, especially if the intersection stays closed. If this is the case, pedestrian safety at the level crossing needs to be addressed to ensure the level crossing in compliant with TCD manual part 9.

2.4 Safety System Assessment

A scored safe system assessment has been undertaken in accordance with Waka Kotahi Safe System Assessment Guidelines 2022. The method identifies key route features (such as rail crossings and particular crash types and vulnerable users) and scores the features under the criteria of Exposure, Likelihood and Severity (0 to 4). The criteria are multiplied to achieve a score for that feature. The overall sum of the feature scores provides an overall Risk Score for the road section in question.. Higher scores correspond to a higher risk route. The method is repeated for each road section and option or route alternative.

The scoring system adopted assesses Telephone Road as a closed road, and separately the full alternate route (Seddon, Waverley and Holland). These two scores are compared to a repeated assessment for the two routes with Telephone Road reopened. A further assessment considers the two routes with improvements undertaken.

The option to keep Telephone Road open, with improvements has not been assessed. The key issue with Telephone Road is the alignment of the combined level crossing and Holland Road intersection which to correct would require significant earthworks and pavement lifting and regrading, particularly on the Holland Road side. This degree of intervention is understood to be out of scope.

Table 2: Summary Safe System Assessment Scores

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Alternative Route (Telephone Rd Closed)							
Telephone Rd	4	4	6	0	16	4	4
Alternative Route	18	36	18	24	4	24	36
Total	**22**	**40**	**24**	**24**	**20**	**28**	**40**
Total Score	**198/448**						
Original Route (Telephone Rd Open)							
Telephone Rd	8	16	12	24	4	16	16
Alternative Route	8	16	12	12	4	16	16
Total	**16**	**32**	**24**	**36**	**8**	**32**	**32**
Total Score	**180/448**						
Alternative Route with Improvements (Telephone Rd Closed)							
Telephone Rd	2	4	6	0	8	4	4
Alternative Route	6	36	9	9	4	24	18
Total	**8**	**40**	**15**	**9**	**12**	**28**	**22**
Total Score	**134/448**						

After undertaking the Safe System Assessment, the preferred option is to close Telephone Road level crossing permanently and undertake a number of improvements to both the ‘Alternative route’ and Telephone Road.

Appendix A – provides the full details of this assessment.

3 Route 1 (Telephone Rd) Mitigation Measures

3.1 Intersection of Telephone Road and Puketaha Road

Currently, there are a number of signs and bollards on the Puketaha Road approaches to inform drivers that Telephone Road is closed. If this closure is permanent, these signs need to be removed and/or made permanent.

As part of the temporary works, it has been assumed a ‘no right turn’ sign has been installed on the Puketaha Road north-bound approach to the intersection.

Figure 3-1: Puketaha Road (2017) no signage installed

This is an inappropriate sign as it is presumably intended to deter SH1B users but legally bans all right turns, including legitimate resident access. This could be confusing for drivers, as the right turn is still accessible.

Figure 3-2: Temporary no right turn sign

At the intersection the temporary orange bollards have been installed.

Figure 3-3: Temporary orange bollards

3.1.1 PROPOSED TELEPHONE/PUKETAHA INTERSECTION IMPROVEMENTS

Table 3: Telephone/Puketaha Intersection Improvements

Problem	Recommendation	Constraints	Length/Quantity
Temporary traffic management on site, which is creating sign clutter and distraction to drivers	remove temporary traffic management and install signage that needs to be permanent	N/A	5 new signs

3.2 Telephone Road

Telephone Road is generally straight with a number of rural accesses.

Very deep (4m+) drains, with steep drop-offs from the edge of the seal run along the eastern side of the road at its northern end, crossed with concrete structures providing access to adjacent properties. The proximity of these hazards to the carriageway means there is risk of death or serious injury to the occupants of any errant vehicle that does not remain on the sealed carriageway.

Figure 3-4: Deep side drains and driveway crossing on Telephone Road

The straight alignment of the road and low traffic volumes reduces the likelihood and exposure of vehicles to these hazards. The safety team do not consider mitigation measures are necessary If the road remains no exit, with low traffic volumes. However, if the road reopens to through traffic, then road side barrier or other mitigation measure should be considered.

3.3 Telephone Road/Holland Road/ECMT

The primary reason for the closure of Telephone road is the high-risk level crossing near Holland Road.

This level crossing has had 20 near hits or collisions over the past 11 years, along with several track damage incidents resulting in closures of both the railway line and Telephone Road.

Waka Kotahi and KiwiRail have agreed to close the road, and keep the railway line open.. As part of this change a bus stop has been installed within the adjacent intersection splay. The safety team understands that this primarily used for school bus activity. It is not used by other bus services.

Figure 3-5: Bus Stop within the intersection

The Safety team understand the majority of users cross the railway to get to and from the bus stop. The safety team recommends that if the bus stop stays, a pedestrian gate is installed to keep the children safe. The TCD manual part 9: Level Crossings suggests the installation of a pedestrian maze for the safe passage of pedestrians, as shown below.

Due to the age of the bus users, the safety team would also suggest fencing 300m either side of the maze to encourage pedestrians to use the maze.

Figure 8.1 Typical pedestrian maze for level crossings

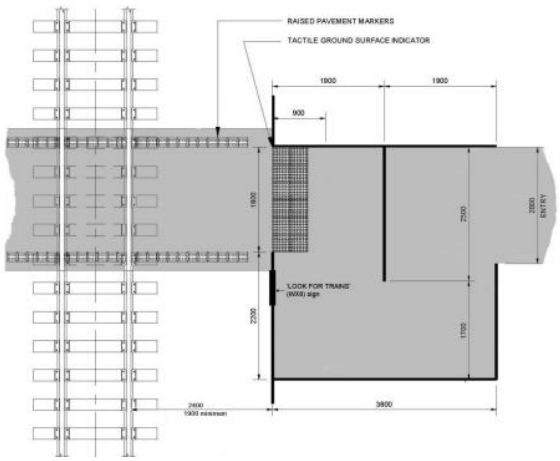


Figure 3-6: typical pedestrian details from TCD manual

3.3.1 PROPOSED TELEPHONE RD LEVEL CROSSING IMPROVEMENTS

Table 4: Telephone Level Crossing Improvements

Problem	Recommendation	Constraints	Length/Quantity
Pedestrian crossing the railway line, without any protection	consider installing a pedestrian facility at the level crossing	high cost item and some surfacing level changes likely required	1
Pedestrians could try and cross railway line in an unsafe location	install pedestrian fencing 300m each side of the pedestrian maze	consultation with KiwiRail required	600m

4 Route 2 (Alternative Route) Mitigation Measures

4.1 Puketaha/Seddon Road Intersection

The intersection is a standard perpendicular tee with straight and flat approaches. It lacks a right turn bat but features a wide sealed shoulder northbound. The southbound shoulder is heavily constrained by the wide, deep drain immediately adjacent to the road.

The Puketaha/Seddon Road intersection is likely to receive more turning traffic with the closure of Telephone Road to north-south through traffic. Instead of travelling through the intersection, SH1B traffic will tend to turn left into Seddon from the north, and exit Seddon to the north as a right turn out movement.

Figure 4-1: Intersection of Seddon/Puketaha Road

The intersection is also known to be part of a local commuter route between northern Hamilton to the south-west, and Morrinsville to the east (i.e. a south-east movement). This is consistent with the 3pm peak in traffic turning right into Seddon observed by the Team. Queues of up to 6 vehicles queued within the lane, with following northbound traffic overtaking on the wide shoulder. Consequently, the Safety team recommends a right turn bay is considered. This recommendation is from one observation – no turning counts have been undertaken, and further counts and investigation will be required. The Safety Team acknowledges the constraints imposed by the large east side drain on available road reserve width for a turn bay.

The Safety Team has also noted the damage to the white sight rail on the northern side of the intersection splay. The left turn appears tight for heavy vehicles, which could have caused this damage.

Figure 4-2: White sight rail on the northern side

The Safety Team recommends that replacement of the sight rail with road side barrier is considered to mitigate the combined effects of steep road-side drains combined with increased turning volumes.

The Team also note the overgrown verge foliage blocking sightlines to the north of the intersection should be cleared.

4.1.1 PROPOSED SEDDON INTERSECTION IMPROVEMENTS

Table 5: Seddon/Puketaha Intersection Improvements

Problem	Recommendation	Constraints	Length/Quantity
Horizontal constraints at intersection for large vehicle tracking	Review tracking for heavy vehicles, ensuring all vehicle types can turn into the intersection	possible land purchase may be required	intersection wide
Queuing turning right into Seddon Road.	Investigate turning volumes. If warranted, providing a formal right turn bay facility	possible land purchase may be required	intersection wide
Deep road side drains, around the intersection. Damaged sight rails	Install MASH tested roadside barrier protecting errant vehicles from road side drains.	This may require the possible closure of a farm access. Buried road side services.	150m barrier with 4 leading end terminals
intersection sight visibility	Trimming and maintaining road side vegetation on Puketaha Road.	some vegetation may be in private land	intersection wide

4.2 Seddon Road

In general, Seddon Road has a similar layout to Telephone Road, with narrow shoulders and (in places) deep road side drains. The Safety Team expects traffic volumes will increase in this area as the east side of Hamilton grows.

The road features occasional deep drain scattered along its length. These should be considered for road side barrier protection. The safety team suggests a 1.5m offset from the edge line for barrier installations to provide some clearance for cyclists. The Safety Team has identified the following locations where road side barrier should be considered (all chainages are measured from Puketaha Road).

- CH959 LHS
- CH1930 LHS
- CH1930 RHS
- CH3630 LHS
- CH3630 RHS at the intersection of Kiroa Road
- CH4140 RHS at intersection of Shewan Road
- CH4560 LHS

These locations represent lengths of severe road side drop offs, or on the outside of curves.

Figure 4-3: Road side drop off at CH4560 with large non-frangible trees

During the drive over the Team noted a number of edge marker posts (EMPs) were missing. No night inspection was undertaken, but missing EMPs can be expected to impact effective night time definition. Missing EMPs should be replaced.

4.2.1 PROPOSED SEDDON ROAD IMPROVEMENTS

Table 6: Seddon Rd Improvements

Problem	Recommendation	Constraints	Length/Quantity
Deep Road side cross culvert drain at CH959 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Deep Road side drain at CH1930 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Deep Road side drain at CH1930 RHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Deep Road side drain at CH3630 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Deep Road side drain at CH3630 RHS at intersection of Kiroa Road	replace sight rail with compliant barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	70m + 2 leading terminal ends
Deep Road side drain at CH7770 RHS at intersection of Shewan Road	replace sight rail with compliant barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	70m + 2 leading terminal ends
Deep Road side drain at CH4560 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers. Drive way in the curve	150m+ 2 leading terminal ends
missing EMPs	EMP night inspection	None	route wide

4.3 Seddon/Waverley Road Intersection

The intersection of Seddon and Waverley Road has been relatively recently reconstructed as wide and expansive. It includes a right turn bay. The Safety Team observed the intersection appears to operate well.

Figure 4-4:Seddon/ Waverley intersections

However, it was noted that the intersection road markings are very faded. A well delineated intersection is key to drivers positioning themselves correctly when travelling through the intersection. A night time inspection was not undertaken, however the Safety team believes it is likely the intersection has delineation that is ineffective for night time traffic.

The safety team also noted that there is a significant amount of foliage on the northern corner. The team would suggest reviewing the sight lines at the intersection and ensure that appropriate visibility distance on the eastbound approach can be met for a give way sign. If not, foliage will need to be removed or a Stop sign installed.

Figure 4-5: Visibility to the left of the intersection

4.3.1 PROPOSED INTERSECTION IMPROVEMENTS

Table 7: Seddon/Waverley Intersection Improvements

Problem	Recommendation	Constraints	Length/Quantity
Intersection road markings are ineffective in poor light conditions	Review markings and remark where necessary	N/A	intersection wide
Review sightlines at the intersection and ensure that a intersection viability can be met	Review sightlines onsite and consider Stop sign if required.	legislation change required	intersection wide

4.4 Waverley Road

Waverley Road is generally straight with sweeping curves. Its cross section features narrow shoulders and deep road side drains.

Waverley Road has a left hand curve at CH617 supported with chevron repeaters for southbound traffic. The team concluded an addition sign at the end of the row of chevrons should be considered., placed near the driveway of 51A (shown by the star in the image below). However, care must be taken to ensure driveway access visibility is not impaired by the installation of this sign.

Figure 4-6: Waverley Road sweeping bend

4.4.1 PROPOSED WAVERLEY ROAD IMPROVEMENTS

Table 8: Waverley Rd Improvements

Problem	Recommendation	Constraints	Length/Quantity
Sweeping corner at CH617 LHS	Installation of one southbound chevron	ensure visibility from driveway is reviewed before sign is installed.	1 sign

4.5 Waverley Rd Rail Crossing & Holland Rd Corner

Waverley Road, Holland Road and the Waverley Road railway level crossing all meet at one location adjacent to a sharp 25km/h speed advisory corner. The crossing is served by bells, barrier arms and warning signals.

Figure 4-7: Waverley/Holland and railway crossing

Both approaches have good sightlines to the rail crossing signals. Combined with the low traffic volumes this crossing has had a lower number of near hit and collisions compared to the Telephone Road crossing.

As it is likely traffic volumes will have increased due to the closure of Telephone Road, the team would suggest a Level Crossing Safety Impact Assessment (LCSIA) to assess the specific safety issues in relation to the level crossing.

The team noted that there is a damaged road side barrier on both approaches next to the level crossing. On the eastern side the barrier wraps around the half arm barrier. It is not clear exactly why the barrier wraps around the half arm barrier, however, the team would suggest replacing the barrier with MASH tested product and off setting the barrier from the half arm. It is also noted that a deep culvert crosses Waverley Road less than 20m from the end of the existing barrier. If the barrier is replaced, the team suggest the barrier is also lengthened to protect this culvert.

Figure 4-8: Waverley Drain Crossing

On the northbound side the barrier is similarly damaged at the departure end terminal, as shown below. This terminal should be replaced. KiwiRail may require the terminal is stopped early in order to enable vehicle access to the adjacent electrical control cabinets

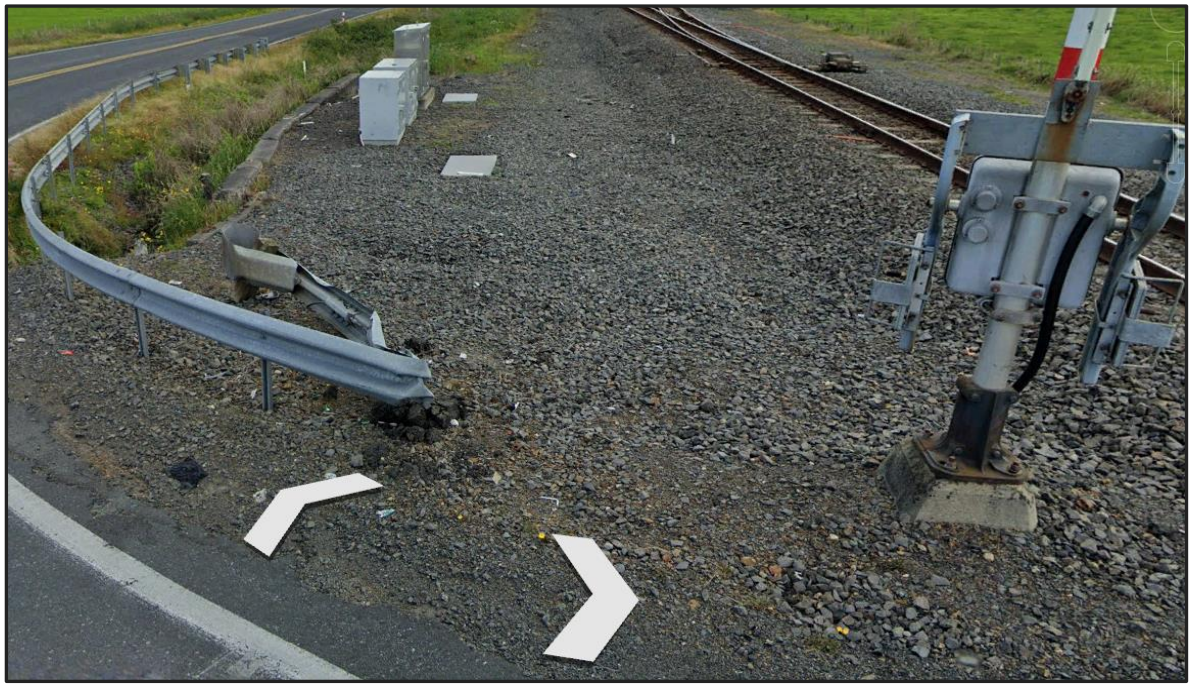


Figure 4-9: Damaged terminal on Northbound approach

The team noted that the sharp corner has a big drop off on its outside edge with no barrier protection. Whilst there has been no crashes off here, the team would suggest proactively protecting this drop off.

Figure 4-10: Steep drop off behind the 25km/h sign

Whilst onsite the team observed a tractor and trailer travelling north-bound over the crossing. The vehicle crossed the centreline to occupy most of both lanes, although it is not clear if this tracking was intentional. The team would suggest that heavy vehicle tracking is checked through here, in both directions.

The Team noted, as can be seen in Figure 4-10, a number of ghost giveway lines on the approach to the intersection. It is not clear to approaching drivers which is the intended giveway line to use.

4.5.1 PROPOSED WAVERLEY RD LEVEL CROSSING IMPOVEMENTS

Table 9: Waverley Level Crossing improvements

Problem	Recommendation	Constraints	Length/Quantity
No LCSIA has been undertaken on assess impact of traffic transferring to Waverley Road Level Crossing.	commission a LCSIA for this crossing and undertake improvements	N/A	1 report
Damaged existing barrier on both north and south approaches.	Repair damage road side barrier near the level crossing. Consider lengthening the barrier to protect cross culvert. Consider replacement with MASH TL3.	Review of services conflicts. Consider KiwiRail access to cabinets.	likely to require 2 new terminal and 40m of TL3 MASH barrier
Multiple limit line ghost markings	Remark correct limit line, and remove the limit lines not required	N/A	6m2 – reseal or water blasting

Problem	Recommendation	Constraints	Length/Quantity
Road side drop off on the outside of a corner	Install Road side barrier. Widen shoulders if needed to ensure 1.5m minimum offset from edge line.	Review of services conflicts. Allow a 10m off set from railway corridor	40m+ 2 leading terminal ends
Heavy Vehicles tracking over full carriageway around corner.	Check tracking to ensure a design heavy vehicle can manoeuvre around this corner safely.	Intersection wide	Intersection wide

APPENDICES

Appendix A Safe System Assessment

This safety assessment only assesses the impacts on traffic that are transferring between the two routes. Residual traffic on either route are not considered as they remain common to both options.

Safe System Assessment of Alternative Route – Telephone Rd Section

1) **Telephone Road – Diversion in Place– Telephone Road is closed, with Bus stop and pedestrian access only at south end. Telephone Rd now no-exit, only used by residential traffic**

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	Factors that increase the Exposure include						
	Only residual traffic affected.	Only residual traffic affected.	Only residual traffic affected.	N/A. Rail crossing closed, no traffic crossing.	Pedestrians crossing the railway line, with no protection. Narrow for shoulders for pedestrian who need to walk to and from the bus stop.	Busy railway line – 38 train movements per day. Narrow shoulders in places	N/A. Only residual traffic affected.
	Factors that decrease the Exposure include						
	small amount of resident traffic only	small amount of resident traffic only	small amount of resident traffic only		Pedestrians moving in groups across the railway line, as they disembark the bus. Pedestrians can safely walk on Telephone Rd carriageway due to almost zero traffic.	Very low traffic. Half the route length of the alternate route	
Exposure Score:	1/4	1/4	1/4	0/4	2/4	1/4	1/4
Likelihood Comments:	Factors that increase the Liklihood include						
	Only residual traffic affected.	Only residual traffic affected.	N/A. Only residual traffic affected.	High incidence crossing	Pedestrians moving in groups across the railway line, as they disembark the bus	Low traffic numbers likely to encourage more cyclists. Narrow shoulders	N/A. Only residual traffic affected.

	Factors that decrease the Liklihood include						
		Good alignment and viz			Assume pedestrians are only crossing during the day time	Very Low traffic	
Likelihood Score:	2/4	1/4	2/4	3/4	2/4	1/4	1/4
Severity Comments:	Factors that increase the severity include:						
	Some places at north end with deep side drain No formed run off slopes	No median separation. Head on crashes typically severe			Pedestrians have no formal protection at the level crossing Pedestrian have no protection on the road High speed road	High speed road No protection for cyclists Narrow shoulders	
	Factors that decrease the severity include:						
	Few road side hazards						
Severity Score:	2/4	4/4	3/4	4/4	4/4	4/4	4/4
Product **(multiply scores above for crash type)**	**4/64**	**4/64**	**6/64**	**0/64**	**16/64**	**4/64**	**4/64**
TOTAL	**38/448**						

Safe System Assessment of Alternative Route - Seddon / Waverley / Holland Rds Section

2) Seddon / Waverley / Holland Rds – Diversion in Place with Telephone Road closed. Increased Diversion traffic on alternative route.

Safe System Assessment – current layout – 'Alternative Route'

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	Factors that increase the Exposure include:						
	Deep side drains in place Narrow shoulder Majority of roadside hazards are not protected. One right hand curve Longer route Greater traffic	No physical separation between traffic lanes. Medium traffic volumes. High speed alignment. Longer route Greater traffic	Intersection without right turn bay at Puketaha/Seddon Road Overgrown vegetation at Puketaha/Seddon Poor road marking at Seddon/Waverley Road	Greater traffic	Narrow shoulder No pedestrian facility Greater exposure to greater traffic)	Narrow shoulder No cyclist facility Known cycling route Greater exposure to greater traffic	Deep side drains in place Narrow shoulder Majority of roadside hazards are not protected. Longer route
	Factors that decrease the Exposure include:						
	Relatively straight terrain with easy curves	Relatively straight terrain with easy curves	Good sightlines at Seddon/Waverley	N/A	Minimal pedestrians in the area (and no reason for pedestrians to be in the area}	Majority of cyclists are confident in the area	Relatively straight terrain with easy curves
Exposure Score:	3/4	3/4	3/4	3/4	1/4	3/4	3/4
Likelihood Comments:	Factors that increase the likelihood include:						
	High speed area Unprotected Road side hazards Limited EMPs along the route	Traffic volumes are likely to increase	Traffic volumes are likely to increase All intersections are only controlled by a giveway	Trucks are tracking over the centreline at the level crossing at Waverley Vehicles crossing a level crossing near a curve at Holland/Waverley Road Road closure for Telephone Road is confusing for some drivers	Narrow shoulder	Narrow shoulder Popular cycle routes	High Speed area

	Factors that decrease the likelihood include:						
	Relatively straight terrain with easy curves	Traffic volumes may not lead to a head on crash	Good sightlines at Waverley/Seddon Road	Barrier arms are already installed at level crossing	Low number of pedestrians	Confident cyclists using the area Good forward sight visibility along the route	Good forward sight visibility along the route
Likelihood Score:	3/4	3/4	2/4	2/4	1/4	2/4	3/4
	Factors that increase the severity include:						
Severity Comments:	High speed road Severe road side hazards	High speed road	High speed roads at all	High speed roads High speed trains in the area	High speed roads+ Narrow shoulder	High speed roads Narrow shoulder	High speed road Severe road side
	Factors that decrease the severity include:						
Severity Score:	2/4	4/4	3/4	4/4	4/4	4/4	4/4
Product (multiply scores above for crash type)	**18/64**	**36/64**	**18/64**	**24/64**	**4/64**	**24/64**	**36/64**
TOTAL	**160/448**						

Safe System Assessment of Original Route – Telephone Rd Section

1) Telephone Road – No Diversion in Place, Telephone Road is Open. No Bus stop at south end, normal school pickup along telephone Rd.

Safe System Assessment – Previous layout – Telephone Road open

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	Factors that increase the Exposure include:						
	Medium traffic volume Deep side drains in place Narrow shoulder	Medium traffic volume No physical barrier between lanes	Medium traffic volume Intersection with Holland Road will be open, known high crash area Intersection is not adequately designed for the traffic that uses it. Poor sightlines to the intersection from Telephone Road	Busy railway line – 38 movements per day All traffic crossing the railway line at Telephone road Know issues with vehicles short stacking on the railway line	No bus stop at this location with the intersection open Narrow shoulders Medium traffic volume	Medium traffic volume Narrow shoulders	Medium traffic
	Factors that decrease the Exposure include:						
	Road side barrier installed in strategic locations			Shorter travel route than the 'alternative route' which would be used if Telephone road is closed			
Exposure Score:	2/4	2/4	2/4	2/4	1/4	2/4	2/4
Likelihood Comments:	Factors that increase the likelihood include:						
	Medium traffic volume Narrow shoulder	Medium traffic volume	Medium traffic volume Lots of turning movements for all traffic types, at the Telephone/Holland road intersection.	Medium traffic volume Busy railway line	N/A	Larger hcv take up space	N/A

	Factors that decrease the likelihood include:						
	Road side barrier installed in strategic locations Straight alignment			Shorter travel route than the 'alternative route' which would be used if Telephone road is closed	Less pedestrians on the road with no bus stop at the intersection – e.g no reason for them to be on the road	Less cyclists as traffic volume will be heavy Straight wide roads	Medium traffic volume Road side barrier installed in strategic locations Straight alignment
Likelihood Score:	2/4	2/4	2/4	3/4	1/4	2/4	2/4
	Factors that increase the severity include:						
Severity Comments:	Deep road side drains will cause serve crash if a crash takes place High speed road	Medium traffic volume High speed road	High speed intersection	High severity crash of train vs car could take place High speed High speed train	Pedestrian have no protection on the road High speed road	Cyclists have no protection on the road High speed road	High speed road
	Factors that decrease the severity include:						
Severity Score:	2/4	4/4	3/4	4/4	4/4	4/4	4/4
Product (multiply scores above for crash type)	**8/64**	**16/64**	**12/64**	**24/64**	**4/64**	**16/64**	**16/64**
TOTAL	**96/448**						

Safe System Assessment of Original Route - Seddon / Waverley / Holland Rds Section

2) Seddon / Waverley / Holland Rds – No Diversion in Place, Telephone Road is Open.

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	Factors that increase the Exposure include:						
	Deep side drains in place Narrow shoulder Majority of roadside hazards are not protected. One right hand curve Longer route	No physical separation between traffic lanes. Medium traffic volumes. High speed alignment. Longer route	Intersection without right turn bay at Puketaha/Seddon Road Overgrown vegetation at Puketaha/Seddon Poor road marking at Seddon/Waverley Road	Vehicles crossing a level crossing near a curve at Holland/Waverley Road Road closure for Telephone Road is confusing for some drivers	Narrow shoulder No pedestrian facility	Narrow shoulder No cyclist facility Known cycling route Greater exposure to greater traffic	Deep side drains in place Narrow shoulder Majority of roadside hazards are not protected. Longer route
	Factors that decrease the Exposure include:						
	Relatively straight terrain with easy curves	Relatively straight terrain with easy curves	Good sightlines at Seddon/Waverley	N/A	Minimal pedestrians in the area other than school pickup (and no reason for pedestrians to be in the area}	Majority of cyclists are confident in the area	Relatively straight terrain with easy curves
Exposure Score:	2/4	2/4	2/4	2/4	1/4	2/4	2/4
Likelihood Comments:	Factors that increase the likelihood include:						
	High speed area Unprotected Road side hazards Limited EMPs along the route	Traffic volumes are likely to increase	Traffic volumes are likely to increase All intersections are only controlled by a giveway	Trucks are tracking over the centreline at the level crossing at Waverley	Narrow shoulder	Narrow shoulder Popular cycle routes	High Speed area
	Factors that decrease the likelihood include:						

	Relatively straight terrain with easy curves	Traffic volumes may not lead to a head on crash	Good sightlines at Waverley/Seddon Road	Barrier arms are already installed at level crossing	Low number of pedestrians	Confident cyclists using the area Good forward sight visibility along the route	Good forward sight visibility along the route
Likelihood Score:	2/4	2/4	2/4	2/4	1/4	2/4	2/4
	Factors that increase the severity include:						
Severity Comments:	High speed road Severe road side hazards	High speed road	High speed roads at all	High speed roads High speed trains in the area	High speed roads+ Narrow shoulder Vulnerable kids	High speed roads Narrow shoulder	High speed road Severe road side
	Factors that decrease the severity include:						
Severity Score:	2/4	4/4	3/4	3/4	4/4	4/4	4/4
Product (multiply scores above for crash type)	**8/64**	**16/64**	**12/64**	**12/64**	**4/64**	**16/64**	**16/64**
TOTAL	**84/448**						

Safe System Assessment of Alternative Route with Improvements – Telephone Rd Section

1) Telephone Road – Diversion in Place– Telephone Road is closed, with Bus stop and pedestrian access only at south end. Telephone Rd now no-exit, only used by residential traffic. Includes Improvements Telephone Rd Ped Crossing

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	Factors that increase the Exposure include						
	Only residual traffic affected.	Only residual traffic affected.	Only residual traffic affected.	N/A. Rail crossing closed, no traffic crossing.	~~Pedestrians crossing the railway line, with no protection.~~ Narrow for shoulders for pedestrian who need to walk to and from the bus stop.	Busy railway line – 38 train movements per day. Narrow shoulders in places	N/A. Only residual traffic affected.
	Factors that decrease the Exposure include						
	small amount of resident traffic only	small amount of resident traffic only	small amount of resident traffic only		Pedestrians moving in groups across the railway line, as they disembark the bus. Pedestrians can safely walk on Telephone Rd carriageway due to almost zero traffic.	Very low traffic. Half the route length of the alternate route	
Exposure Score:	1/4	1/4	1/4	0/4	2/4	1/4	1/4
Likelihood Comments:	Factors that increase the Liklihood include						
	Only residual traffic affected.	Only residual traffic affected.	N/A. Only residual traffic affected.	High incidence crossing	School children not paying attention or running heedless	Low traffic numbers likely to encourage more cyclists. Narrow shoulders	N/A. Only residual traffic affected.
	Factors that decrease the Liklihood include						
		Good alignment and viz		Pedestrian and cyclists crossing with formal protection	Assume pedestrians are only crossing during the day time	Very Low traffic	

					Pedestrians crossing the railway line, with formal protection		
Likelihood Score:	1/4	1/4	2/4	2/4	1/4	1/4	1/4
Severity Comments:	Factors that increase the severity include:						
	Some places at north end with deep side drain No formed run off slopes	No median separation. Head on crashes typically severe			Pedestrians have no formal protection at the level crossing Pedestrian have no protection on the road High speed road	High speed road No protection for cyclists Narrow shoulders	
	Factors that decrease the severity include:						
	Few road side hazards						
Severity Score:	2/4	4/4	3/4	4/4	4/4	4/4	4/4
Product **(multiply scores above for crash type)**	**2/64**	**4/64**	**6/64**	**0/64**	**8/64**	**4/64**	**4/64**
TOTAL	**28/448**						

Safe System Assessment of Alternative Route with Improvements - Seddon / Waverley / Holland Rds Section

2) Seddon / Waverley / Holland Rds – Diversion in Place with Telephone Road closed. Increased Diversion traffic on alternative route. Includes Improvements to Seddon and Waverley Intersections, and midblock Verge Barrier.

Safe System Assessment – current layout – 'Alternative Route'

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	Factors that increase the Exposure include:						
	Deep side drains in place Narrow shoulder Majority of roadside hazards are not protected. One right hand curve Longer route Greater traffic	No physical separation between traffic lanes. Medium traffic volumes. High speed alignment. Longer route Greater traffic	Intersection without right turn bay at Puketaha/Seddon Road Overgrown vegetation at Puketaha/Seddon Poor road marking at Seddon/Waverley Road	Greater traffic	Narrow shoulder No pedestrian facility Greater exposure to greater traffic)	Narrow shoulder No cyclist facility Known cycling route Greater exposure to greater traffic	Deep side drains in place Narrow shoulder Majority of roadside hazards are not protected. Longer route
	Factors that decrease the Exposure include:						
	Relatively straight terrain with easy curves	Relatively straight terrain with easy curves	Good sightlines at Seddon/Waverley	N/A	Minimal pedestrians in the area (and no reason for pedestrians to be in the area}	Majority of cyclists are confident in the area	Relatively straight terrain with easy curves
Exposure Score:	3/4	3/4	3/4	3/4	1/4	3/4	3/4
Likelihood Comments:	Factors that increase the likelihood include:						
	High speed area Unprotected Road side hazards Limited EMPs along the route	Traffic volumes are likely to increase	Traffic volumes are likely to increase All intersections are only controlled by a giveway	Trucks are tracking over the centreline at the level crossing at Waverley Vehicles crossing a level crossing near a curve at Holland/Waverley Road	Narrow shoulder	Narrow shoulder Popular cycle routes	High Speed area

				Road closure for Telephone Road is confusing for some drivers			
	Factors that decrease the likelihood include:						
	Relatively straight terrain with easy curves EMPs and delineation to be reviewed and re-instated	Traffic volumes may not lead to a head on crash	Good sightlines at Waverley/Seddon Road Review and installation of a right turn by at Seddon/Puketaka Road Remark of Waverley/Seddon Road	Barrier arms are already installed at level crossing Undertaking a LCSIA and implementing the improvements	Low number of pedestrians	Confident cyclists using the area Good forward sight visibility along the route	Good forward sight visibility along the route EMPs and delineation to be reviewed and re-instated
Likelihood Score:	2/4	3/4	1/4	1/4	1/4	2/4	2/4
	Factors that increase the severity include:						
Severity Comments:	High speed road Severe road side hazards	High speed road	High speed roads at all	High speed roads High speed trains in the area	High speed roads+ Narrow shoulder	High speed roads Narrow shoulder	High speed road Severe road side
	Factors that decrease the severity include:						
	Road side barrier installed at high risk locations						Road side barrier installed at high risk locations
Severity Score:	1/4	4/4	3/4	3/4	4/4	4/4	3/4
Product (multiply scores above for crash type)	**6/64**	**36/64**	**9/64**	**9/64**	**4/64**	**24/64**	**18/64**
TOTAL	**106/448**						

Summary Risk Score (Higher Number = Higher Risk)

Scores	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
	Alternative Route (Telephone Rd Closed)						
Telephone Rd	4	4	6	0	16	4	4
Alternative Route	18	36	18	24	4	24	36
Total	**22**	**40**	**24**	**24**	**20**	**28**	**40**
Total Score	**198/448**						
	Original Route (Telephone Rd Open)						
Telephone Rd	8	16	12	24	4	16	16
Alternative Route	8	16	12	12	4	16	16
Total	**16**	**32**	**24**	**36**	**8**	**32**	**32**
Total Score	**180/448**						
	Alternative Route with Improvements (Telephone Rd Closed)						
Telephone Rd	2	4	6	0	8	4	4
Alternative Route	6	36	9	9	4	24	18
Total	**8**	**40**	**15**	**9**	**12**	**28**	**22**
Total Score	**134/448**						

Appendix B Proposed Improvements

Site	#	Problem	Recommendation	Constraints	Length/Quantity
All route	1	lack of signs for new route	sign post new route for all road users		route wide
Puketaha/Seddon Rd Intersection	1	Possible constraints at the intersection, for large vehicles to turn at the intersection	Review tracking for heavy vehicles, ensuring all vehicle types can turn into the intersection	possible land purchase may be required	intersection wide
Puketaha/Seddon Rd Intersection	2	with the change in traffic movements, more vehicles are right turning into Seddon Road.	If warranted, providing a formal right turn bay facility, using up to date traffic volumes	possible land purchase may be required	intersection wide
Puketaha/Seddon Rd Intersection	3	Deep road side drains, around the intersection. Damaged sight rails	Installed MASH tested roadside barrier protecting errant vehicles from road side drains.	This may require the possible closure of a farm access. Review of services in the area to determine safe installation of barriers	150m + 4 leading end terminals
Puketaha/Seddon Rd Intersection	4	intersection sight visibility	Trimming and maintaining road side vegetation on Puketaha road.	some vegetation may be in private land	intersection wide
Seddon Road	1	Deep Road side cross culvert drain at CH959 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Seddon Road	2	Deep Road side drain at CH1930 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Seddon Road	3	Deep Road side drain at CH1930 RHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Seddon Road	4	Deep Road side drain at CH3630 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	100m+ 2 leading terminal ends
Seddon Road	5	Deep Road side drain at CH3630 RHS at intersection of Kiroa Road	replace sight rail with compliant barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	70m + 2 leading terminal ends
Seddon Road	6	Deep Road side drain at CH7770 RHS at intersection of Shewan Road	replace sight rail with compliant barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers	70m + 2 leading terminal ends
Seddon Road	7	Deep Road side drain at CH4560 LHS	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers. Drive way in the curve	150m+ 2 leading terminal ends
Seddon Road	8	The team noted a number of missing EMPs	Review EMPs during a night inspection, to ensure the meet TCD manual.	N/A	route wide
Seddon/Waverley Intersection	1	intersection road markings are faded. No night inspection undertaken, however its likely the markings will not be effective at night	Review markings and remark where necessary	N/A	intersection wide
Seddon/Waverley Intersection	2	review sightlines at the intersection and ensure that a intersection viability can be met	Review sightlines onsite and consider Stop sign if required.	legislation change required	intersection wide

Site	#	Problem	Recommendation	Constraints	Length/Quantity
Waverley Road	1	Sweeping corner at CH617 LHS	Installation of one southbound chevron	ensure visibility from driveway is reviewed before sign is installed.	1 sign
Waverley Road rail crossing & Holland corner	1	With the Telephone Road closure, more traffic will be crossing the Waverley Road Level Crossing. No LCSIA has been undertaken on this site, however as we know volumes are changing, a new assessment needs to be undertaken	commission a LCSIA for this crossing and undertake improvements	N/A	1 report
Waverley Road rail crossing & Holland corner	2	damaged existing barrier on RHS	Repair damage road side barrier near the level crossing. Consider lengthening the barrier to protect cross culvert on Waverley Road, at CH 59	Review of services in the area to determine safe installation of barriers	likely to require 1 new terminal and 20m of TL3 MASH barrier
Waverley Road rail crossing & Holland corner	3	Three limit lines are currently on site. Confusing for drivers	Remark limit line, and remove the limit lines not required	N/A	6m2 - blacking out
Waverley Road rail crossing & Holland corner	4	Road side drop off on the outside of a corner	Install Road side barrier. 1.5m minimum offset from edge line	Review of services in the area to determine safe installation of barriers. Allow a 10m off set from railway corridor	40m+ 2 leading terminal ends
Waverley Road rail crossing & Holland corner	5	When onsite, the team saw a heavy vehicle tracking over the centre line. When approaching the railway line.	Tracking to ensure heavy vehicle can manoeuvre around this corner safely.	Intersection wide	Intersection wide
Telephone level crossing and adjacent Holland Tee	1	Pedestrian crossing the railway line, without any protection	consider installing a pedestrian facility at the level crossing	high cost item and some surfacing level changes likley required	1
Telephone level crossing and adjacent Holland Tee	2	Pedestrians could try and cross railway line in an unsafe location	install pedestrian fencing 300m each side of the pedestrian maze	consultation with Kiwirail required	600m
Puketaha/ Telephone Road intersection	1	Temporary traffic mangement on site, which is creating sign clutter and distraction to drivers	remove temporary traffic management and install signage that needs to be permantant		5 new signs

Appendix F – Additional Cost Estimates

Estimated Safety Improvements Cost on Telephone Road Diversion Route

Site	Stantec SSA Recommendation	Length/ Quantity	WSP 2022 Expected Cost (including 30% contingency)	WSP 2022 Cost Estimate Assumption / Comments
Puketaha/ Telephone Road intersection	Remove temporary traffic management and install signage that needs to be permanent	5 new signs	$ 14,670.50	Assuming this is regular RG/RD signs and can be installed within 2 days
Telephone level crossing and adjacent Holland Tee	Install ped fencing 300m each side of the pedestrian maze	600m	$ 542,412.00	Allowed for full security fencing, and then added TTM and P&G. *Note that there may be an opportunity to reduce this length through detailed design.*
Puketaha/ Seddon Rd Intersection	Review tracking for heavy vehicles, ensuring all vehicle types can turn into the intersection	intersection wide	$ 2,700.00	Cost for widening check against Austroads. Standard practice including 1-hour review.
Puketaha/ Seddon Rd Intersection	If warranted, providing a formal right turn bay facility, using up to date traffic volumes	intersection wide	$ 5,400.00	Cost of investigation - standard practice including 2-hour review.
Puketaha/ Seddon Rd Intersection	Install MASH tested roadside barrier protecting errant vehicles from road side drains.	150m + 4 leading end terminals	$ 193,016.20	Allowed for new TL3 Barrier, with 4 impact ends, realignment of accessway, new swale with planting, and associated TTM.
Puketaha/ Seddon Rd Intersection	Trimming and maintaining road side vegetation on Puketaha road.	intersection wide	$ 7,500.00	Allowance to get to site, set up, trim vegetation, including TTM and P&G
Seddon Road	Install road side barriers		**EXCLUDED** – consistent with existing SH1B and most Waikato rural roads. Installing barriers considered beyond the scope of safety improvements to bring the diversion route to Telephone Road standard.	
Seddon Road	Review EMPs during a night inspection, to ensure the meet TCD manual.	route wide	$ 22,021.50	Includes investigation cost 4.5hrs site visit with 2x staff, report, and new EMPs installation cost.
Seddon/ Waverley Intersection	Review markings and remark where necessary	intersection wide	$ 12,362.87	Includes new edgelines and centrelines, TTM and associated P&G
Seddon/ Waverley Intersection	Review sightlines onsite and consider Stop sign if required.	intersection wide	$ 2,700.00	Cost of investigation – standard practice with 1-hour review.
Waverley Road	Installation of one southbound chevron	1 sign	$ 7,454.20	Cost of installation - 1 chevron and associated installation costs (TTM and P&G)
Waverley Road rail crossing & Holland corner	Commission a LCSIA for this crossing and undertake improvements	1 report	**EXCLUDED** – not considered necessary according to KiwiRail advice.	
Waverley Road rail crossing & Holland corner	Repair damage road side barrier near the level crossing. Consider lengthening the barrier to protect cross culvert on Waverley Road, at CH 59	likely to require 1 new terminal and 20m of TL3 MASH barrier	$ 39,491.40	Removal of damaged barrier, new impact end, 20m new barrier, TTM and P&G
Waverley Road rail crossing & Holland corner	Remark limit line, and remove the limit lines not required	6m - blacking out	$ 11,758.60	Includes reseal and remark to avoid ghostlines
Waverley Road rail crossing & Holland corner	Install road side barrier. 1.5m minimum offset from edge line	40m+ 2 leading	$ 119,108.60	Allowed for widening the pavement to accommodate the offset.

		terminal ends		
Waverley Road rail crossing & Holland corner	Check tracking to ensure heavy vehicle can manoeuvre around this corner safely.	Intersection wide	$ 5,400.00	Cost of investigation - standard practice including 2-hour review.
All route	Sign post new route for all road users	route wide	$ 82,472.00	Includes new sign every 500m on both sides, TTM to install 2 signs per day.
		TOTAL	**$1,068,467.87**	

Appendix G – MCA Framework

Version of MCA: *FINAL - POST WORKSHOP*

Multi-Criteria Analysis

Project name:	**SH1B Telephone Road/Holland Road Intersection**	**Problem/opportunity statement:**	Safety issues at Telephone/Holland road intersection and railway crossing.
Reference Case	Hypothetical baseline as a tool for comparison. Telephone Road is open with the current design.		

		Reference Case	**Options**			
			Option 1 - Permanent Closure of Telephone Road	Option 2 - Vertical Realignment of SH1B	Option 3 - Vertical Realignment of SH1B + Re-Prioritised Intersection	Option 4 - Roundabout
Investment Objectives	**Weight**					
Improve road user safety (GPS requirement) Reduce DSI for road users including general traffic, pedestrians/cyclists and heavy vehicles.	**11%**	0	1	1	1	3
		Neutral base line.	Slight positive impact - because fewer conflict points, no exposure to rail, allows safe stopping point for school bus. Lowered due to remaining crossing-turning movements and crash migration - diversion route travels through more intersections and corridors than Telephone Road which may worsen existing risk there.	Slight positive impact - minor changes possible with speed management work etc. Lowered due to high impact crash angles (head on/right angle), crossing and turning movements.	Slight positive impact - minor changes possible with speed management work etc. Lowered due to high impact crash angles (head on/right angle), crossing and turning movements.	Major positive impact - All traffic must slow down to give way (lower speeds) and lower crash impact angles - highest DSI reduction.
Improve rail safety (GPS requirement) Reduce risk of derailment, grounding out, and avoid further damage to the ECMT railway.	**11%**	0	3	1.5	2	1.5
		Neutral base line.	Major positive impact because rail has no conflict with road traffic. No risk of damage to railway from vehicles.	Slight-moderate positive impact - minimised risk of grounding out. Score lowered as there may be some risk of stacking (if volumes are very high) and road traffic/rail conflict exists, and motorists on Telephone Road may ignore incoming trains due to distraction e.g. checking for traffic.	Moderate positive impact - minimised risk of grounding out and stacking. Score lowered as road traffic/rail conflict exists.	Slight-moderate positive impact - minimised risk of grounding out. Score lowered as there may be some risk of stacking (if volumes are very high) and road traffic/rail conflict exists, and motorists on Telephone Road may ignore incoming trains due to distraction e.g. checking for traffic.
Critical Success Factors						
Achievability Can this option be technically delivered? Does this option have technical/practical risks? Does this option have safety in design or maintenance risks?	**11%**	0	2	-2	-2	-2
		Neutral base line.	Moderate positive as this has already been done (existing situation) and reduced maintenance and maintenance risk around rail crossing. Lowered slightly due to new ped rail crossing likely needed.	Moderate negative impact - temporary closure of road during construction, with diversion route in place, and rail crossing maintenance.	Moderate negative impact - temporary closure of road during construction, with diversion route in place, and rail crossing maintenance.	Moderate negative impact - slightly more challenging temporary closure of road during construction than Options 2 and 3, and rail crossing maintenance.
Consentability/Legal How complex/difficult is this option to meet consent/legal requirements? Are there any impacts on property take and can the necessary properties be acquired?	**11%**	0	-1	-2	-1	-1.5
		Neutral base line.	Slight negative impact - consultation likely needed with locals. Lessened as agreement to close already in place with KiwiRail and RCA.	Moderate negative impact - property take required, potential HAIL sites, poor ground conditions. Lessened slightly as KiwiRail likely to support due to reducing grounding out risk, but stacking risk remains (if very high road volumes).	Slight negative impact - slightly less property take required, potential HAIL sites, poor ground conditions. Lessened as KiwiRail likely to support due to reducing grounding out and stacking risks.	Slight-moderate negative impact - slightly less property take required, potential HAIL sites, poor ground conditions. Lessened slightly as KiwiRail likely to support due to reducing grounding out risk, but stacking risk remains (if very high road volumes).
Affordability Does this option provide value for money?	**11%**	0	-0.5	-3	-3	-3
		Neutral base line.	Most affordable option (costs less than $1M)	Extremely high cost (>$8M) for little road safety benefits.	Extremely high cost (>$8M) for little road safety benefits.	Extremely high cost (>$8M) like Options 2 and 3 (may be slightly less) but has far more road safety benefits.
Network productivity (GPS requirement) How will the option impact movement of freight (by road or rail) and other key traffic movements for economic productivity? How will the option impact travel times?	**11%**	0	-2	0.5	1	0.5
		Neutral base line.	Moderate negative impact - diverts local traffic (e.g. farm vehicles/local freight/commuters) elsewhere and adds about 6.1km travel distance and travel time. Not -3 as it improves rail efficiency.	Very slight positive impact - largely the same as reference case but minimises risk to rail movements i.e. rail freight.	Slight positive impact - largely the same as reference case but minimises risk to rail movements (i.e. rail freight) and prioritises higher volume traffic travelling north-south.	Very slight positive impact - largely the same as reference case but minimises risk to rail movements i.e. rail freight. Lowered due to all traffic on all approaches having to slow and give way through roundabout.
Perceived social impacts How well perceived (i.e. acceptable) will the option be by the local community and stakeholders?	**11%**	0	-2	1	1.5	2
		Neutral base line.	Moderate negative impact - existing situation suggests poorly received by local community - including existing issue with school bus stop and children crossing rail.	Slight positive impact - safety issues mostly resolved for KiwiRail and north-south connectivity retained for locals. Lessened due to potential stacking issues (if volumes are very high).	Slight-moderate positive impact - slightly more safety issues mostly resolved for KiwiRail and north-south connectivity retained for locals. Lessened due to potential stacking issues (if volumes are very high).	Slight positive impact - slightly more safety issues resolved for KiwiRail and north-south connectivity retained for locals. Lessened due to potential stacking issues (if volumes are very high).
Social and cultural impacts (GPS requirement) How will the option impact community access (i.e. severance and disruption) to social/economic opportunities e.g. work/recreation/school? How will the option impact neighbouring property owners?	**11%**	0	-2	-1	-1	-1.5
		Neutral base line.	Moderate negative impact - locals severed between north-south e.g. Vulnerable users (children) crossing rail to get to school bus stop on Holland Road.	Slight negative impact - disruption due to temporary closure of sections of road during construction and property acquisition. Lessened due to ability to maintain traffic movements during construction and ongoing connectivity retained post-construction.	Slight negative impact - disruption due to temporary closure of sections of road during construction and property acquisition. Lessened due to ability to maintain traffic movements during construction and ongoing connectivity retained post-construction.	Slight-moderate negative impact - disruption/access slightly more affected due to slightly more challenging TTM during construction than Options 2 and 3, and property take. Lessened due to ability to maintain traffic movements during construction and ongoing connectivity retained post-construction.
Climate Change (GPS requirement) How will the option impact embodied and operational carbon emissions? Will the option be adversely affected by climate change risk or other natural hazards over time?	**11%**	0	-1	-2	-2	-2
		Neutral base line.	Moderate negative impact - road traffic travels longer and further through diversion route increasing VKT. Lessened due to no new structures and minimal if any earthworks.	Slight-moderate negative impact - construction emissions associated with new structures and earthworks. Lessened due to no change in VKT.	Slight-moderate negative impact - construction emissions associated with new structures and earthworks. Lessened due to no change in VKT.	Slight-moderate negative impact - construction emissions associated with new structures and earthworks. Lessened due to no change in VKT.
Summary						
Total MCA Score (all criteria weighted the same)		**0.0**	**-2.7**	**-6.6**	**-3.8**	**-3.3**
Total MCA Ranking		**1**	**2**	**5**	**4**	**3**
Details						
Cost		N/A	$750K (SSBC)	$5M (SSBC) $8.88M (updated PBE cost, 95th%ile)	$5M (SSBC) $9.35M (updated PBE cost, 95th%ile)	$6.6M (SSBC) Likely between $8M-9M (based on updated PBE costs)
Key risks - Scheduling (can the option be reasonably implemented in the short term e.g. by 2023 as per the SSBC?)		- Unacceptable rail safety outcome	- May need to consider crash migration - additional safety risk associated with diverting traffic through more rural intersections and corridors - this is factored in scoring - Consider long term plan for school bus stop	- Consider long term plan for school bus stop - Property owners may request additional acoustic effects management which will increase costs - Neighbouring property may be HAIL sites - Utility relocations	- Consider long term plan for school bus stop - Property owners may request additional acoustic effects management which will increase costs - Neighbouring property may be HAIL sites - Utility relocations	- Consider long term plan for school bus stop - Property owners may request additional acoustic effects management which will increase costs - Relatively difficult to implement within short term - Neighbouring property may be HAIL sites - Utility relocations
Key discussion comments		N/A	- Likely high level of DSI reduction at the site as effectively removing exposure, however crash migration may offset benefits from a wider safety perspective	- Can shorten deflection on Holland Road	- Can shorten deflection on Holland Road - Could stagger Holland east approach to avoid extensive property take (1,200sqm)	- 75% DSI reduction (SSI Toolkit)
Decision		DISCARD	**Preferred Option**	DISCARD	DISCARD	DISCARD

SENSITIVITY TEST
Scenario 1 : Weight investment objectives more highly

Version of MCA: *DRAFT V1.1 - PROVISIONAL*

Multi-Criteria Analysis

Project name:	**SH1B Telephone Road/Holland Road Intersection**	**Problem/opportunity statement:**	Safety issues at Telephone/Holland road intersection and railway crossing.
Reference Case	Hypothetical baseline as a tool for comparison. Telephone Road is open with the current design.		

		Reference Case	**Options**			
			Permanent Closure of Telephone Road	Vertical Realignment of SH1B	Vertical Realignment of SH1B + Re-Prioritised Intersection	Roundabout
Investment Objectives	**Weight**					
Improve road user safety (GPS requirement) Reduce DSI for road users including general traffic, pedestrians/cyclists and heavy vehicles.	**15%**	0	1	1	1	3
Improve rail safety (GPS requirement) Reduce risk of derailment, grounding out, and avoid further damage to the ECMT railway.	**15%**	0	3	1.5	2	1.5
Critical Success Factors						
Achievability Can this option be technically delivered? Does this option have technical/practical risks? Does this option have safety in design or maintenance risks?	**10%**	0	2	-2	-2	-2
Consentability/Legal How complex/difficult is this option to meet consent/legal requirements? Are there any impacts on property take and can the necessary properties be acquired?	**10%**	0	-1	-2	-1	-1.5
Affordability Does this option provide value for money?	**10%**	0	-0.5	-3	-3	-3
Network productivity (GPS requirement) How will the option impact movement of freight (by road or rail) and other key traffic movements for economic productivity? How will the option impact travel times?	**10%**	0	-2	0.5	1	0.5
Perceived social impacts How well perceived i.e. accepted will the option be by the local community and stakeholders?	**10%**	0	-2	1	1.5	2
Social and cultural impacts (GPS requirement) How will the option impact community access (i.e. severance) to social/economic opportunities e.g. work/recreation/school? How will the option impact neighbouring property owners?	**10%**	0	-2	-1	-1	-1.5
Climate Change (GPS requirement) How will the option impact long-term carbon emissions? Will the option be adversely affected by climate change risk or other natural hazards over time?	**10%**	0	-1	-2	-2	-2
Total MCA Score		**0.0**	**-0.5**	**-4.8**	**-2.0**	**-0.8**
Total MCA Ranking		**1**	**2**	**5**	**4**	**3**

SENSITIVITY TEST
Scenario 2 : Weight social impacts more greatly

Version of MCA: *DRAFT V1.1 - PROVISIONAL*

Multi-Criteria Analysis

Project name:	**SH1B Telephone Road/Holland Road Intersection**	**Problem/opportunity statement:**	Safety issues at Telephone/Holland road intersection and railway crossing.
Reference Case	Hypothetical baseline as a tool for comparison. Telephone Road is open with the current design.		

		Reference Case	**Options**			
			Permanent Closure of Telephone Road	Vertical Realignment of SH1B	Vertical Realignment of SH1B + Re-Prioritised Intersection	Roundabout
Investment Objectives	**Weight**					
Improve road user safety (GPS requirement) Reduce DSI for road users including general traffic, pedestrians/cyclists and heavy vehicles.	**10%**	0	1	1	1	3
Improve rail safety (GPS requirement) Reduce risk of derailment, grounding out, and avoid further damage to the ECMT railway.	**10%**	0	3	1.5	2	1.5
Critical Success Factors						
Achievability Can this option be technically delivered? Does this option have technical/practical risks? Does this option have safety in design or maintenance risks?	**10%**	0	2	-2	-2	-2
Consentability/Legal How complex/difficult is this option to meet consent/legal requirements? Are there any impacts on property take and can the necessary properties be acquired?	**10%**	0	-1	-2	-1	-1.5
Affordability Does this option provide value for money?	**10%**	0	-0.5	-3	-3	-3
Network productivity (GPS requirement) How will the option impact movement of freight (by road or rail) and other key traffic movements for economic productivity? How will the option impact travel times?	**10%**	0	-2	0.5	1	0.5
Perceived social impacts How well perceived i.e. accepted will the option be by the local community and stakeholders?	**15%**	0	-2	1	1.5	2
Social and cultural impacts (GPS requirement) How will the option impact community access (i.e. severance) to social/economic opportunities e.g. work/recreation/school? How will the option impact neighbouring property owners?	**15%**	0	-2	-1	-1	-1.5
Climate Change (GPS requirement) How will the option impact long-term carbon emissions? Will the option be adversely affected by climate change risk or other natural hazards over time?	**10%**	0	-1	-2	-2	-2
Total MCA Score		**0.0**	**-4.5**	**-6.0**	**-3.3**	**-2.8**
Total MCA Ranking		**1**	**4**	**5**	**3**	**2**

SENSITIVITY TEST
Scenario 3 : Score social impacts for Option 1 more severely

Version of MCA: *DRAFT V1.1 - PROVISIONAL*

Multi-Criteria Analysis

Project name:	**SH1B Telephone Road/Holland Road Intersection**	**Problem/opportunity statement:**	Safety issues at Telephone/Holland road intersection and railway crossing.
Reference Case	Hypothetical baseline as a tool for comparison. Telephone Road is open with the current design.		

		Reference Case	**Options**			
			Permanent Closure of Telephone Road	Vertical Realignment of SH1B	Vertical Realignment of SH1B + Re-Prioritised Intersection	Roundabout
Investment Objectives	**Weight**					
Improve road user safety (GPS requirement) Reduce DSI for road users including general traffic, pedestrians/cyclists and heavy vehicles.	**11%**	0	1	1	1	3
Improve rail safety (GPS requirement) Reduce risk of derailment, grounding out, and avoid further damage to the ECMT railway.	**11%**	0	3	1.5	2	1.5
Critical Success Factors						
Achievability Can this option be technically delivered? Does this option have technical/practical risks? Does this option have safety in design or maintenance risks?	**11%**	0	2	-2	-2	-2
Consentability/Legal How complex/difficult is this option to meet consent/legal requirements? Are there any impacts on property take and can the necessary properties be acquired?	**11%**	0	-1	-2	-1	-1.5
Affordability Does this option provide value for money?	**11%**	0	-0.5	-3	-3	-3
Network productivity (GPS requirement) How will the option impact movement of freight (by road or rail) and other key traffic movements for economic productivity? How will the option impact travel times?	**11%**	0	-2	0.5	1	0.5
Perceived social impacts How well perceived i.e. accepted will the option be by the local community and stakeholders?	**11%**	0	-2.5	1	1.5	2
Social and cultural impacts (GPS requirement) How will the option impact community access (i.e. severance) to social/economic opportunities e.g. work/recreation/school? How will the option impact neighbouring property owners?	**11%**	0	-2.5	-1	-1	-1.5
Climate Change (GPS requirement) How will the option impact long-term carbon emissions? Will the option be adversely affected by climate change risk or other natural hazards over time?	**11%**	0	-1	-2	-2	-2
Total MCA Score		**0.0**	**-3.9**	**-6.6**	**-3.9**	**-3.3**
Total MCA Ranking		**1**	**3**	**5**	**3**	**2**