

Single stage business case

State Highway 1: Cambridge to Piarere short term safety improvements

December 2016

VERSION 2.2 - FINAL



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GLOSSARY OF TERMS

ABBREVIATION	TERM
AEE	Assessment of environmental effects
BCR	Benefit-cost ratio
CAPEX	Capital expenditure
DE	Design estimate
EEM	Economic evaluation manual
GPS	Government Policy Statement
HCV	Heavy commercial vehicle
HNO	Highways and Network Operations
ILM	Investment logic map
IRS	Investment and revenue strategy
ITS	Intelligent transport systems
KPI	Key performance indicator
LTMA	Land Transport Management Act
MVKT	Million vehicle kilometres travelled
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NOR	Notice of requirement
NZTA (or the Agency)	The New Zealand Transport Agency
ONRC	One Network Road Classification
OPEX	Operating expenditure
P&I	Planning and Investment
RAMM	Road Assessment and Maintenance Management
RLTS	Regional Land Transport Strategy
RMA	Resource Management Act
RoNS	Road of national significance
SH(#)	State Highway (number)
SOI	Statement of intent
TA	Territorial Authority
TDM	Traffic demand management
VAC	Value Assurance Committee (formerly SSRC)
WEBs	Wider economic benefits

EXECUTIVE SUMMARY

This Single Stage Business Case details the case for investment to improve safety outcomes for the State Highway 1: Cambridge to Piarere corridor. It supports the NZ Transport Agency's commitments to the Safer Journey's Strategy 2010-2020. The overall vision of the Strategy is for 'a safe road system increasingly free of death and serious injury'.

The corridor is identified in the Safer Journey: Delivering Safe Roads and Roadsides National Programme Business Case (NPBC) (2014) for further investigation.

A Programme Business Case (PBC) for this corridor was completed and approved by the NZ Transport Agency Board in July 2015. The PBC recommended short-term online safety improvements as one of three measures. Also recommended were SH1/29 Intersection Improvements (6 to 10 years) and longer term efficiency and safety improvements (10 years+). An indicative business case has commenced by a separate external consultant and is considering the longer term efficiency recommendation.

The corridor extends from the southern end of the Cambridge section of the Waikato Expressway through to the SH1/SH29 intersection, a distance of approximately 15.8km.

The Average Annual Daily Traffic (AADT) count for this corridor is approximately 15,500 VPD, with HCV making up 11% of this count. With the completion of the Waikato Expressway, traffic volumes are projected to increase to 25,000 vpd by 2041.

The One Network Road Classification for this corridor is National (high volume).

This KiwiRAP star rating for this corridor is 3.0.

The historic crash record for this corridor shows that there have been 24 FSI crashes resulting in 39 DSI casualties (29 serious and 10 fatal) over the 2005-2014 period. The majority of these crashes were midblock and involve a loss of control, resulting in a head-on or run-off-road crash.

Based on the crash record, the Collective Risk for the corridor is High, which constitutes a high-risk rural road as defined in the NZ Transport Agency's High Risk Rural Roads Guide. The Personal Risk is Low-medium.

Key stakeholders were engaged as part of a workshop process to identify the specific issues associated with this corridor. These issues were summarised in the following problem statements:

1. High traffic volumes and an inconsistent, unprotected, unforgiving road corridor, result in high DSI crash rates (70%); and
2. The number and layout of intersections and accesses, coupled with high traffic volumes, results in a significant crash rate at intersections (weighting 30%).

The Project Investment Objectives for State Highway 1: Cambridge to Piarere are proposed as:

1. Reduce the probability and severity of DSI crashes by 50 to 60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements.
2. Improve 30 to 50% of the corridor to a KiwiRAP star rating of above 4 star by end of 2017.

Nine options were short listed and analysed:

1. Do minimum
2. Wide centreline
3. Wide centreline + SH29 roundabout
4. Wide centreline + side barriers in high risk locations. Wide centreline designed to accommodate retrofit of centreline barrier.
5. Median barrier + side barriers at higher risk locations + SH29 + Karapiro Road turnarounds
6. Wide centreline + continuous side barriers + SH29 roundabout
7. Three barriers + SH29 roundabout + Karapiro Road roundabout
8. Continuous 2+1 with three barriers + SH29 roundabout + Karapiro Road roundabout + Hickey Road curve realignment
9. Four lane expressway

NZ Transport Agency stakeholders agreed (workshop 27 April 2016) a common objective for 50-60% DSI reduction over 10 years which can be achieved through both short and long term improvements.

Potential long term improvement options are currently being developed through an Indicative Business Case led by Opus for the NZ Transport Agency. The Agency has indicated an intention to deliver the long term scheme as early as the end of 2023 (operational by 2024). While this is achievable if the development process proceeds smoothly, several delivery risks could extend the completion date. Completion by the end of 2023 is considered to be the earliest possible date, with later dates equally likely. Accordingly, the short term scheme benefits have been assessed for a 10 year benefit stream, with sensitivity testing for six year and 20 year benefit streams.

Based on a combined assessment of benefits for both the short term and long term schemes the following recommendations are provided:

- Option 4, with an estimated capital cost of \$7.4M and a BCR of 1.2 based on a 10 year benefits period, is recommended until such time that further details can be provided for the long term investigations. This option is predicted to achieve a reduction of 12 DSI over a ten-year period (approx. 30%). The BCR would increase to 1.9 for this option if the investment period was increased to 20 years. The BCR would be 0.8 for a six year benefit stream (in the event that the long term scheme were completed by the end of 2023).

Option 4 would be designed with ability to retrofit a central barrier and turn around areas (Option 5). A decision to proceed with Option 5 would be made once outcomes and timing were understood regarding the long term scheme. Inclusion of centre barrier and turnaround areas would increase the total capital cost to \$12.2M and would increase the number of DSI's saved over a 10 year period to 22 (approx. 56%) . The BCR would be equivalent at 1.2 for this option based on a 10 year benefit stream.

1. BACKGROUND

1.1 Road corridor overview

The SH1 – Cambridge to Piarere road corridor extends along SH1 from the southern end of the Cambridge section of the Waikato Expressway (RP 574/2.8) through to the SH1/SH29 intersection (RP 591/1.6 (RS 594)), a distance of approximately 15.8km.

The alignment of this corridor is relatively flat although the surrounding topography is undulating. There are several curves that are out of context for the prevailing speed environment, all of which are posted at 100km/h. The cross-section is a two lane undivided carriageway with two northbound passing lanes and two southbound passing lanes. Other passing opportunities exist but at low flows only.

The environment for this corridor can broadly be typified by two distinct sections: The western section (between Cambridge Expressway and Fergusson Gully Road) has more frequent side entrances, and less passing opportunities. The eastern section has fewer side accesses and traverses alongside Lake Karapiro.

In terms of the natural environment, this corridor is dominated by two features – Lake Karapiro which runs immediately to the south of SH1 and the steep Karapiro hills alongside long sections on the northern side of the carriageway.

These hills present a constraint for the transport corridor, limiting its ability to expand, as well as for the development along the corridor, with little suitable land for activities other than farming or the current roadside activities. The land-uses adjacent to this section are predominantly agricultural, horticultural, and sports/recreational based, including several small commercial businesses located along the route.

Due to the proximity of Lake Karapiro and the Waikato River, there are several access points for boat access and recreation. Lake Karapiro is an international rowing venue and home to the National Rowing Academy. The Lake is located immediately south of the state highway, with associated land-uses including recreational and occasional sporting events.

There are eleven at-grade intersections along the corridor with Hydro Road and Karapiro Road being the higher volume side roads. The SH1/SH29 intersection at the southern extent of the corridor is a key decision making location for traffic travelling northeast toward Tauranga or southeast toward Rotorua and Taupo.

Despite numerous intersections along the corridor, there are few secondary or alternative routes in the event of emergencies or a crash. This makes the corridor in its present form susceptible to delays and provides a relatively low level of resilience.

At the western end of the corridor is Cambridge, the largest centre for residential and commercial growth in the vicinity. The Karapiro Township is located towards the northern end of the section and accesses SH1 via Hydro Road. The Karapiro School is also located adjacent to the state highway with access via Karapiro Road. There is a petrol service area (Mobil Karapiro) located immediately adjacent to the Karapiro Road intersection. There is a consent application with Council for expanding the petrol station operations and these plans have been considered in the context of safety improvements considered.

The Waipa District Growth Strategy aims to accommodate growth within existing urban areas such as Cambridge where Council is able to consolidate the growth and control the rural subdivision and sprawl. Growth in the Karapiro village, which is identified as a “village growth” area is moderate with an additional 500 people, but growth in the large rural Karapiro area is not expected to be significant.

1.1.1 Waikato Expressway

The Cambridge to Piarere corridor is to the immediate south of the Waikato Expressway. The Expressway when completed will be 102km in length running from the Bombay Hills to south of Cambridge. It will provide for two lanes of traffic in each direction divided by a central barrier with local roads and interchanges generally serviced by bridges and underpasses. When complete the expressway will be the key strategic transport corridor for the Waikato region, connecting Auckland to the agricultural and business centres of Waikato and Bay of Plenty. The Expressway will improve economic growth and productivity through more efficient movement of people and freight.

The Expressway will have the following four key benefits:

- Reducing travel times
- Improving safety and reducing DSIs
- Reducing congestion
- Improving connections for the local community

The Cambridge section of the Waikato Expressway was completed in December 2015. This section extends to the start of the Cambridge to Piarere corridor, as illustrated in the corridor location plan below.

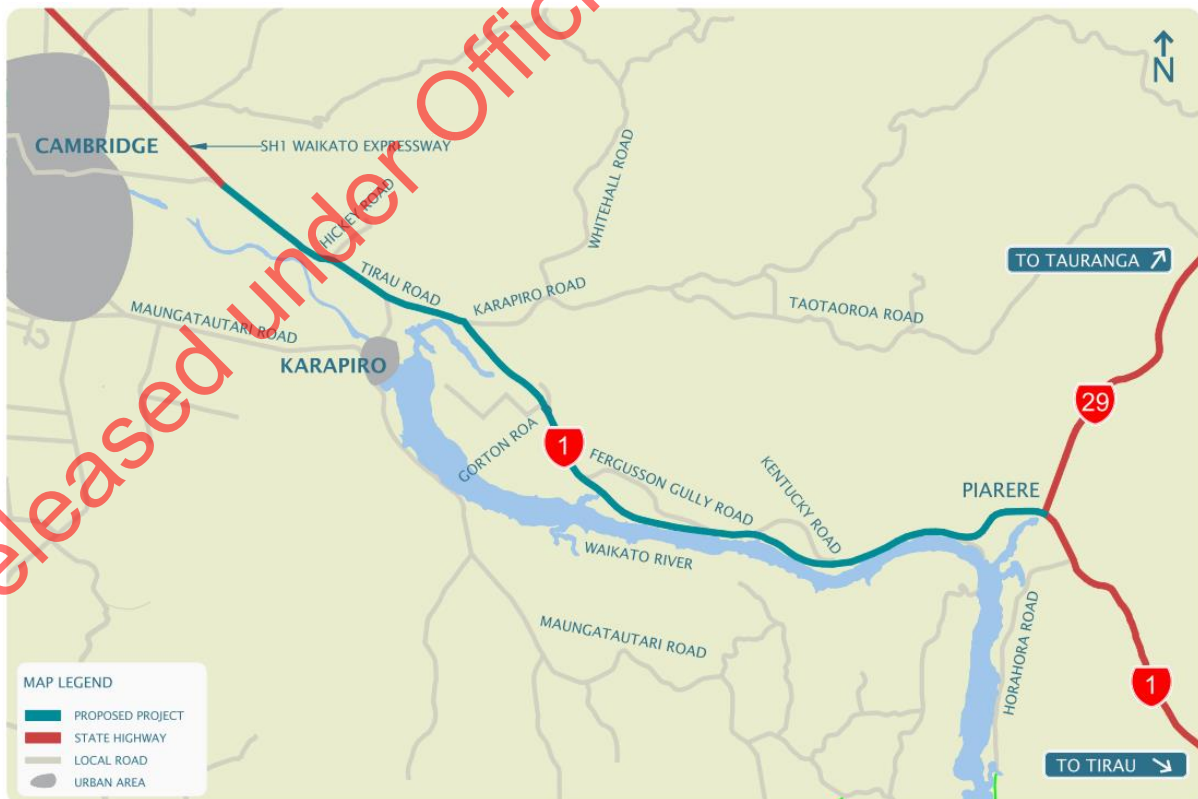


Figure 1: Corridor location plan

1.1.2 One Network Road Classification

The published One Network Road Classification (ONRC) for this corridor is National (high volume).

1.1.3 Traffic Volumes

The corridor has a recorded AADT of 15,840 vpd in 2015 (NZ Transport Agency count station 01N00580).

The average growth over the period from 2000 to 2015 has been 1.0%.

Table 1: State highway AADT volumes 2011-2015

SH	RS	RP	DESCRIPTION	DIRECTION	AADT					% HCV
					2011	2012	2013	2014	2015	
1N	574	5.71	Karapiro – Telemetry Site 20	Both	14,726	14,365	14,625	15,181	15,840	11%

Heavy Vehicles make up approximately 11% of the total AADT.

With the completion of the Waikato Expressway, traffic volumes are projected to increase to 25,000 vpd by 2041.

Peak flows are typically round 400 to 700 vehicles per hour (vph) in each direction, with sixteen individual hours recorded in 2015 where one-direction flow exceeded 1200vph. Future predictions are for the hours exceeding 1200 vph to increase to 50 hours per year.

1.1.4 Speeds

The existing average speed (for all times of day and all vehicles) is 89 km / hr (with the 15th percentile approximately 85 km / hr). This is projected to degrade to 79 km / hr by 2041.

1.2 Work completed to date

1.2.1 Upper North Island Journeys Strategic Context Board Paper (August 2015)

This sets out the strategic context and outcomes-based approach for key journeys between Auckland, Hamilton and Tauranga via SH1/SH29 and Auckland and Tauranga via SH2. The paper provides context for future development on the network in order to provide consistency with strategy set in 2006 to make SH1/SH29 the main route between Auckland and Tauranga and align future investment with the One Network Road Classification (ONRC) outcomes based approach. The key findings were the need to provide:

- Travel time savings on the key journey from Auckland to Tauranga (via SH1/SH29)
- Safety - reduction in deaths and serious injuries and a predictable journey (reliable travel times) on the journey from Pokeno to Tauranga (via SH2).

1.2.2 SH1 Hamilton to Waiouru (July 2014) and Hamilton to Tauranga (April 2015) Strategic Cases

Strategic cases for SH1 Hamilton to Waiouru and Hamilton to Tauranga overlap on the Cambridge to Piarere Section. They identified problems associated with the corridor in conjunction with key stakeholders, assessed their significance from a national perspective and the potential consequences of not addressing them. The strategic case confirmed there was a case for change, and provided the basis for further investigation in the Programme Business Cases. The problems identified in both Strategic Cases related to Road Safety and efficiency particularly the movement of freight.

Following the wider ranging Strategic Cases, the routes were split into smaller sections SH1 Cambridge to Piarere being one of them.

The objectives and outcomes in the Strategic Context Board Paper, ONRC outcome based objectives and Strategic Cases will need to be considered when developing the SH1 Cambridge to Piarere online safety improvements. For example, any impact of online safety improvements on the efficiency and resilience of the route will need to be addressed.

1.2.3 Safer Journeys – Delivering State Highway Safer Roads & Roadsides Programme Business Case (PBC) (March 2014)

The Safer Journeys - Delivering State Highway Safer Roads and Roadsides PBC is based on a strategy of reducing the number of New Zealanders that are killed or seriously injured on our roads annually, minimising the social harm and economic impact of road crashes, by delivering against the NZ Transport Agency's commitments to Safer Roads and Roadsides. The scope of the PBC includes high risk state highway intersections, as well as high and high-medium collective risk state highway corridors not otherwise addressed by major projects.

Benefits have been identified within the strategic and programme business cases, to improve our roads and roadsides, and lead to a reduction of deaths and serious injuries. The expected long term outcomes of the programme are:

- collective risk: Total state highway deaths and serious injuries
- % State highway network by KiwiRAP rating bands by state highway classification

To balance these long term benefits, short term results in the form of success factors have also been developed:

- Success Factor 1: Improve at least 8 state highway intersections by 2016;
- Success Factor 2: Increase the percentage of national and regional strategic state highways with a star rating of 3.5 and above by 2017;
- Success Factor 3: Reduce annual deaths and serious injuries on open roads (including local roads) by 246 across all Safer Journeys pillars by 2017.

The SH 1: Cambridge to Piarere corridor was identified within the Safer Journey's – Delivery State Highway Safer Roads and Roadsides National PBC as a rural state highway to be investigated further based on criteria within the High Risk Rural Roads Guide (HRRRG). Successful intervention on the SH 1: Cambridge to Piarere corridor was anticipated to contribute to these benefits and success factors.

1.2.4 SH1 Cambridge to Piarere Programme Business Case (PBC) (July 2015)

A PBC for this corridor was completed and approved by the NZ Transport Agency Board in July 2015. This refined the problem and benefit statements with stakeholders specifically as they related to the Cambridge to Piarere section. The ILM workshop (April 2014) identified the following problems:

- Problem 1: Poor driver behaviour coupled with a sub-standard road design for its current function leads to a high crash rate along the corridor (40%)
- Problem 2: Competing priorities of access and throughput along the corridor has contributed to the crash history (20%)
- Problem 3: Future demand for the corridor is expected to exceed capacity, potentially reducing the regions ability to support growth (40%).

The benefits were weighted 70% safety and 30% efficiency demonstrating that stakeholders agreed there was a clear safety problem to be addressed on the route.

Following from PBC workshops in 2014, analysis was undertaken which provided clear evidence to confirm the problem and benefit statements and support the case for safety improvements in the short term. The PBC recommended:

- Short-term online safety improvements (0 to 3 years)
- SH1/29 Intersection Improvements (6 to 10 years)
- Longer term efficiency and safety improvements (10 years+)

The PBC recommended proceeding to the Indicative Business Case (IBC) on all three of the recommended activities. Although each of the above activities will have separate business cases they need to take account of each other.

The Transport Agency is now focusing directly on defining the safety specific problems and addressing these through online (within corridor) improvements. Separate tranches of work will be progressed to address the longer-term efficiency improvements (implemented beyond 10 years) and SH1/ SH29 improvements (implemented beyond 6 years).

1.2.5 Cambridge to Piarere Long Term Scheme Indicative Business Case (under development)

Opus have been engaged to carry out the Indicative Business Case (IBC) which will consider options which will address safety and efficiency problems identified through the PBC phase. The IBC phase officially commenced in September 2016 with public announcement of the short term (this single stage business case) and long term improvements. Investment Logic Mapping (ILM) problem, investment objectives and options workshops are planned for November / December 2016 with a preferred option expected as part of final IBC in mid-2017. Although the short term and long term improvements have been separated in terms of delivery they are inherently linked, the proposed treatments from both schemes influence overall outcomes and hence communications are critical between both teams. For this reason Safe Roads are represented at ILM problem and options workshops being held and a single Communications and Engagement Strategy for both schemes is in place.

1.3 Project governance

1.3.1 Organisation structure

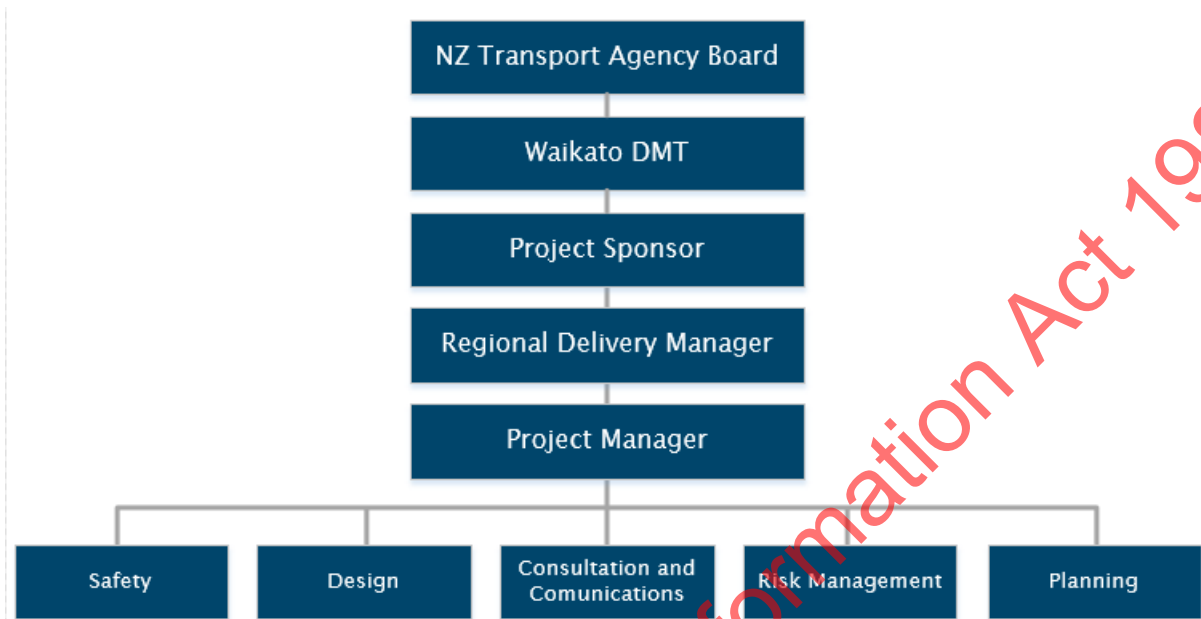


Figure 2: Governance organisation structure

1.3.2 NZ Transport Agency Board

The NZ Transport Agency Board has overall responsibility for NZ Transport Agency projects. The Board reports directly to the Minister of Transport and is responsible for:

- land transport planning
- managing the state highway network
- regulating access to, and participation in, the land transport network
- promotion of land transport safety and sustainability.

1.3.3 Highways and Network Operations (HNO) Group Value Assurance Committee (VAC)

The HNO Group Value Assurance Committee (VAC) is the most senior project decision making team within the HNO group, which comprises the National Manager Professional Services and various other senior managers and technical specialists.

1.3.4 Waikato Decision Making Team (DMT)

The Decision Making Team (DMT) review investment proposals regarding Waikato State Highways and make recommendations for funding approval.

1.3.5 Project sponsor

The project sponsor is James Bevan.

The project sponsor is responsible for:

- Ultimate authority and responsibility for the project
- Endorsing changes to scope, schedule, budget and quality
- Endorsing escalation and championing recommendations to the Highways VAC
- Providing policy guidance to the Project Manager
- Endorsing the Project Management Plan to confirm that project scope and deliverables are correct
- Reviewing progress and providing advice on resolution of issues
- Supporting the Project Manager
- Resolving issues beyond the Project Managers authority

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2. PROBLEMS AND BENEFITS

The NZ Transport Agency engaged with key stakeholders in the form of pre-distributed background material and a subsequent Stage 1 workshop, held in February 2016. A record of invitees and outcomes of the workshop, including the workshop information pack, are included as APPENDIX D – WORKSHOP ENGAGEMENT.

The purpose of the Stage 1 workshop was to gain a better understanding of the problems associated with this corridor (real or perceived), the benefits of resolving those problems, and to explore what high-level mechanisms might be used as a strategic response to remedy those problems.

The following problems were identified for this corridor through this workshop were:

- High traffic volumes and an inconsistent, unprotected, and unforgiving road corridor result in high DSI crash rates (70%)
- The number and layout of intersections and accesses, coupled with high traffic volumes, results in a significant DSI crash rate at intersections (30%)

The following benefits have been identified;

- Reduction in run-off-road and head-on DSI casualties
- Increase in the length of corridor above the current 3 star rating
- Reduction in intersection DSI casualties

The problems identified and described align with those identified in the strategic case and programme business case for this corridor, specifically:

- Road Safety (Strategic Case)
- Poor driver behaviour coupled with a sub-standard road design for its current function leads to a high crash rate along the corridor (PBC)
- Competing priorities of access and throughput along the corridor has contributed to the crash history (PBC)

2.1 Problem 1

High traffic volumes and an inconsistent, unprotected, and unforgiving road corridor result in high DSI crash rates (70%)

2.1.1 Problem Definition

This problem statement refers to the high proportion of crashes that occur in mid-block sections of this corridor (77% of all injury crashes).

The characteristics of this corridor that were identified to contribute to the problem statement are:

- undivided highway with high traffic volumes
- Narrow shoulders
- Steep roadside drop-offs in some areas and roadside table drains

- Road cuttings – unforgiving banks
- Utility poles, timber rail fences and trees in close proximity to running lanes

The Safe System approach recognises that, inevitably, drivers will make mistakes for a variety of reasons. These reasons include distraction, fatigue, illness or impairment (including medical). Due to the high traffic volume, when a vehicle crosses the centreline a head-on collision with an opposing vehicle has a high probability of occurrence. When a vehicle leaves the road, the unforgiving roadside environment results in a high probability of death or serious injury.

2.1.2 What is expected?

This corridor has a ONRC of National (High Volume), with a AADT of 15,840 in 2015, of which 11% were heavy vehicles.

The relevant Customer Levels of Service for a National (High Volume) ONR classification relating to this issue is:

- *Safety: Mostly forgiving roads and roadsides, equivalent to KiwiRAP 4-star standard. User hazards absent or mitigated including head on risk.*

2.1.3 Current State

The following evidence is presented to illustrate the problem.

KiwiRAP classification

The published 5km KiwiRAP star rating across the corridor is 3 star, as illustrated in the figure below.



Figure 3: KiwiRAP published star rating (5km)

When analysed at 100m segments, the Star rating across the corridor ranges from 1 to 3, with the majority of the route as 3 star.



Figure 4: KiwiRAP star rating (100m) ¹

The majority of the small increments with a KiwiRAP rating of 1 correspond with the intersections along the corridor.

The low KiwiRAP star rating is inconsistent with the expected customer level of service expected of a ONRC National (High Volume) corridor. The low KiwiRAP star rating will be indicative of elevated risk profiles for run off road and head on risk, outlined below.

As discussed earlier, this section of state highway follows the recently completed Waikato Expressway Cambridge bypass section. Stakeholders have raised concerns that the level of safety risk has increased due to the change in road environment (indicated by the change in KiwiRAP star rating) exiting the expressway and transitioning onto the Cambridge to Piarere corridor.

Run-off Road Outcome Risk

Run off road outcome risk is a component of the KiwiRAP star rating. This corridor has approximately 80% of its length (combined directions) measured as either Moderate or Severe run-off road outcome risk, broken down as:

- 20.2 km (59%) has a moderate roadside risk
- 7.1 km (21%) has a severe roadside risk

¹ Extracted from SafetyNET 15 March 2016

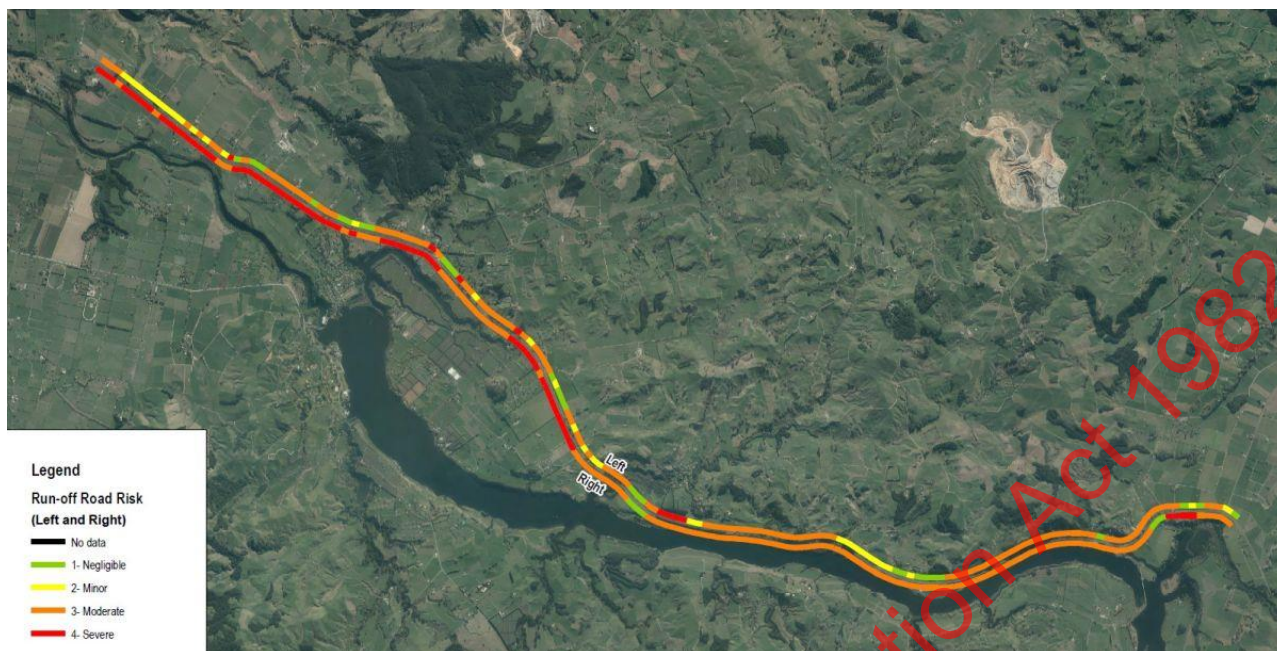


Figure 5: Run-off road risk

The average run-off road RPS score of 5.68 is in the medium risk range and contributes to the 3-star rating.

Run off road risk is a measure of the severity of outcome should a vehicle leave the road. Measures of Severe or Moderate indicate a ranges of road characteristics that contribute to elevated risk such as narrow shoulders and the presence and proximity of roadside hazards. An elevated risk contributes to an elevated outcome should a vehicle leave the road.

Head-on Risk

Head-on outcome risk is a component of the KiwiRAP star rating. This corridor has approximately 100% of its length (combined directions) measured as either Moderate or Severe head-on outcome risk, broken down as:

- 12.6 km (74%) has a moderate head-on risk
- 4.5 km (26%) has a severe head-on risk

The average head-on Road Protection Score (RPS) of 10.76 is in the medium to high risk range and correlates with a 3-star rating.

Crash history

Over the 10 year period from 2005-2014 there were 24 FSI crashes along this corridor, resulting in 39 DSI casualties (29 serious and 10 deaths)².

² As investigation work began prior to the end of 2015, the 2005-2014 crash record was used as the DSI baseline and to assess potential benefits. The same 2005-2014 crash record is used as the baseline for the long term IBC investigation to ensure constancy between the two schemes. The crash data for the 2006-2015 period is similar to the 2005-2014 record. The 2006-2015 records contains four more DSI's than the 2005-2014 record, all resulting from head-on crashes.

Of these, 85% are a result of head on or run off road crashes.

The following table provides a breakdown of the DSI crash statistics for head on and run off road crashes:

Table 2: DSI crash types 2005-2014

TYPE OF CRASH	TOTAL	TOTAL %
Head On	28	72
Loss of Control (off road)	5	13

The figure below illustrates the location of these crashes:

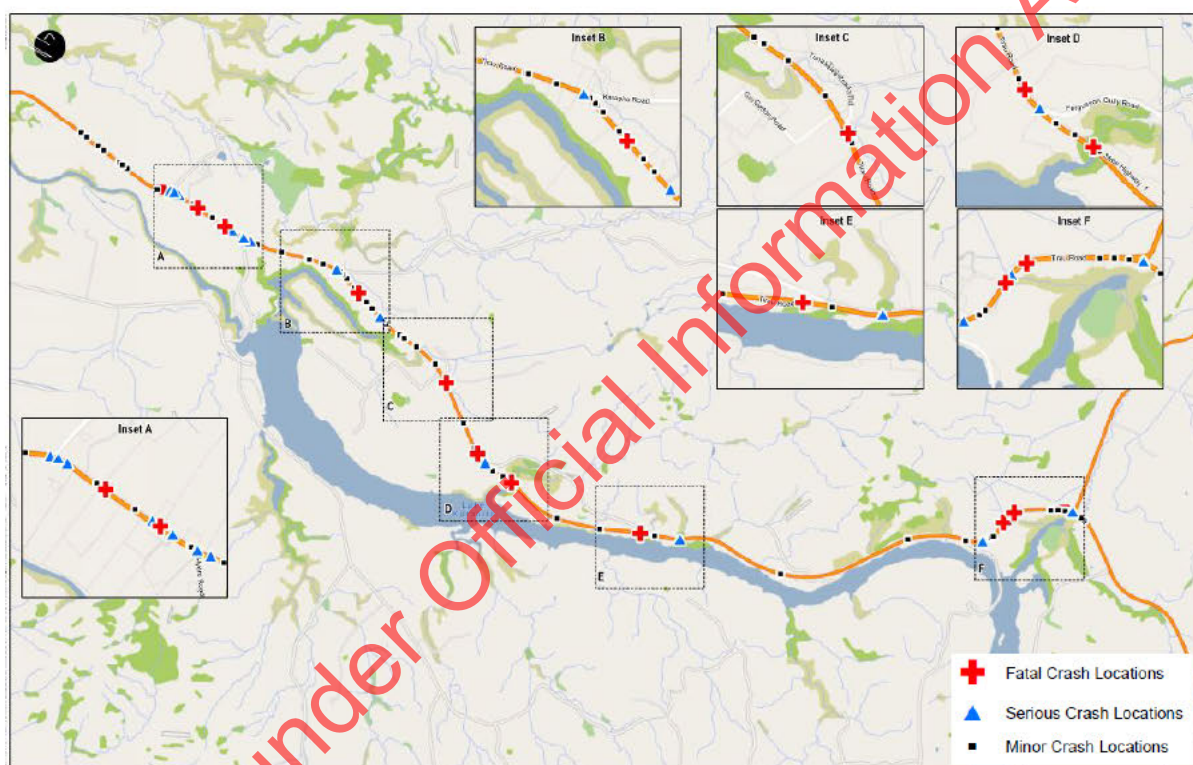


Figure 6: Injury crash locations (2005 – 2014) (note, this map includes all FSI crashes, including those at intersections)

Key points relating to the crash history are as follows:

- 32% of all FSI crashes (44% of all DSI casualties) are recorded as occurring as “Bend – Lost Control / Head On” crashes
- % of all FSI crashes (33% of all DSI casualties) are recorded as occurring as “Straight Road Lost Control” crashes

Collective Risk rating

The Collective Risk for the full corridor extent over the 2005-2014 period is High (calculated as 0.16 FSI/year/km).

Incrementally, the Collective Risk varies along the corridor, as illustrated below.

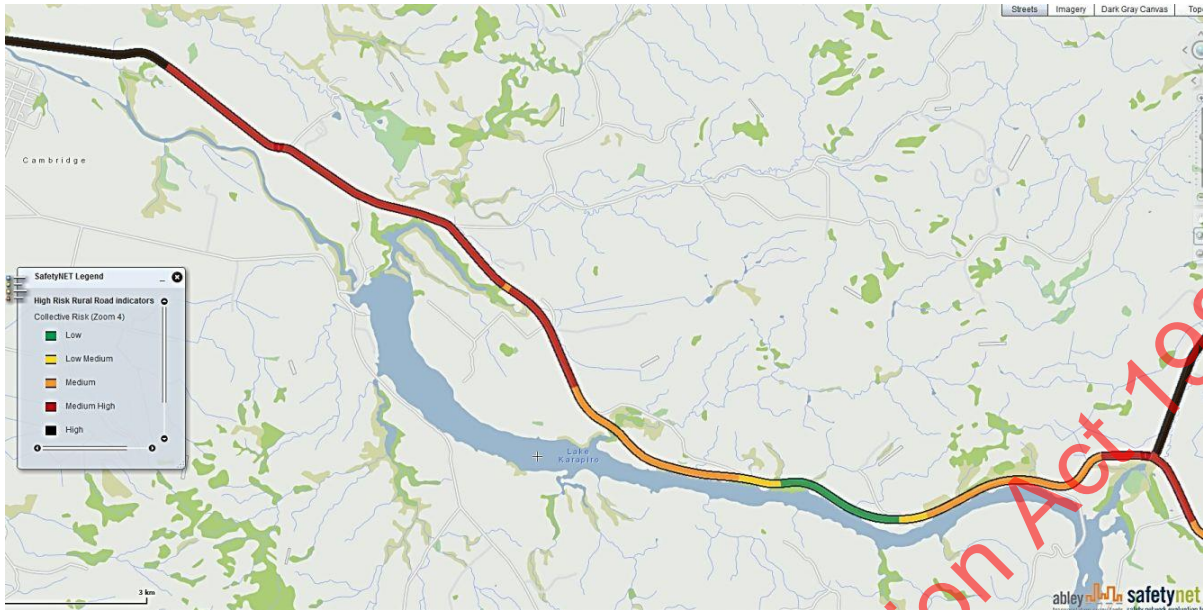


Figure 7: Collective risk³

Personal Risk rating

The Personal Risk for the corridor over the 2005-2014 period is Low-medium (calculated as 3.3).

Measured along the corridor in smaller increments Personal Risk ranges from Low to Low-Medium, as illustrated below.



Figure 8: Personal risk⁴

³ Extracted from SafetyNET

⁴ Extracted from SafetyNET

Out of Context Curves

The alignment of this corridor is relatively flat although the surrounding topography is undulating. Several curves are out of context for the prevailing speed environment. The posted speed limit is 100km/h throughout.

Four curves are greater than 20 km/h out of context with the approach speed environment. One curve is between 15 and 20 km/h out of context. The locations of these curves are illustrated below.

Out of context curves can contribute to midblock safety issues. When the location of these out of context curves is compared to the injury crash map for 2005-2014 (Figure 6), a correlation can be observed with the location of the fatal and serious injury crashes for the corridor.



Figure 9: Out of context curves

Existing safety treatments

The Cambridge to Piarere corridor has existing safety treatments that contribute to existing safety issue mitigation, specifically:

- The road has edge line and centreline ATP along the majority of the corridor.
- There are short sections of existing side barrier installed greater than 5 years ago. Side barrier associated with the Cambridge Expressway tie-in is also installed north of Hickey Road.

These treatments alone have not reduced the problem, as evidenced above.

Recent and planned safety improvements

Recent safety improvements have been implemented around the transition between the Cambridge section of the Waikato Expressway and the Cambridge to Piarere corridor, specifically:

- Removal of the northbound passing lane south of the expressway transition, ≈2014
- Installation of side barriers south of the expressway transition, ≈2015
- Additional signage through the expressway transition section emphasising two-way traffic, ≈2015

These changes have been made to mitigate potential safety issues for corridor users transiting from the two road environments.

2.1.4 Potential benefits

The following benefits to addressing this problem have been identified:

- Reduction in run-off-road and head-on DSI casualties
- Increase in the length of corridor above the current 3 star rating

2.2 Problem 2

The number and layout of intersections and accesses, coupled with high traffic volumes, results in a significant DSI crash rate at intersections (30%)

2.2.1 Problem Definition

This problem statement refers to the intersections and access points along the corridor, and the issues that this has on a route with high volumes of high speed traffic.

Uncontrolled intersections coupled with high AADT along this corridor result in an unacceptable number of crashes. The high speed of through traffic (100km/h) means that there is a high likelihood of injuries or death.

2.2.2 What is expected?

This corridor has a ONRC of National (High Volume), with a AADT of 15,840 in 2015, of which 11% were heavy vehicles.

The relevant Customer Levels of Service for a National (High Volume) ONR classification relating to this issue is:

- *Accessibility: landuse access for road users rare and highly engineered.*

2.2.3 Current State

Intersections

There are 9 intersections located along the corridor. All of the intersections are uncontrolled and allow all left turn and right turn movements. The location of these intersections is illustrated below:

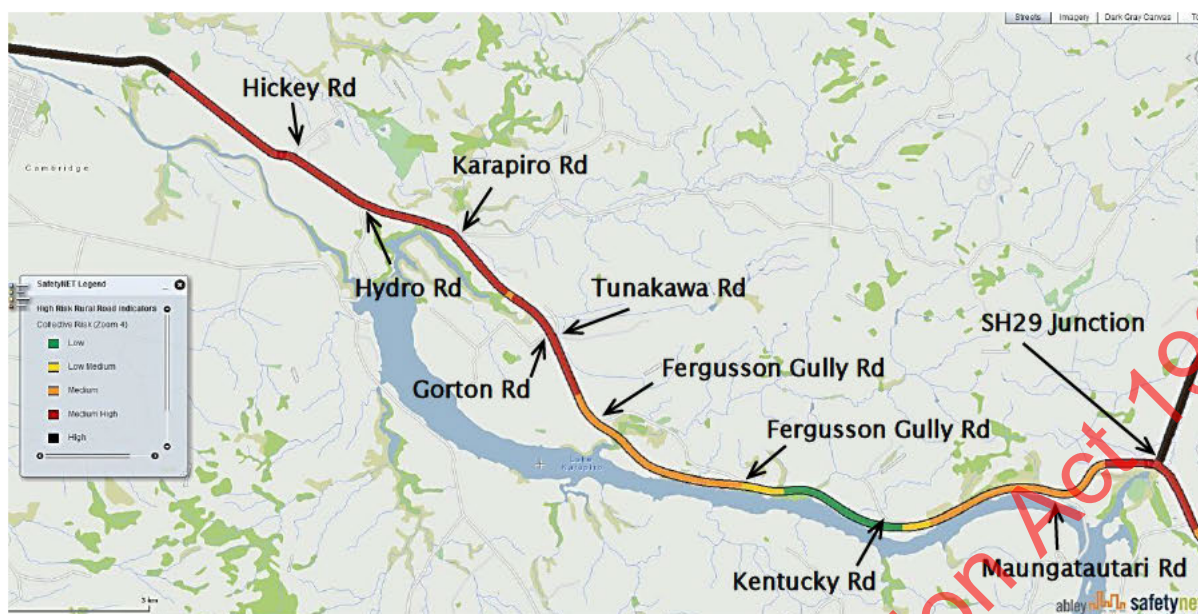


Figure 10: Intersection locations (overlaid over Collective Risk)

Access points

Excluding intersections, there are approximately 70 access points along the corridor. The majority of these are at the western end of the corridor. Access point types range from farm access points to residential access points.

Crash history

The total number of DSI crashes at intersections over the 2005-2014 period is 5, representing 13% of all DSI crashes.

For the corridor, 23% (23) of the *total* injury crashes occurred at intersections. This is higher than the national average of 16%.

The number of crashes by intersection is outlined in the table below.

Table 3: Intersection crash types

INTERSECTION	TOTAL CRASHES	TOTAL INJURY CRASHES	TOTAL FSI CRASHES	NUMBER OF DSIS	OTHER NOTES
SH1 / Hickey Road	3	2	1	4	Crossing / turning
SH1 / Hydro Road	16	6	1	1	Failed to give way
SH1 / Karapiro Road	8	1	0	0	No FSI crashes
SH1 / Gorton Road	1	0	0	0	No injury crashes
SH1 / Tunakawa Road	0	0	0	0	No crashes
SH1 / Fergusson Gully Road	2	1	1	1	Lost control due to fatigue
SH1 / Kentucky Road	1	0	0	0	No Injury crashes

SH1 / Maungatautari Road	15	3	0	0	No FSI crashes
SH1 / SH29 Junction	21	10	2	2	Failed to give way
TOTAL	67	23	5	8	

Hydro Road intersection has a high crash count compared to the other intersections on the project corridor (24% of intersection crashes).

The SH29/SH1 intersection has both a high crash rate and severity compared to other intersections on the project corridor (31% of intersection crashes and 43% of intersection injury crashes).

Intersection Risk

Two intersections, Hydro Road and Karapiro Road are rated as “Medium” risk.

The remaining intersections are rated as “Low” risk.

Existing safety treatments

There are limited existing safety treatments on these intersections. The higher volume intersections have right-hand turn bays.

Recent and planned safety improvements

Expansion of the Mobil at Karapiro Road is proposed and a planning application has been lodged with Council. The changes will affect access/egress to the state highway and the safety impacts have yet to be addressed.

A detailed design has been prepared for a new right turn bay off the state highway to provide safer access to Keeley Reserve. This project has been put on hold so that the right turn bay design can be integrated with the corridor safety improvements.

2.2.4 Potential benefits

The following benefits to addressing this problem have been identified:

- Reduction in Intersection DSI casualties

2.3 Constraints and dependencies

2.3.1 Road corridor environment

This corridor is dominated by two natural environment features – Lake Karapiro which runs immediately to the south of SH1 and the steep Karapiro hills alongside long sections on the northern side of the carriageway.

These hills present a constraint for the transport corridor, limiting its ability to expand, as well as for the development along the corridor, with little suitable land for activities other than farming or the current roadside activities. The steep bluffs that border sections of the corridor provide a constraint for road widening.

The land-uses adjacent to this section are predominantly agricultural, horticultural, and sports/recreational based, including several small commercial businesses located along the route. Existing high productivity farming and grazing paddocks adjacent to road corridor will make any potential land purchase costly for treatments that require additional road widening beyond existing corridor.

A Transpower 400kV overhead transmission line crosses over the corridor approximately 750m west of Kentucky Road. A transmission pylon associated with this line sits close to the road corridor. Underground services located in the berm include Telecom (Chorus) and Optical Fibre (Optex). Any treatments considered will need to account for the location of these services.

Due to the proximity of Lake Karapiro and the Waikato River, there are several access points for boat access and recreation. Any consideration of safety treatments for the corridor will need to consider minimising disruption to these existing access points.

2.3.2 Waikato Expressway – Cambridge Section

As outlined in Section 2.1.3, the Waikato Expressway Cambridge section opened in 2015, and bookends the Cambridge to Piarere corridor at its southern extent. Traffic transitions from the high design standard expressway on to the Cambridge to Piarere corridor at a higher speed. Options for treatment need to take this transition into account.

2.3.3 Cambridge to Piarere Long Term Scheme Indicative Business Case

As outlined in Section 1.2.5, the Cambridge to Piarere Long Term Scheme (LTS) IBC is under development. The LTS IBC is considering options which will address safety and efficiency problems identified through the Cambridge to Piarere PBC. Any treatments identified as part of this single stage business case (the short term scheme) will need to integrate with anticipated treatment options developed through the LTS. As highlighted in Section 1.2.5, close communication will be maintained between the two schemes to identify treatment and option constraints as well as manage single and consistent stakeholder communication.

3. OUTCOMES

3.1 Strategic outcomes

The **Upper North Island Journeys Strategic Context Board Paper** sets out the strategic context and outcomes-based approach for key journeys between Auckland, Hamilton and Tauranga via SH1/SH29 and Auckland and Tauranga via SH2.

The key findings were the need to provide:

- Travel time savings on the key journey from Auckland to Tauranga (via SH1/SH29)
- Safety - reduction in deaths and serious injuries and a predictable journey (reliable travel times) on the journey from Pokeno to Tauranga (via SH2).

The **SH1 Hamilton to Waiouru Strategic Case** and the **Hamilton to Tauranga Strategic Case** overlap on the Cambridge to Piarere Section. The problems identified in both Strategic Cases related to Road Safety and efficiency particularly the movement of freight.

3.2 Programme outcomes

The **Safer Journeys - Delivering State Highway Safer Roads and Roadside Programme Business Case** is based on a strategy of reducing the number of New Zealanders that are killed or seriously injured on our roads annually, minimising the social harm and economic impact of road crashes. The expected long term outcomes of the programme are:

- collective risk: Total state highway deaths and serious injuries
- % State highway network by KiwiRAP rating bands by state highway classification

The SH 1: Cambridge to Piarere corridor was identified within this PBC as a rural state highway to be investigated further based on criteria within the High Risk Rural Roads Guide (HRRRG) - namely the existing High Collective Risk rating.

The **SH1 Cambridge to Piarere Programme Business Case** identified the following problems to be addressed:

- Poor driver behaviour coupled with a sub-standard road design for its current function leads to a high crash rate along the corridor (40%)
- Competing priorities of access and throughput along the corridor has contributed to the crash history (20%)
- Future demand for the corridor is expected to exceed capacity, potentially reducing the regions ability to support growth (40%).

3.3 Project outcomes

Project outcomes (investments objectives) were developed for this project during Workshop 1 from the overarching strategic and programme level objectives. The objectives were discussed further and agreed at the options workshop with NZTA stakeholders (meeting dated 27 April 2016).

The investments objectives have been further informed based on the treatment philosophy for road corridors in the **High Risk Rural Roads Guide (2011)** corridors as illustrated in the figure below:

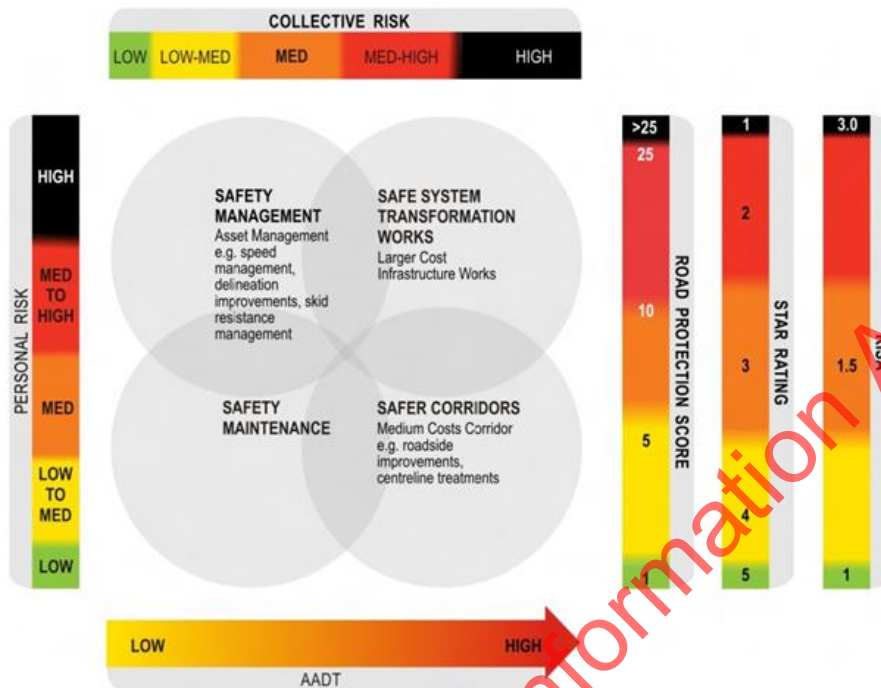


Figure 11: HRRRG treatment philosophy

The HRRRG figure above indicates a Safer Corridors treatment philosophy for this corridor.

In addition, it was agreed to develop the investment objective statements regarding DSI reduction with a context of:

- 10 year return period
- Potential combined benefit stream of short and long term improvements

For the SH1: Cambridge to Piarere corridor the agreed investment objectives are therefore:

1. Reduce the probability and severity of DSI crashes by 50 to 60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements.
2. Improve 30 to 50% of the corridor to a KiwiRAP star rating of above 4 star by end of 2017.

The figure of 30-50 % change in star rating to 4 from sections currently below 4 has been identified as an achievable length without significant investment in intersection layout and road realignment. The figure of 4 star has been used as an indicator of the Level of Customer Service for Safety for a corridor with a ONRC of National High Volume.

By improving the star rating of the corridor, it is expected that the Personal and Collective Risk of the treated sections will improve. In other words an improvement in KiwiRAP will also lead to a reduction in death and serious injury crashes along the route.

The Project outcomes (investment objectives) are consistent with the Strategic outcomes and the Programme outcomes identified above, specifically the safety outcomes, and are expected to contribute to both.

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4. STAKEHOLDERS

4.1 Consultation and communication approach

Specific engagement with key stakeholders was undertaken throughout the development of this business case.

For detail on stakeholder engagement and communications planning refer to APPENDIX G – STAKEHOLDER PROJECT ENGAGEMENT AND COMMUNICATIONS PLAN.

4.1.1 Identification of problems and benefits

Key stakeholders were invited to participate in the identification and clarification of the problems along the corridor, confirm the case for change and to identify the benefits of investment. Background material was prepared and distributed to this stakeholder group prior to a workshop (Workshop 1) held in February 2016. A record of invitees and outcomes of the workshop, including the workshop information pack, are included as APPENDIX D – WORKSHOP ENGAGEMENT.

The purpose of this workshop was to better understand the problems associated with this corridor (real or perceived), the benefits of resolving those problems, and to explore what high-level mechanisms might be used as a strategic response to remedy those problems.

4.1.2 Options assessment workshop

A workshop was held with NZTA stakeholders and Safe Roads Alliance staff on 27 April 2016.

The purpose of the workshop was to review the options development and the options assessment process with a view to the endorsement of a recommended option.

4.1.3 Future engagement and consultation

Future stakeholder engagement and communications are to be undertaken in conjunction with the Long Term Scheme and are covered by a single consistent strategy. This strategy will be led by the lead consultant for the Long Term Scheme (Opus) and the NZ Transport Agency.

All communications regarding the Long Term Scheme will include messaging regarding the short term works planned, explaining why this work is to be carried out and when.

Communications for the long term scheme have commenced with a media release and a letter to landowners. Opus are planning a further stakeholder workshop, followed by a community drop in session early in 2017.

4.2 Stakeholder views

Further detail of stakeholder views from the problems and benefits works are recorded in APPENDIX D – WORKSHOP ENGAGEMENT.

5. OPTION DEVELOPMENT

5.1 Treatments considered

Stakeholders considered a wide range of high-level treatments, with the understanding that those treatments carried through to the short list would form the platform for subsequent option development.

The long list evaluation and screening of the treatments was considered at a high level to determine how they contribute towards meeting the investment objectives. The evaluation considered the following:

- Traffic volumes, i.e. median treatment will not be appropriate for a corridor with a low number of vehicles per day
- An assessment is made of what looks good for the corridor. i.e. lighting over a short length may not be appropriate
- A high level assessment for each option comparing the potential construction cost to the potential DSI savings per 10 years.
- Safe Roads and Roadside treatment philosophy: screening and short listing options that are most appropriate within the safe roads and road sides quadrant. Options which fall outside of this will be noted and passed on to the relevant groups with NZ Transport Agency as appropriate.

The treatments are grouped according to themes and are summarised in the table below:

Table 4: Treatments Considered

TREATMENT	COMMENTARY	ADOPT / DEFER / REJECT	RATIONALE
Reduced speed environment	Reduction of speed limits to reduce crash risk	Reject	A reduced speed limit would not be desirable for a rural high volume National Strategic corridor for efficiency and journey management reasons
Improving road and roadsides	<ul style="list-style-type: none"> • Shoulder widening • Hazard Protection (Edge Barriers) • Median Barriers • Hazard Removal • Signs and Delineation • Centreline Widening • ATP (continuous centreline and edge line) 	Accept	There was a strong consensus among stakeholders that physical works were a necessity for safety improvements along this route. As demonstrated in the analysis in section 2, there is need for at least localised treatments along this route. Therefore this alternative and the options under it were developed.

Improving intersections	Improvements to existing intersections including; <ul style="list-style-type: none"> • Signs and Delineation • Road Widening • Right turn bay/s • Alternative intersection layout 	Accept	Some improvement to intersections will provide a higher level of safety but also to provide more frequent safe U-Turn facilities. The option analysis will need to carefully consider the scale of investment improvements
Four Lane Divided Highway	Investigation of a long-term efficiency scheme is underway and will consider this in greater detail.	Defer	A four lane divided highway is the preferred solution for a high volume National Strategic corridor

5.2 Short List development

Possible short list options along the route to respond to the Collective and Personal Risk, traffic volumes and One Network Road Classification along with the HRRRG Safer Corridors treatment approach

Workshop 1 participants identified a shortlist of options, which were developed by combining safety treatments. Treatments discussed at the workshop included continuous ATP edge lines, wide centrelines, side barriers, median barriers, additional passing lanes, and intersection treatments.

A key aspect of intersection treatments discussed at workshop 1 related to safety, in particular for right turning movements. The stakeholder group at workshop 1 identified the Karapiro Road and SH29 intersections with SH1 as two key intersections with elevated levels of risk. The use of roundabouts at these locations was discussed as a treatment to improve safety but also to provide accessibility. Concerns were raised that central barriers would reduce accessibility to private property and this could be mitigated through appropriate intersection upgrades. The use of RIAWS (rural intersection activated warning signs) was also discussed at these high volume intersections, however it was put forward that roundabouts provided for a greater level of safety, improved condition for turning traffic, and were also more appropriate given the High Volume road classification.

A four lane expressway (Option 9) has been agreed as a potential long term improvement and outside scope of short term scheme. This treatment has been carried through option analysis to highlight the cost-effective nature of safety improvements proposed in the other options, rather than an option for selection.

The Short List options developed are set out in Table 5 below.

Table 5: Options analysed

OPTION	DESCRIPTION
1	Do minimum
2	Wide centreline
3	Wide centreline + SH29 roundabout
4	Wide centreline + side barriers at higher risk locations. Wide centreline to accommodate retrofit of centreline barrier.
5	Median barrier + side barriers at higher risk locations + SH29 & Karapiro road turnarounds
6	Wide centreline + continuous side barriers + SH29 roundabout
7	Three barriers + SH29 roundabout + Karapiro road roundabout
8	Continuous 2+1 with three barriers + SH29 roundabout + Karapiro road roundabout + Hickey road curve realignment
9	Four lane expressway

5.3 Options description

A high level description of the short list options is provided below. All options, excluding option 1 and 9 include minor intersection safety improvements. This could include visibility improvements and minor layout or geometry changes.

5.3.1 Option 1: do minimum

Continue to maintain highway in current form with no proposed safety improvements.

5.3.2 Option 2: wide centreline

Option 2 would introduce a wide centreline along the whole corridor length as well as providing lane and shoulder widths of not less than 3.5m and 1.5m respectively. The centreline would be 1.5m wide to allow future retrofit of a median barrier. Around 8km of the corridor would require widening to provide sufficient width for the wide centreline.

5.3.3 Option 3: wide centreline + SH29 roundabout

Option 3 is the same as option 2 (wide centreline) with the addition of a roundabout to reduce the risk of deaths and serious injuries at the SH1/SH29 intersection. This would be an effective treatment and would be consistent with existing and proposed treatments at other major state highway to state highway intersections on the Waikato and Bay of Plenty networks.

5.3.4 Option 4: wide centreline + side barriers in high risk locations

Option 4 is similar to option 2 (wide centreline) with the addition of side barrier at locations with higher assessment of roadside risk.

5.3.5 Option 5: median barrier + side barriers at higher risk locations + SH29 and Karapiro Road turnarounds

Option 5 is similar to option 4 with the addition of a median barrier to reduce head-on crashes by an estimated 90%. The centre barrier would be within a 1.5m median, therefore the road widening would be the same as for the wide centreline of the previous options.

Turnaround facilities associated with the median barrier include HCV turnarounds at SH29 and at the Karapiro road intersection and three lower cost turnarounds at existing side road junctions.

5.3.6 Option 6: wide centreline + continuous side barriers + SH29 roundabout

Option 6 is a wide centreline with continuous side barriers and a roundabout at SH29 intersection. Gaps in the side barrier would be provided at private property access locations and at intersections.

Intersection and turnaround facilities are the same as for option 5.

5.3.7 Option 7: three barriers + SH29 roundabout + Karapiro road roundabout

Option 7 is similar to option 5 but includes extended infill of side barriers along the full length of the corridor. Gaps in the side barrier would be provided at private property access locations and at intersections.

Intersection and turnaround facilities are the same as for option 5.

5.3.8 Option 8: Continuous 2+1 with three barriers + SH29 roundabout + Karapiro Road roundabout + Hickey Road curve realignment

Option 8 would improve the levels of service for travel time reliability, resilience, and safety in anticipation of the increased traffic volumes post 2020. It also includes realignment of the out of context back-to-back curves at Hickey Road. This represents the likely maximum practicable investment in the corridor before the transformational change to a four-lane, median divided, and access controlled expressway.

5.3.9 Option 9: four-lane expressway

Option 9 involves extension of the Waikato Expressway south to provide a four-lane, median divided, and access controlled road.

The option is included to highlight the cost-effective nature of the safety improvements proposed in the other options. The additional benefits of option 9 are future assumed efficiency and resilience and it would provide an inherently safe route.

6. OPTION ASSESSMENT

To assess the short list options, high level scheme design of each option was undertaken and cost estimates prepared. An assessment of these options was then be completed. This allows the project team to recommend the right combination and return on investment. The assessment includes:

- Effectiveness against investment objectives
- Effect on collective and personal risk
- Cost per DSI saved
- Estimated capital cost range
- BCR
- Social and environmental screen (Safety, economy, integration, social, natural environment, human health, cultural and property); and
- Implementability (Technical, consentability, operational/maintenance, safety in design, financial and public/stakeholders).

The full assessment profiles for each option are included as APPENDIX A – ASSESSMENT OF OPTIONS.

Cost estimates for all options are contained within APPENDIX B – COST ESTIMATES.

6.1 Option analysis

6.1.1 Option 1: Do minimum

Option 1 would not provide a reduction in DSI casualties or improvement in the KiwiRAP star rating.

6.1.2 Option 2: wide centreline

Option 2 would reduce overall DSIs between 25% and 30% whilst improving 18% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$5.7M and has a BCR >1.

This option has the lowest capital cost and lowest cost per DSI saved, along with low consenting risk. In addition this option allows for future retrofitting of centre barrier treatment.

This option however does not meet the project outcomes (investment objectives), does not address the identified intersection issues and does not address head on crash risk.

6.1.3 Option 3: wide centreline + SH29 roundabout

Option 3 would reduce overall DSIs by approximately 30% and improve 18% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$9.9M, with a BCR <1

This option addresses the intersection issue identified at the key junction of SH1 and SH29, and allows for future retrofitting of centre barrier treatment.

This option however does not meet the project outcomes (investment objectives) and does not address head on crash risk. The proposed roundabout will likely require an alteration to existing designation extents and may require consenting.

6.1.4 Option 4: wide centreline + side barriers in high risk locations

Option 4 would reduce overall DSIs by approximately 30% and improve 30% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$7.4M and has a BCR >1.

This option meets the improved KiwiRAP star rating outcome (investment objective), has low consenting risk and allows for future retrofitting of centre barrier treatment.

6.1.5 Option 5: median barrier + side barriers at higher risk locations + SH29 and Karapiro Road turnarounds

Option 5 would reduce overall DSIs by approximately 60% and improve 43% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$12.2M and has a BCR >1.

This option addresses the intersection issue identified at the key junction of SH1 and SH29, and meets the both project outcomes (investment objectives).

The median barrier could impact property access along the corridor, with the requirement of turn around areas. Additional land outside of the current designation may be required to accommodate these turn around areas.

6.1.6 Option 6: wide centreline + continuous side barriers + SH29 roundabout

Option 6 would reduce overall DSIs by approximately 40% and improve 90% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$26.1M, with a BCR <1.

This option meets the project outcome (investment objective) for improved KiwiRAP star rating. This option addresses the intersection issue identified at the key junction of SH1 and SH29, address the run-off-road risk and allows for future retrofitting of centre barrier treatment.

This option however does not meet project outcome (investment objective) for DSI reduction. The proposed roundabout will likely require an alteration to existing designation extents and may require consenting.

6.1.7 Option 7: three barriers + SH29 roundabout + Karapiro road roundabout

Option 7 would reduce overall DSIs by approximately 65% and improve 90% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$36M, with a BCR<1.

This option meets the both project outcomes (investment objectives), address the run-off-road and head-on risks, and addresses the intersection issue identified at the key junction of SH1 and SH29.

The proposed roundabout will likely require an alteration to existing designation extents and may require consenting. The median barrier could impact property access along the corridor, with the requirement of turn around areas. Additional land outside of the current designation may be required to accommodate these turn around areas.

6.1.8 Option 8: Continuous 2+1 with three barriers + SH29 roundabout + Karapiro Road roundabout + Hickey Road curve realignment

Option 8 would reduce overall DSIs by approximately 65% and improve 90% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$39M with a BCR<1.

This option meets the both project outcomes (investment objectives), address the run-off-road and head-on risks, addresses the intersection issue identified at the key junction of SH1 and SH29 and addresses an out of context curve issue at Hickey Road.

The proposed roundabout will likely require an alteration to existing designation extents and may require consenting. The median barrier could impact property access along the corridor, with the requirement of turn around areas. Additional land outside of the current designation may be required to accommodate these turn around areas.

An altering the existing designation an additional land purchase is expected to be required for this option to allow for the extra lane. The widening required may be constrained by the physical environment, and consenting requirements are expected.

6.1.9 Option 9: four-lane expressway

This option would reduce overall DSIs by approximately 95% and improve >90% of the corridor to a KiwiRAP star rating above 4.

The estimated cost of this option is \$300M, with a BCR<1.

This option meets the both project outcomes (investment objectives), address the run-off-road and head-on risks and addresses the intersection and access issues.

This option however has significant land purchase and consenting requirements, along with social, cultural and natural environment considerations.

6.2 Option assessment

6.2.1 First level assessment of options

Option 1 makes no change to the existing situation, and does not meet either of the desired project outcomes, and is rejected on this basis.

Option 2 has a BCR >1, and has the lowest capital cost and lowest cost per DSI saved. This option however does not meet either of the project outcomes, and is rejected on this basis.

Options 3, 6, 7, 8 and 9 have a BCR <1 and are rejected primarily on this basis. Variants of Options 8 and 9 are expected to be considered in further detail by the Long Term Scheme IBC.

Options 4 and 5 were carried forward for further assessment.

6.2.2 Options assessment workshop April 2016

A workshop was held with NZTA stakeholders and Safe Roads Alliance staff on 27 April 2016.

The purpose of the workshop was to endorse a recommended option. This was not achieved due to uncertainty over long term scheme, however there was agreement in principle that a wide centreline based option and targeted side barrier (known as Option 2a at the time of this meeting) could deliver reasonable safety benefits that would contribute to overall corridor safety objectives for the corridor through both the short term online and long term schemes.

A centre barrier was discussed as a treatment that would provide a greater level of safety benefits but would require detailed assessment by Safe Roads. There was a concern that centre barrier might become redundant depending on the timing and format of the agreed long term scheme. It was agreed that Safe Roads should give consideration to staged delivery for short term safety improvements to allow designs and construction to progress in parallel with the long term scheme indicative business case.

NZ Transport Agency stated at this meeting an intention for the long term scheme to be constructed and opened by late 2023. The NZ Transport Agency stated an intention to consider safety investment objectives to be set across the corridor for both short term and long term schemes and Safe Roads was instructed to assess the short term scheme based on an assessment period of 10 years.

Delivery risks for the long term scheme were acknowledged (including designation, land acquisition, consenting and funding) and these will be monitored by a steering group led by the NZ Transport Agency.

It was also confirmed that major intersection upgrades such as SH29 intersection improvements would be delivered by the long term scheme. The short term safety scheme should consider low level safety interventions to intersections.

Minutes recorded at this meeting are included in APPENDIX H – OPTIONS WORKSHOP MINUTES.

6.2.3 DMT meeting June 2016

The project was presented to the Waikato NZTA DMT in June 2016. An early draft summary business case document was provided for circulation and is included in APPENDIX I – DMT MEMO: POST OPTIONS WORKSHOP UPDATE (dated 27/05/2016).

The summary document recommended phasing delivery of the short term safety improvements to enable the long term preferred route decision to inform the need for further investment in online safety improvements.

Option 4 (known as Option 2a at the time of the June meeting) was recommended to be taken forward to pre-implementation with implementation targeted for 2016/17 construction season. The option would be designed with provision for future median barrier installation which may or may not be required depending on the outcome of the long term scheme.

A centre barrier (Option 5) was presented as providing a greater level of safety effectiveness that would significantly increase the reduction in DSIs. Once the long term preferred route is agreed and there is greater certainty on its delivery programme, a decision can be made on whether to proceed with a retrofit of median barrier and associated turnaround areas.

The paper identified that the DSI reduction could be delivered in two ways:

1. The long term scheme, operational in early 2024 combined with Option 4 without median barrier operational in 2017.
2. The long term scheme operational beyond 2024 combined with Option 4 implemented in 2017 including retrofitting full median barrier and associated turnarounds by 2019.

Implementation of Option 4 (without median barrier) is necessary in the short term to ultimately achieve the 50% reduction in DSIs over the 10-year period (in conjunction with the long term scheme).

The figure below illustrates possible timing for design / construction activities assuming long term scheme is operational in shortest possible timeframe (end of 2013) and associated benefit streams (light shading).

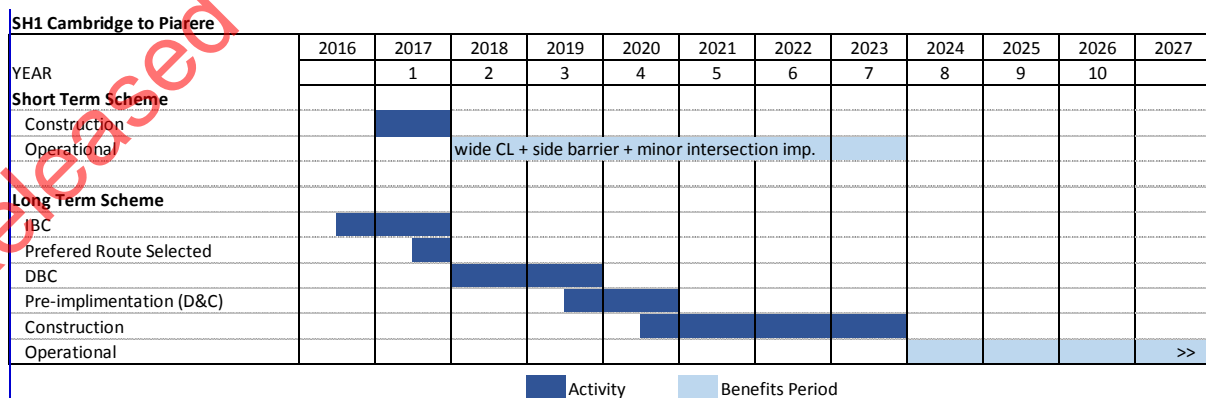


Figure 12: Outline programme: SH1 Cambridge to Piarere

6.2.4 Summary of option analysis

Option 5 has a BCR >1 and meets both investment objectives. However, in consideration of the Long Term Scheme (LTS), and the potential for the LTS to include divided carriage as a solution within 10 years, it is considered that the short term investment in a median barrier would represent overinvestment at this time.

With the Option 5 considerations above, Option 4 is preferred as the short term option on the basis that the LTS will provide transformational change within a 10 year period, including the construction of a divided carriageway. Under this timeframe for delivery of the LTS, the DSI savings investment objective will be met through both the implementation of Option 4 and the LTS.

More detail is discussed in Section 8 below around the timing and benefits sensitivity between Option 4 and 5.

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6.3 Options summary table

The table below provides an assessment summary of the options.

		OPTIONS SUMMARY TABLE								
		OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6	OPTION 7	OPTION 8	OPTION 9
		Do minimum	Wide centreline	Wide centreline + SH29 RAB	Wide centreline + side barriers at higher risk locations	Median barrier + side barriers at higher risk locations + turnaround areas	Wide centreline + continuous side barriers + SH29 RAB	Continuous three barriers + SH29 and Karapiro Road RABs	Continuous 2+1 with three barriers + SH29 and Karapiro Road RABs+ Hickey Road curve realignment	Four lane expressway
	Corridor Specific									
Investment Objective 1 NPBC objective to reduce 1426 DSI within 10 years	Reduce the probability and severity of DSI crashes by 50 to 60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements.	Reduces DSI by 0% (0 DSI)	Reduces DSI by 28% (11 DSI)	Reduces DSI by 30% (12 DSI)	Reduces DSI by 31% (12 DSI)	Reduces DSI by 56% (22 DSI)	Reduces DSI by 38% (15 DSI)	Reduces DSI by 64% (25 DSI)	Reduces DSI by 64% (25 DSI)	Reduces DSI by 97% (38 DSI)
Investment Objective 2 NPBC objective to change star rating on 424km of State Highway	Improve 30-50% of corridor to a KiwiRAP star rating of above 4 star by end of 2017	0% above 4 star	18% above 4 star	18% above 4 star	30% above 4 star	43% above 4 star	90% above 4 star	90% above 4 star	90% above 4 star	>90% 5 Star rated
Predicted Collective Risk Band (Target<=Medium Risk)		High	High	High	High	Medium-high	Medium-high	Medium	Medium	Low
Predicted Personal Risk Band (Target<=Medium Risk)		Low-medium	Low-medium	Low-medium	Low-medium	Low	Low	Low	Low	Low
Cost per DSI saved		-	\$0.51M	\$0.81M	\$0.64M	\$0.55M	\$1.7M	\$1.4M	\$1.5M	\$7.9M
Estimated Capital Cost		-	\$5.7M	\$9.9M	\$7.4M	\$12.2M	\$26.1M	\$35.7M	\$38.8M	\$300M
Indicative BCR Range (for 10 yr – 20 yr benefits periods respectively)			1.4 – 2.4	0.9 – 1.6	1.2 – 1.9	1.2 – 2.1	0.5 - 0.8	0.5 - 0.9	0.5 - 0.8	0.2 – 0.3
Predicted DSI saved / 10 years / \$100M spent		-	195	124	155	181	59	71	66	13
MULTI-CRITERIA ASSESSMENT SUMMARY										
Safety		neutral	+1	+1	+1	+2	+2	+3	+3	+3
Economy		neutral	neutral	neutral	neutral	neutral	neutral	neutral	+1	+2

Integration	neutral	neutral	neutral	neutral	neutral	neutral	neutral	neutral	neutral	
Social	neutral	neutral	-1	-1	-1	-1	-3	-3	-3	
Natural Environment	neutral	neutral	-1	neutral	-1	-1	-1	-3	-3	
Human Health	neutral	neutral	neutral	neutral	neutral	neutral	-1	-2	-3	
Cultural	neutral	neutral	-1	neutral	-1	neutral	-1	-2	-3	
Property	neutral	neutral	-1	neutral	-2	-1	-2	-2	-3	
IMPLEMENTABILITY										
Technical	neutral	neutral	neutral	neutral	neutral	neutral	neutral	neutral	-2	neutral
Consentability	neutral	neutral	-2	-1	-1	-1	-2	-2	-3	-3
Operational / Maintenance	neutral	-1	-1	-1	-1	-1	-1	-2	-2	-1
Safety and Design (Zero Harm)	neutral	-1	-1	-1	-1	-1	-1	-2	-2	-2
Financial	neutral	neutral	neutral	neutral	neutral	neutral	neutral	-2	-2	-3
Public / Stakeholders	-2	-1	neutral	neutral	-1	-1	-1	-2	-2	-2

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7. RECOMMENDED (ENDORSED) OPTION

It is recommended that **Option 4** (wide centreline plus side barriers at high risk locations) is implemented.

Option 4 has the following investment outcomes:

- 12 DSI Reduction (31% of DSI's) in 10 years
- 30% improved of route improved to 4.0 KiwiRAP star rating

Option 4 has the following assessed characteristics:

- Personal Risk band remains as Low-medium
- Collective Risk band remains at High
- A cost per DSI saved of \$0.64M
- An estimated capital cost of \$7.4M
- An indicative BCR of 1.2 to 1.9 (based on a 10 year and 20 year benefits periods respectively)

Option 4 has been assessed as an appropriate level of expenditure for short term safety improvements, given that a long term safety and efficiency intervention business case is underway with targeted implementation as early as 2024 (6 years after completion of the short term improvements – Refer to Figure 11), but more likely in 10 – 20 years. This is also reflected in an option which provides a reduced investment outcomes for the DSI saved.

The BCR range results from the range of possible timeframes for expressway construction, which effects the period of time over which the benefits of the safety improvements can be realised. The BCR range has been calculated for a benefit stream of 10 years and 20 years. The BCR of Option 4 with a benefit stream of 6 years is 0.8.

To fully achieve the investment objective in relation to DSI savings over the 10 year period, Option 4 would require either:

- the long term scheme to be operational by 2024, or, in the event that the long term scheme is delayed;
- upgrading to Option 5 by installing a median barrier and turn around facilities.

In respect of the investment objective of increasing the percentage of the corridor with 4 stars to 30-50%, Option 4 delivers at the lower end of the range. However, because the corridor has a high percentage of head-on crash movements relative to run-off-road crash movements, Option 4, and other options which improve performance with respect to head-on crash reductions, still perform very well in terms of DSI reductions. To achieve a higher percentage of 4 star sections would require more side barrier to be installed. Analysis of the options indicates that investment in measures which reduce head-on crash risk (such as wide centrelines and median barrier) are more effective than investment in side barriers, even though the latter would result in a higher percentage of 4 star sections. Given that the corridor is may be bypassed, over-investment in side barriers to meet the investment objective for 30-50% upgraded to 4 stars is not recommended.

Table 6: Recommended option overview

CRITERIA	COMMENTARY / ANALYSIS
Implementability	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Constructability	Can be constructed with relatively little traffic disruption.
Operability	No operational issues have been identified. The side barriers will require additional maintenance in the event of barrier strikes. Side barriers can restrict access to maintenance vehicles for activities such as mowing, spraying and drainage maintenance. Removal of existing road markings to accommodate wide centreline can reduce the life of existing surface/pavement
Statutory Requirements	The option is generally expected to be implemented within the existing designation and is unlikely to be constrained by district or regional plan requirements (assuming that no significant earthworks or culvert lengthening are required).
Property Impacts	Unlikely to require any land acquisition.
Asset Management	No asset management issues have been identified.

Option 4 described above was discussed and agreed in principle:

- At an options assessment workshop held on 27 April 2016 with delegates from both the Safe Roads Alliance and the NZ Transport Agency in attendance (refer section 3 and Appendix H for details).
- At DMT meeting following the submission of a discussion paper dated 27 May 2016 (refer section 3 and Appendix I for details).

A sensitivity assessment was undertaken for Option 4 with and without centre barrier and against a range of dates for the long term scheme being delivered:

- by the end of 2023 and operational by 2024
- by the end of 2024 and operational in 2025
- by the end of 2026 and operational in 2027, i.e. beyond the short term scheme 10-year assessment period.

The table below highlights the impact of the long term scheme completion date on projected DSI reduction (% reduction) for the combined short term and long term schemes. The table shows that if the long term scheme is delayed, required DSI savings outlined in the investment objectives (50-60%) can only be achieved by adding median barrier to the short term safety scheme.

Table 7: Implementation scenarios - Projected DSI reductions for full corridor.

CRITERIA	LONG TERM SCHEME FULLY OPERATIONAL IN YEAR		
	2024	2025	2027
Option 4 – no median barrier	48%	42%	30%
Option 4 – part median barrier (southern half only)	>50%	49%	39%
Option 4 – full median barrier	>60%	61%	55%

Key assumptions in the above assessment:

- Option 4 without median barrier would be constructed in 2017 and operational in 2018
- Median barrier, if retrofitted, in the southern section would be constructed in 2017/18 allowing time to consult on any access changes and would also allow consideration of the long term preferred route.
- Median barrier, if retrofitted, in the northern half would be constructed in 2018/19. This is conservative estimate to allow time to work through consultation on access changes and potential land take. It would also allow consideration of the long term preferred route.
- It is based on a predictive assessment of the likely reduction in DSIs.

It is recommended that Option 4 is progressed to pre-implementation and implementation including future proofing for possible median barrier.

On completion of the Long Term Plan Indicative Business Case (IBC) the preferred long term option and construction timeframe will be better understood, and if necessary the decision to progress with Option 5 (median barrier and turn around areas) will be made. The expected timeframe for completion of long term IBC is mid-2017 and is the hold point for this decision. This will be monitored by the Safe Roads Alliance and a decision to move to Option 5 (or not) will be made in conjunction with the Waikato DMT.

8. RECOMMENDED OPTION ECONOMIC ASSESSMENT

Table 8: Economic summary table

TIMING				
Earliest implementation start date	February 2017			
Expected duration of implementation	Four months			
ECONOMIC EFFICIENCY				
Time zero	1 July 2016			
Base date for costs and benefits	1 July 2016			
Present value of total project cost of do minimum	\$ 0			
Present value net total project cost of recommended option	\$7.1M			
Present value net benefit of recommended option (exc. WEBs) (assuming 10 year benefit realisation period)	\$8.9M			
Present value net benefit of WEBs of recommended option	\$0			
BCR (exc. WEBs)	1.2 (10 year assessment period)			
BCR (inc. WEBs)	1.2 (10 year assessment period)			
First year rate of return (FYRR)	17%			
P50 COSTS				
			Present value	
	Do minimum	Recommended option	Do minimum	Recommended option
Design	\$0	\$0.7M	\$0	\$0.7M
Statutory applications	\$0	\$0	\$0	\$0
Property	\$0	\$0	\$0	\$0
Construction/ implementation	\$0	\$6.7M	\$0	\$6.2M
External impact mitigation	\$0	\$0	\$0	\$0
Other capital (eg insurances)	\$0	\$0	\$0	\$0
Capital risk	\$0	\$0	\$0	\$0
Management				
TOTAL IMPLEMENTATION COST	\$0	\$7.4M	\$0	\$6.9M

Maintenance	\$0	\$0.3M	\$0	\$0.2M
Renewal	\$0	\$0	\$0	\$0
Operating	\$0	\$0	\$0	\$0
Other ongoing costs (eg toll collection)	\$0	\$0	\$0	\$0
Post project evaluation	\$0	\$0	\$0	\$0
ONGOING COST	\$0	\$0	\$0	\$0
Project contingency	\$0	\$0	\$0	\$1.3
TOTAL P50 PROJECT COSTS	\$0	\$7.7M	\$0	\$7.1M
BENEFITS				
			Present value	
			Do min	Recommended option
Travel time savings			\$ m	\$ m
Vehicle operating cost savings			\$ m	\$ m
Accident cost savings			\$ m	\$8.9M
Vehicle emissions reductions			\$ m	\$ m
Reduced driver frustration			\$ m	\$ m
Walking and cycling (EEM v2)			\$ m	\$ m
Travel behaviour change (EEM v2)			\$ m	\$ m
		PV total net benefits	\$ m	\$8.9M

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8.1 Assessment profile

An assessment profile for the Recommended Option using the Transport Agency's Assessment Framework for 2015-18 NLTP is outlined below. The profile includes the Strategy Fit, Effectiveness, Benefit and cost appraisal and Priority Order for investment.

8.1.1 Strategic fit

Strategic fit of the problem, issue or opportunity that is being addressed: H

The Strategic Fit is assessed as **High**, as the corridor has a high collective crash risk which would be improved by implementing Option 4. The high collective risk was calculated from crash statistics, in accordance with the High-Risk Rural Roads Guide.

8.1.2 Effectiveness

Effectiveness of the proposed solution: H

The Effectiveness is assessed as **High**. This assessment is based on evidence included in this Single Stage Business Case and as outlined below.

Table 9: Effectiveness assessment

CRITERIA	COMMENTARY / ANALYSIS	RATING
Outcomes focused	The recommended option is predicted to save 12 DSIs over 10 years, a 30% reduction. It includes upgrading of 30% of the corridor to >4 star KiwiRAP rating. This option fits within the wider programme of work, being the Cambridge to Piarere Programme Business Case objectives around sub-standard road design leading to a high crash rate, and competing priorities of access and throughput along the corridor contributing to the crash history.	H
Integrated	The recommended option incorporates the identified change in road corridor environment transiting from the recently completed Cambridge section of the Waikato Expressway. This option also works within the Indicative Business Case being developed for the Long Term Scheme for this corridor, being that it incorporates benefits likely to be achieved through long term interventions, but allows for those long term benefits being delayed in that it allows for retrofitting a median barrier	H
Correctly scoped	The recommended option contributes significantly to the 10 year investment objectives (50-60% reduction in DSI's and 30-50% of the corridor upgraded to 4 stars) and is flexible to adapt to timing and outcome of the long term scheme. These outcomes fit with the objectives outlined in the Cambridge to Piarere Programme Business Case.	H

CRITERIA	COMMENTARY / ANALYSIS	RATING
Affordable	The construction costs are able to be funded within existing budget allowance of the NLTF. The short term scheme option does not represent an over investment given the long term scheme anticipated treatments.	H
Timely	The recommended option will deliver benefits within the short term timeframe identified. Longer term solutions are being investigated separately	H
Confidence	Risks have been identified and documented through a risk management workshop and will be actively managed.	H

8.1.3 Benefit and cost appraisal

Benefit and cost appraisal:

BCR 1 to 3

BCR based on the EEM criteria for Option 4 falls within the range of 1 to 3 (indicative BCR of 1.2-2.1).

8.1.4 Assessment profile and prioritisation

The project will provide a robust investment in road safety. This is based on the evidence provided in this Business Case and the HH for Strategic Fit and Effectiveness, with a fundable BCR.

These factors combine to make the project corridor a Priority Order 3 for investment, as indicated in Figure 13 below.

Strategic fit	Effectiveness	Strategic fit and Effectiveness	Numeric benefit and cost appraisal			
			1 to 3	3 to 5	5+	
H	H	HH	Priority 3	Priority 2	Priority 1	Activities with these profiles progress to activity business cases.
H	M	HM	Priority 4	Priority 3	Priority 2	
M	H	MH	Priority 6	Priority 5	Priority 4	
M	M	MM	Priority 7	Priority 6	Priority 5	A decision gate that integrates with the business case approach.
H	L	HL	Low strategic fit does not progress beyond strategic business case. Low effectiveness does not progress beyond programme business case.			
M	L	ML				
L	H	LH				
L	M	LM				
L	L	LL				

Figure 13: Investment Priority Order

9. FINANCIAL CASE

9.1 Project Delivery Costs

The following table outline the key project delivery cost assumptions for the recommended option.

Table 10: Project delivery key costs and assumptions

CRITERIA	KEY COSTS	ASSUMPTIONS
Property Purchase, Management and Disposal Costs	Nil	Property acquisition not required
Design Costs	\$0.7M	12% of base physical works estimate
Construction Costs	\$6.7M	
Statutory application costs	Nil	No designation change required. All works to be contained within existing designation extent.

9.2 Ongoing maintenance and operations costs

The following table outline the key ongoing expenditure assumptions for the recommended option.

Table 11: Key ongoing expenditure and assumptions

CRITERIA	KEY COSTS	ASSUMPTIONS
Maintenance Costs	\$0.1M Annually	Includes re-seal of widening, barrier inspection, maintenance and repairs; cleaning of reflectors; wed spraying around barriers. Maintenance costs for existing infrastructure are not expected to change following barrier installation, although methodology may change due to the presence of side barriers.

9.3 Project revenues

No project revenues are forecast for this project.

9.4 Funding options

Subject to meeting overall thresholds for investment, it is anticipated that the activity can be funded from the National Land Transport Fund (NLTF), Road Improvement Activity Class, and no other funding sources or approaches would be required.

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10. COMMERCIAL CASE

10.1 Scale and Procurement

The proposed construction procurement basis will be in accordance with the Safe Roads Alliance Tranche 1 Safe Systems Procurement Strategy. The strategy has been developed on the basis of the NZ Transport Agency's standard procurement approach with contractors tendering on a detailed design and project documentation and evaluated using various methods such as price-quality, lowest price conforming, NOC's direct appointment and including some bundling of projects.

The project is a relatively low complexity capital project- procurement will be by price quality method (PQM). It is anticipated there will be sufficient capacity and interest from the market.

10.2 Risk allocation and transfer

Risk will be allocated in accordance with a traditional client/consultant /contractor model and will be transferred in accordance with relevant standard conditions of contract (CCCS and NZ3910:2103). However, the end-to-end responsibility for timing, cost and quality will remain with the Safe Roads Alliance.

Risk associated with Safety in Design will be a formal process informing design outcomes. Formal Risk Assessment process in accordance with Z/44 will be undertaken identifying where the most appropriate entity and person to manage the risk. Start and end of phase risk assessments will be completed for design, tendering and construction.

The proposed risk allocation is consistent with the cost estimate including provisional items and suitable contingency.

11. MANAGEMENT CASE

11.1 Project Management Planning

This project will be delivered by the Safe Roads Alliance, working with the Regional and National Transport Agency partners. The Regional BUDMT will be responsible for committing funds and accepting risk.

The governance structure is set out below in Figure 14. The Alliance Board consists of representatives from the Transport Agency (HNO and P&I), and the non-owner participants. They have the relevant skills and experience to make decisions on the project.

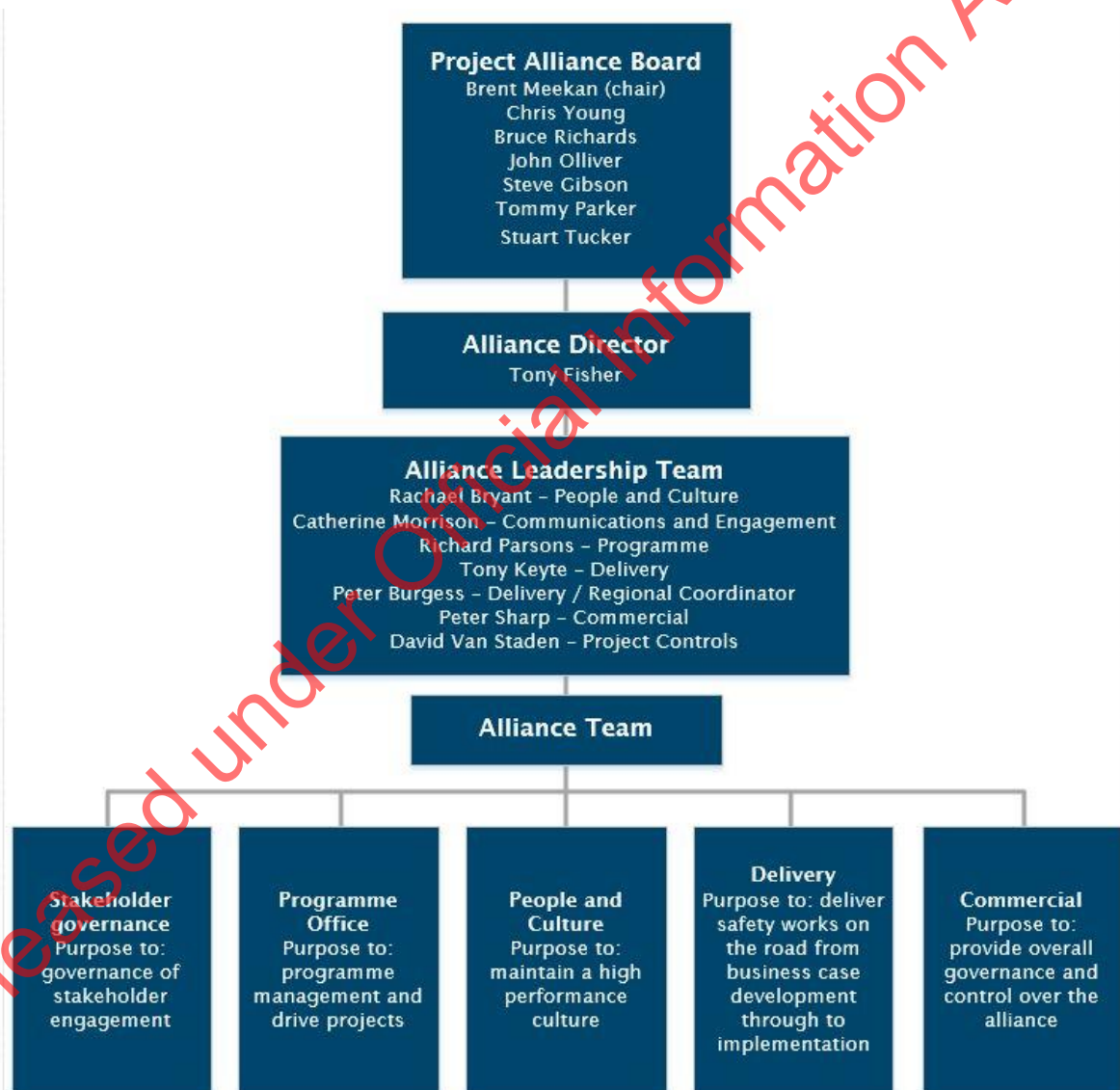


Figure 14: Governance structure

The final Business Case will be subject to internal reviews by the Alliance Team and the Outcomes Planning Team.

An independent Road Safety Audit will be carried out on the detailed design for this project in accordance with the Agency's Road Safety Audit Procedures for Projects – Guideline (Interim release May 2013). A panel of Safety Audit Team Leaders has been identified for carrying out audits of projects within the Safe Roads Programme.

The detailed Pre-Implementation Report will be developed including any departures to be applied for with Regional and/or National approval sought where required.

The key project assurance deliverables for the pre-implementation and implementation are set out in Table 12.

Table 12: Deliverables during pre-implementation and implementation stages

ITEM	COMPONENT	DESCRIPTION	CONTACT
Detailed Design	Non-standard design elements	Elevated to DMT for initial approval	Tony Keyte
	Innovative Solutions	VAC to approve any new systems	Tony Keyte
Tender Phase	Approval to advertise the tender	DMT approval required	Tony Keyte
	Approval to award the tender	DMT approval required	Tony Keyte

11.2 Risk Management Planning

The Project Manager will be responsible for managing project risk and will maintain the risk register. Risk will be managed in accordance with Z/44 – NZTA Minimum Standard for Risk Management, General Approach.

The risks and opportunities identified to date with a risk score greater than 20 (Extreme Risk) are outlined in the following table. The full Z/44 Risk Register is included as

APPENDIX J – RISK REGISTER.

Table 13: Key risks identified to date

TITLE	DESCRIPTION	RISK SCORE	TREATMENT STRATEGY
Programme Delays	<p>Description: Delay in programme</p> <p>Cause: Unrealistic programme assumptions, delays to detail design, inadequate resourcing, delays in funding approvals, changes to NZTA governance structure and process, consenting, weather delays</p> <p>Consequence: Reputational damage, increased cost and continued poor safety record</p>	21	Regularly updated programme
Comms and Engagement	<p>Description: Inconsistent and inadequate engagement between short and long term projects</p> <p>Cause: Poor communication between short and long term engagement teams</p> <p>Consequence: Reputational damage with key stakeholders and/or public for either short and long term projects</p>	22	Single comms and engagement plan between the both projects, regular meetings between project teams
Financial Viability	<p>Description: Over investment in short term improvements</p> <p>Cause: Infrastructure that is no longer required on completion of the long term scheme</p> <p>Consequence: Sunk costs due to over investment</p>	21	Regular meetings with long term scheme project team, benefit cost reviews
Achieving Project Objectives	<p>Description: Long term scheme delivered later than expected</p> <p>Cause: Design, value for money, funding approvals, stakeholders, consenting, Kaikoura earthquake reallocating priorities</p> <p>Consequence: Option 4 will not achieve the investment objectives (50%-60% DSI Savings)</p>	22	Regular meetings with long term scheme project team
Delay in SH29/SH1 Intersection Improvements	<p>Description: Delay in SH29/SH1 intersection improvement due to long term scheme deferral</p> <p>Cause: Design, value for money, funding approvals, stakeholders, consenting, Kaikoura earthquake reallocating priorities</p> <p>Consequence: Unacceptable safety risk and reputational damage</p>	22	Regular meetings with long term scheme project team

Stakeholder Expectations	<p>Description: Not delivering on stakeholder expectations</p> <p>Cause: Poor engagement and not understanding stakeholder expectations</p> <p>Consequence: Reputational damage for both short and long term projects eg not providing intersection improvements to expectations</p>	22	Timely and appropriate engagement with stakeholders and public by both short and long term projects, critical that the relationship between short and long term is understood by customers
Post Construction FSI Crashes	<p>Description: Serious and fatal crash events post construction of short term improvements</p> <p>Cause: Still a residual risk on completion of short term</p> <p>Consequence: Media/reputational damage</p>	21	Comms and engagement strategy with both short and long term
Environmental Damage	<p>Description: Environmental damage during construction eg sediment discharge to Waikato River</p> <p>Cause: Poor environmental management and controls</p> <p>Consequence: Local iwi relationship damage and regional council prosecution/abatement notice. Effects both short and long term</p>	24	Limited environmental effects during design process
Political Attention	<p>Description: Heightened political attention</p> <p>Cause: Election year 2017, prominent corridor and likely to become accelerated by current government</p> <p>Consequence: Unrealistic programme pressure and heightened stakeholder risks</p>	24	Comms and engagement strategy signed off by Transport Agency regional director and Minister visibility of programme
Funding	<p>Description: Funding risk due to marginal BCR above 1.0</p> <p>Cause: Short term return period 10 years and the balance between overinvestment short term versus long term plan</p> <p>Consequence: Funding uncertainty and programme delay</p>	24	SSBC to identify most appropriate option to meet the objectives

11.3 Post-Project Evaluation Planning

The outcome of the project will be measured on the number of deaths and serious injuries that are saved across the corridor, along with the increased length of corridor above 4 star KiwiRAP rating.

Crash records will be reviewed each year following implementation, although a meaningful trend cannot be established until at least 3 years have passed since implementation.

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APPENDIX A – ASSESSMENT OF OPTIONS

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OPTION 1 – ECONOMIC OVERVIEW						
Option description	Do nothing					
Estimated total public sector funding requirement	Capital cost (\$m)		\$ 0			
	Net property cost (\$m)		\$ 0			
	Maintenance (\$m/30yr)		\$ 0			
	Present value of cost to govt. (\$/m)		\$ 0			
Estimated BCR range			NA			
IAF Profile	Strategic Fit	L	Effectiveness	L	Efficiency	0-1

OPTION 1 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 0 DSI expected on route within 10 years
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 0 km improved.
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> Does not address the identified issues or achieve investment objectives

OPTION 1 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
No costs or consenting issues	Does not address identified issues
	Does not meet investment objectives

OPTION 1 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	No technical risks
Consentability	neutral	No consenting requirements

Operational / Maintenance	neutral	No change to operational/maintenance requirements
Safety in design consideration (Zero Harm)	neutral	No safety or design considerations
Financial	neutral	No costs
Public / Stakeholders	-2	Potential negative perception of not taking any action to address identified issues

OPTION 1 – MULTI-CRITERIA ANALYSIS

Criterion	Significance Score	Supporting Information
Safety	neutral	No change to current safety issues
Economy	neutral	NA
Integration	neutral	NA
Social	neutral	NA
Natural environment	neutral	NA
Human health	neutral	NA
Cultural	neutral	NA
Property	neutral	NA

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OPTION 2 – ECONOMIC OVERVIEW						
Option description	Wide centreline					
Estimated total public sector funding requirement	Capital cost (\$m)		\$5.74			
	Net property cost (\$m)		\$ 0			
	Maintenance (\$m/30yr)		\$0.09			
	Present value of cost to govt. (\$/m)		\$5.98			
Estimated BCR range			1.4 -2.4 (10 - 20 year)			
IAF Profile	Strategic Fit	H	Effectiveness	H	Efficiency	1-3

OPTION 2 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 11 DSI expected on route within 10 years.
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 18% improved to above 4 star.
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> Does not achieve investment objectives

OPTION 2 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
Lowest capital cost and lowest cost per DSI saved	Does not meet investment objectives
Low consenting risk	Intersection issues not addressed
Allows for future retrofitting of centre barrier	Does not address head on risk

OPTION 2 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Consentability	neutral	The option is expected to be implemented within the existing designation and is unlikely to be constrained by district or regional plan requirements (assuming that no earthworks or culvert lengthening is required).
Operational / Maintenance	-1	Removal of existing road markings to accommodate wide centreline can reduce the life of existing surface/pavement.
Safety in design consideration (Zero Harm)	-1	Specific traffic management planning will be required as part of design and implementation (for both initial construction and maintenance). Risks can be managed with appropriate HSE processes and practices.
Financial	neutral	Estimated cost of option is within current RLTP allocation therefore affordable
Public / Stakeholders	-1	Works are within road reserve and will not affect property access, improvements will generally be seen as positive improvement. Potential negative perception of not taking enough action to address safety issues

OPTION 2 - MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+1	A wide centreline will reduce the likelihood of a crash by giving vehicles time and space to correct after exiting their lane.
Economy	neutral	Traffic volumes and travel time reliability will be unaffected by the option.
Integration	neutral	Land-use integration will be unchanged by this option.
Social	neutral	There is unlikely to be any disruption to land owners or road users during construction. This option would have no flow on effects on employment, community services, or neighbouring amenity values.
Natural environment	neutral	This option is not expected to present an increased impact to the natural environment.
Human health	neutral	This option does not present an increased risk to human health.

Cultural	neutral	The ability to contain works within the designation corridor is unlikely to raise cultural concerns.
Property	neutral	The option will be contained within the designation and not necessitate property purchase. Property access will not be affected.

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OPTION 3 – ECONOMIC OVERVIEW					
Option description	Wide centreline + SH29 Roundabout				
Estimated total public sector funding requirement	Capital cost (\$m)		\$9.87		
	Net property cost (\$m)		\$1.00		
	Maintenance (\$m/30yr)		\$0.12		
	Present value of cost to govt. (\$/m)		\$10.10		
Estimated BCR range			0.9 -1.6 (10 - 20 year)		
IAF Profile	Strategic Fit	H	Effectiveness	H	Efficiency 0-1

OPTION 3 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 12 DSI expected on route within 10 years
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 18% improved to above 4 star.
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> Does not meet either investment objective Low BCR

OPTION 3 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
Lower cost option	BCR <1
SH29 intersection issues addressed	Does not meet investment objectives
Allows for future retrofitting of centre barrier	Does not address head on risk

OPTION 3 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Consentability	-2	The option is generally expected to be implemented within the existing designation and is unlikely to be constrained by district or regional plan requirements (assuming that no earthworks or culvert lengthening is required). The proposed roundabout will likely require an alteration to the designation and may also require regional consents.
Operational / Maintenance	-1	The roundabout may require additional maintenance (e.g. planting). Removal of existing road markings to accommodate wide centreline can reduce the life of existing surface/pavement
Safety in design consideration (Zero Harm)	-1	Specific traffic management planning will be required as part of design and implementation (for both initial construction and maintenance). Risks can be managed with appropriate HSE processes and practices.
Financial	neutral	Estimated cost of option is within current RLTP allocation therefore affordable
Public / Stakeholders	neutral	Works are within road reserve and will not affect property access, improvements will generally be seen as positive improvement. Roundabouts can be particularly divisive among the community and road users.

OPTION 3 – MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+1	A wide centreline will reduce the likelihood of a crash by giving vehicles time and space to correct after exiting their lane. A roundabout at the SH29 intersection is expected to reduce crashes associated with that intersection.
Economy	neutral	Traffic volumes and travel time reliability will be unaffected by the option.
Integration	neutral	Land-use integration will be unchanged by this option.
Social	-1	During construction works there is the potential for minor disruption and inconvenience to road users during roundabout construction.

		This option would have no flow on effects on employment, community services, or neighbouring amenity values.
Natural environment	-1	This option is not expected to present an increased risk to the natural environment. However, it should be confirmed that the roundabout footprint does not overlap one of the large number of significant natural areas or potential significant natural areas along the route.
Human health	neutral	This option is not expected to present an increased risk to human health. It is possible there are HAIL and SLUR sites adjoining the corridor and this should be considered if adjacent land is required for widening / roundabout.
Cultural	-1	There are a significant number of archaeological sites recorded in the vicinity of the corridor, especially where it runs in close proximity to the Waikato River/Lake Karapiro. There is a risk of new sites being uncovered where earthworks are required.
Property	-1	The option will generally be contained within the designation and not necessitate property purchase. It should be confirmed during detailed design whether land is required for the SH29 roundabout. Property access will not be affected.

Released under Official Information Act 1982

OPTION 4 – ECONOMIC OVERVIEW						
Option description	Wide centreline + side barriers at higher risk locations					
Estimated total public sector funding requirement	Capital cost (\$m)		\$7.45			
	Net property cost (\$m)		\$ 0			
	Maintenance (\$m/30yr)		\$0.10			
	Present value of cost to govt. (\$/m)		\$7.67			
Estimated BCR range			1.2 -1.9 (10 - 20 year)			
IAF Profile	Strategic Fit	H	Effectiveness	H	Efficiency	1-3

OPTION 4 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 12 DSI expected on route within 10 years Ability to retrofit centre barrier once outcome of long term scheme is known – increases DSI savings to 22 (56%).
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 30% improved to above 4 star.
Rationale for selection or rejection of option	This option is selected. The key reasons for this decision are: <ul style="list-style-type: none"> • Meets star rating objective • Allows for future retrofitting of centre barrier if longer term improvements are delayed.

OPTION 4 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
KiwiRAP objective met	DSI objective not met
Lower cost option	Intersection issues not addressed
Allows for future retrofitting of centre barrier	Does not address head on risk
Low consenting risk	

OPTION 4 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Consentability	-1	The option is generally expected to be implemented within the existing designation and is unlikely to be constrained by district or regional plan requirements (assuming that no earthworks or culvert lengthening is required).
Operational / Maintenance	-1	The side barriers will require additional maintenance in the event of barrier strikes. Side barriers can restrict access to maintenance vehicles for activities such as mowing, spraying and drainage maintenance. Removal of existing road markings to accommodate wide centreline can reduce the life of existing surface/pavement
Safety in design consideration (Zero Harm)	-1	Specific traffic management planning will be required as part of design and implementation (for both initial construction and maintenance). Risks can be managed with appropriate HSE processes and practices.
Financial	neutral	Estimated cost of option is within current RLTP allocation therefore affordable
Public / Stakeholders	neutral	Works are within road reserve and will not affect property access, improvements will generally be seen as positive improvement.

OPTION 4 - MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+1	A wide centreline will reduce the likelihood of a crash by giving vehicles time and space to correct after exiting their lane. The proposed side barrier installation provides a more forgiving roadside environment to vehicles running off the road in high risk locations.
Economy	neutral	Traffic volumes and travel time reliability will be unaffected by the option.
Integration	neutral	Land-use integration will be unchanged by this option.
Social	-1	During construction works there is the potential for minor disruption and inconvenience to land owners with direct access to SH1.

		Side barriers may affect property access. However, this will be minimised as much as practical during the detailed design stage. This option would have no flow on effects on employment, community services, or neighbouring amenity values.
Natural environment	neutral	This option is not expected to present an increased risk to the natural environment.
Human health	neutral	This option does not present an increased risk to human health.
Cultural	neutral	The ability to contain works within the designation corridor is unlikely to raise cultural concerns.
Property	neutral	The option will be contained within the designation and not necessitate property purchase. Subject to detailed design, property access will not be affected by the proposed side barriers.

Released under Official Information Act 1982

OPTION 5 – ECONOMIC OVERVIEW						
Option description	Median barrier + side barriers at higher risk locations + SH29 and Karapiro Road turnarounds					
Estimated total public sector funding requirement	Capital cost (\$m)		\$12.24			
	Net property cost (\$m)		\$0.4			
	Maintenance (\$m/30yr)		\$0.23			
	Present value of cost to govt. (\$/m)		\$13.78			
Estimated BCR range			1.2 -2.1 (10 - 20 year)			
IAF Profile	Strategic Fit	H	Effectiveness	H	Efficiency	1.3

OPTION 5 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 22 DSI expected on route within 10 years
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 43% improved to above 4 star.
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> Higher cost

OPTION 5 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
Meets both investment objectives	Higher cost
Addresses head on risk	Access severance
SH29 and Karapiro Road intersection issues addressed	

OPTION 5 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Consentability	-1	The option is generally expected to be implemented within the existing designation and is unlikely to be constrained by district or regional plan requirements (assuming that no earthworks or culvert lengthening is required). The proposed turnarounds will likely require an alteration to the designation and may also require regional consents.
Operational / Maintenance	-1	The side and median barriers will require additional maintenance in the event of barrier strikes. Side barriers can restrict access to maintenance vehicles for activities such as mowing, spraying and drainage maintenance. They also restrict use of road shoulder to pull safely off road and must be set at an appropriate offset. Median barriers can restrict the ability to divert traffic around crashes and maintenance activities.
Safety in design consideration (Zero Harm)	-1	Specific traffic management planning will be required as part of design and implementation (for both initial construction and maintenance). Risks can be managed with appropriate HSE processes and practices.
Financial	neutral	Estimated cost of option is within current RLTP allocation therefore affordable
Public / Stakeholders	-1	Median barriers present a perceived new hazard, particularly for motorcyclists. Central median barrier will restrict property access in some cases and may be received negatively.

OPTION 5 - MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+2	A median barrier provides close to 100% reduction in head-on crash risk. The proposed side barrier installation provides a more forgiving roadside environment to vehicles running off the road in high risk locations.
Economy	neutral	Traffic volumes and travel time reliability will be unaffected by the option.
Integration	neutral	Land-use integration will be unchanged by this option.

Social	-1	<p>During construction works there is the potential for disruption and inconvenience to land owners with direct access to SH1 and to road users during median and roundabout construction.</p> <p>Side barriers may affect property access. However, this will be minimised as much as practical during the detailed design stage.</p> <p>Median barriers can hinder connectivity between private property and towns.</p> <p>This option would have no flow on effects on employment, community services, or neighbouring amenity values.</p>
Natural environment	-1	<p>This option is not expected to present an increased risk to the natural environment. However, it should be confirmed that the turnaround footprints do not overlap one of the large number of significant natural areas or potential significant natural areas along the route.</p>
Human health	neutral	<p>This option is not expected to present an increased risk to human health.</p> <p>It is possible there are HAIL and SLUR sites adjoining the corridor and this should be considered if adjacent land is required for widening / turnarounds.</p>
Cultural	-1	<p>There are a significant number of archaeological sites recorded in the vicinity of the corridor, especially where it runs in close proximity to the Waikato River/Lake Karapiro. There is a risk of new sites being uncovered where significant earthworks are required.</p>
Property	-2	<p>The option will generally be contained within the designation and not necessitate property purchase. It should be confirmed during detailed design whether land is required for the SH29 and Karapiro Road turnarounds.</p> <p>Subject to detailed design, property access will not be affected by the proposed side barriers.</p> <p>Median barriers can affect property access. It should also be confirmed during detailed design whether additional land is required for turn-around areas.</p>

OPTION 6 – ECONOMIC OVERVIEW						
Option description	Wide centreline + continuous side barriers + SH29 RA					
Estimated total public sector funding requirement	Capital cost (\$m)		\$26.14			
	Net property cost (\$m)		\$1.00			
	Maintenance (\$m/30yr)		\$0.18			
	Present value of cost to govt. (\$/m)		\$25.91			
Estimated BCR range			0.5 -0.8 (10 - 20 year)			
IAF Profile	Strategic Fit	H	Effectiveness	M	Efficiency	0-1

OPTION 6 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 15 DSI expected on route within 10 years
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 90% improved to above 4 star.
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> Higher cost and BCR < 1

OPTION 6 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
Meets KiwiRAP investment objective	DSI objective not met
Allows for future retrofit of centre median barrier	Does not address head-on risk
Addresses run-off road risk	BCR < 1
Addresses SH29 intersection issue	

OPTION 6 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Consentability	-2	The option is generally expected to be implemented within the existing designation and is unlikely to be constrained by district or regional plan requirements (assuming that no earthworks or culvert lengthening is required). The proposed roundabout will likely require an alteration to the designation and may also require regional consents.
Operational / Maintenance	-1	The side barriers will require additional maintenance in the event of barrier strikes. Side barriers can restrict access to maintenance vehicles for activities such as mowing, spraying and drainage maintenance. They also restrict use of road shoulder to pull safely off road and must be set at an appropriate offset. The roundabout may require additional maintenance (e.g. planting). Removal of existing road markings to accommodate wide centreline can reduce the life of existing surface/pavement
Safety in design consideration (Zero Harm)	-1	Specific traffic management planning will be required as part of design and implementation (for both initial construction and maintenance). Risks can be managed with appropriate HSE processes and practices.
Financial	neutral	Estimated cost of option is within current RLTP allocation therefore affordable
Public / Stakeholders	-1	Generally safety improvements would be seen as positive however side barriers present a new perceived roadside hazard, particularly for cyclists and motorcyclists. Roundabouts can also be divisive among the community and road users.

OPTION 6 – MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+2	A wide centreline will reduce the likelihood of a crash by giving vehicles time and space to correct after exiting their lane.

		<p>The proposed side barrier installation provides a more forgiving roadside environment to vehicles running off the road in high risk locations.</p> <p>A roundabout at the SH29 intersection is expected to reduce crashes associated with that intersection.</p>
Economy	neutral	Traffic volumes and travel time reliability will be unaffected by the option.
Integration	neutral	Land-use integration will be unchanged by this option.
Social	-1	<p>During construction works there is the potential for disruption and inconvenience to land owners with direct access to SH1 and to road users during construction.</p> <p>Side barriers may affect property access. However, this will be minimised as much as practical during the detailed design stage.</p> <p>This option would have no flow on effects on employment, community services, or neighbouring amenity values.</p>
Natural environment	-1	This option is not expected to present an increased risk to the natural environment. However, it should be confirmed that the roundabout footprint does not overlap one of the large number of significant natural areas or potential significant natural areas along the route. If widening is required for the side barriers, then impacts on significant natural areas should be considered.
Human health	neutral	<p>This option is not expected to present an increased risk to human health.</p> <p>It is likely that there are HAIL and SLUR sites adjoining the corridor and this should be considered if adjacent land is required for widening / roundabouts.</p>
Cultural	neutral	There are a significant number of archaeological sites recorded in the vicinity of the corridor, especially where it runs in close proximity to the Waikato River/Lake Karapiro. There is a risk of new sites being uncovered where earthworks are required.
Property	-1	<p>The option will generally be contained within the designation and not necessitate property purchase. It should be confirmed during detailed design whether land is required for the SH29 roundabout.</p> <p>Subject to detailed design, property access will not be affected by the proposed side barriers.</p>

OPTION 7 – ECONOMIC OVERVIEW						
Option description	Continuous three barriers + SH29 and Karapiro Road roundabouts					
Estimated total public sector funding requirement	Capital cost (\$m)		\$35.70			
	Net property cost (\$m)		\$2.00			
	Maintenance (\$m/30yr)		\$0.37			
	Present value of cost to govt. (\$/m)		\$36.78			
Estimated BCR range			0.5 -0.9 (10 - 20 year)			
IAF Profile	Strategic Fit	H	Effectiveness	M	Efficiency	0-1

OPTION 7 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 25 DSI expected on route within 10 years
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 90% improved to above 4 star
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> High cost and BCR < 1

OPTION 7 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
Meets both investment objectives	Higher cost
Addresses run off road and head on risk	BCR <1
SH29 and Karapiro Road intersection issues addressed	

OPTION 7 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Consentability	-2	The option is generally expected to be implemented within the existing designation and is unlikely to be constrained by district or regional plan requirements (assuming that no earthworks or culvert lengthening is required). The proposed roundabouts will likely require an alteration to the designation and may also require regional consents.
Operational / Maintenance	-2	The side and median barriers will require additional maintenance in the event of barrier strikes. Side barriers can restrict access to maintenance vehicles for activities such as mowing, spraying and drainage maintenance. They also restrict use of road shoulder to pull safely off road and must be set at an appropriate offset. The roundabout may require additional maintenance (e.g. planting).
Safety in design consideration (Zero Harm)	-2	Specific traffic management planning will be required as part of design and implementation (for both initial construction and maintenance). Risks can be managed with appropriate HSE processes and practices.
Financial	-2	Estimated cost of option is above the expected cost for short term improvements. Risk of over investment given long term scheme.
Public / Stakeholders	-2	Median and side barriers present a perceived new hazard, particularly for motorcyclists. Central median barrier will restrict property access in some cases and may be received negatively. Roundabouts can be divisive among the community and road users.

OPTION 7 – MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+3	A median barrier provides close to 100% reduction in head-on crash risk. The proposed side barrier installation provides a more forgiving roadside environment to vehicles running off the road.

		Roundabouts at the SH29 and Karapiro Road intersections are expected to reduce crashes associated with those intersections.
Economy	neutral	Traffic volumes and travel time reliability will be unaffected by the option.
Integration	neutral	Land-use integration will be unchanged by this option.
Social	-3	<p>During construction works there is the potential for disruption and inconvenience to land owners with direct access to SH1 and to road users during construction.</p> <p>Side barriers may affect property access. However, this will be minimised as much as practical during the detailed design stage.</p> <p>Median barriers can hinder connectivity between private property and towns.</p> <p>This option would have no flow on effects on employment, community services, or neighbouring amenity values.</p>
Natural environment	-1	This option is not expected to present an increased risk to the natural environment. However, it should be confirmed that the roundabout footprints do not overlap one of the large number of significant natural areas or potential significant natural areas along the route. If widening is required for the barriers, then impacts on significant natural areas should be considered.
Human health	-1	It is likely that there are HAIL and SLUR sites adjoining the corridor and this should be considered if adjacent land is required for widening / roundabouts.
Cultural	-1	There are a significant number of archaeological sites recorded in the vicinity of the corridor, especially where it runs in close proximity to the Waikato River/Lake Karapiro. There is a risk of new sites being uncovered where earthworks are required.
Property	-2	<p>The option will generally be contained within the designation and not necessitate property purchase. It should be confirmed during detailed design whether land is required for the SH29 and Karapiro Road roundabouts.</p> <p>Subject to detailed design, property access will not be affected by the proposed side barriers.</p> <p>Median barriers can affect property access. It should also be confirmed during detailed design whether additional land is required for turn-around areas.</p>

OPTION 8 – ECONOMIC OVERVIEW						
Option description	Continuous 2+1 with three barriers + SH29 and Karapiro Road roundabouts+ Hickey Road curve realignment					
Estimated total public sector funding requirement	Capital cost (\$m)		\$38.79			
	Net property cost (\$m)		\$3.0			
	Maintenance (\$m/30yr)		\$0.37			
	Present value of cost to govt. (\$/m)		\$39.69			
Estimated BCR range			0.5 -0.8 (10 - 20 year)			
IAF Profile	Strategic Fit	H	Effectiveness	M	Efficiency	0.1

OPTION 8 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 25 DSI expected on route within 10 years
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: 90% improved to above 4 star.
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> • High cost and BCR < 1 • This option will be considered through long term IBC

OPTION 8 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
Meets both investment objectives	Higher cost
Addresses run off road and head on risk	BCR <1
SH29 and Karapiro Road intersection issues addressed	
Out-of-context curve issue addressed	

OPTION 8 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	-2	Physical constraints including Waikato River and steep existing embankment cuts will make widening difficult in some areas.
Consentability	-3	The option is expected to be require an alteration to the designation to provide for the additional lane and is likely to have other district or regional plan requirements. The proposed roundabouts will likely require an alteration to the designation and may also require regional consents.
Operational / Maintenance	-2	The side and median barriers will require additional maintenance in the event of barrier strikes. Side barriers can restrict access to maintenance vehicles for activities such as mowing, spraying and drainage maintenance. They also restrict use of road shoulder to pull safely off road and must be set at an appropriate offset. The additional lane will increase the area of pavement requiring maintenance. The roundabout may require additional maintenance (e.g. planting).
Safety in design consideration (Zero Harm)	-2	Specific traffic management planning will be required as part of design and implementation (for both initial construction and maintenance). Risks can be managed with appropriate HSE processes and practices.
Financial	-2	Estimated cost of option is well above the expected cost for short term improvements. This is an option likely to be considered by long term scheme.
Public / Stakeholders	-2	Median and side barriers present a perceived new hazard, particularly for motorcyclists. Central median barrier will restrict property access in some cases and may be received negatively. Roundabouts can be particularly divisive among the community and road users.

OPTION 8 – MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+3	A median barrier provides close to 100% reduction in head-on crash risk.

		<p>The proposed side barrier installation provides a more forgiving roadside environment to vehicles running off the road.</p> <p>Roundabouts at the SH29 and Karapiro Road intersections are expected to reduce crashes associated with those intersections.</p> <p>A curve realignment at Hickey Road would remove existing out-of-context curves.</p>
Economy	+1	Continuous 2+1 will improve travel times.
Integration	neutral	Land-use integration will be unchanged by this option.
Social	-3	<p>During construction works there is the potential for disruption and inconvenience to land owners with direct access to SH1 and to road users during construction.</p> <p>Side barriers may affect property access. However, this will be minimised as much as practical during the detailed design stage.</p> <p>Median barriers can hinder connectivity between private property and towns.</p> <p>This option would have no flow on effects on employment, community services, or neighbouring amenity values.</p>
Natural environment	-3	<p>This option is not expected to present an increased risk to the natural environment. However, it should be confirmed that the roundabout or curve realignment footprints do not overlap one of the large number of significant natural areas or potential significant natural areas along the route.</p> <p>If widening is required for the barriers, then impacts on significant natural areas should be considered.</p>
Human health	-2	It is likely that there are HAIL and SLUR sites adjoining the corridor and this should be considered if adjacent land is required for widening / roundabouts.
Cultural	-2	There are a significant number of archaeological sites recorded in the vicinity of the corridor, especially where it runs in close proximity to the Waikato River/Lake Karapiro. There is a risk of new sites being uncovered where earthworks are required.
Property	-2	<p>Significant additional land would be required for road widening, roundabouts and road realignment.</p> <p>Subject to detailed design, property access will not be affected by the proposed side barriers.</p> <p>Median barriers can affect property access. It should also be confirmed during detailed design whether additional land is required for turn-around areas.</p>

OPTION 9 – ECONOMIC OVERVIEW						
Option description	Four lane expressway					
Estimated total public sector funding requirement	Capital cost (\$m)		\$300			
	Net property cost (\$m)		\$10			
	Maintenance (\$m/30yr)		\$1			
	Present value of cost to govt. (\$/m)		\$150			
Estimated BCR range			0.2 – 0.3 (10 – 20 year)			
IAF Profile	Strategic Fit	H	Effectiveness	H	Efficiency	0.1

OPTION 9 – OUTCOME OBJECTIVES	
NPBC objective to reduce 1426 DSI within 10 years Reduce death and serious injury crashes by 50-60% (20-24 DSI) over the 10-year period following completion of the short-term safety improvements over 10 years	Extent to which investment objective is met: Reduction of 38 DSI expected on route within 10 years
NPBC objective to change star rating on 424km of State Highway Improve 30-50% of the corridor to above 4 star KiwiRAP rating by end of 2017	Extent to which investment objective is met: >90% improved to 5 star
Rationale for selection or rejection of option	This option is rejected. The key reasons for this decision are: <ul style="list-style-type: none"> • Very high cost and BCR < 1 • This option will be considered through long term IBC

OPTION 9 – ADVANTAGES AND DIS-BENEFITS	
Advantages	Dis-Benefits
Meets both investment objectives	Very high cost
Addresses run off road and head on risk	BCR <1
SH29 and Karapiro Road intersection issues addressed	
Out-of-context curve issue addressed	

OPTION 9 - IMPLEMENTABILITY APPRAISAL		
Criterion	Significance Score	Supporting Information
Technical	neutral	Subject to detailed design being undertaken, there are no technical risks that would prevent the implementation of this option.
Consentability	-3	A four lane expressway is expected to require a significant alteration to the designation.
Operational / Maintenance	-1	The four lane expressway would likely include significant length outside of the current designation therefore introduce additional road to be maintained (old highway to be returned to District Council). Although new expressway would be constructed to high standard requiring less maintenance, interventions would be costly due to traffic management requirements.
Safety in design consideration (Zero Harm)	-2	Most complex construction, multiple high risk activities, risks can be managed with appropriate HSE processes and practices. Operational and maintenance activities to be controlled by appropriate level of temporary traffic management.
Financial	-3	Estimated cost of option is outside current RLTP allocation for short term scheme therefore require robust case for increase. Option will be considered by long term IBC
Public / Stakeholders	-2	A four lane expressway option is likely to raise significant interest from the public. It is inevitable stakeholder views will be varied and could present significant risk to implementation. A comprehensive engagement process would need to be implemented.

OPTION 9 – MULTI-CRITERIA ANALYSIS		
Criterion	Significance Score	Supporting Information
Safety	+3	A four lane expressway would provide a high standard of safety. A median barrier provides close to 100% reduction in head-on crash risk.
Economy	+2	Travel time would likely be improved by providing a continuous 4 lanes.
Integration	neutral	Land-use integration will be unchanged by this option.
Social	-3	During construction works there is the potential for major disruption and inconvenience to land owners

		with direct access to SH1 and to road users during construction. Expressways are typically grade separated and can cause connectivity issues for adjoining property owners.
Natural environment	-3	The extensive earthworks that would be required for this option are likely to have much larger environmental impacts than other options.
Human health	-3	It is likely that there are HAIL and SLUR sites adjoining the corridor that would be disturbed.
Cultural	-3	This option represents the most significant earthworks and land disturbance. There are a significant number of archaeological sites recorded in the vicinity of the corridor, especially where it runs in close proximity to the Waikato River/Lake Karapiro. There is a risk of new sites being uncovered where earthworks are required.
Property	-3	It is inevitable significant additional land would be required for a 4 lane expressway option. Severance of existing land uses would also be likely.

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APPENDIX B – COST ESTIMATES

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Project Estimate - Form C

DBE

Project Name: SH1 Cambridge to Piarere Option 4

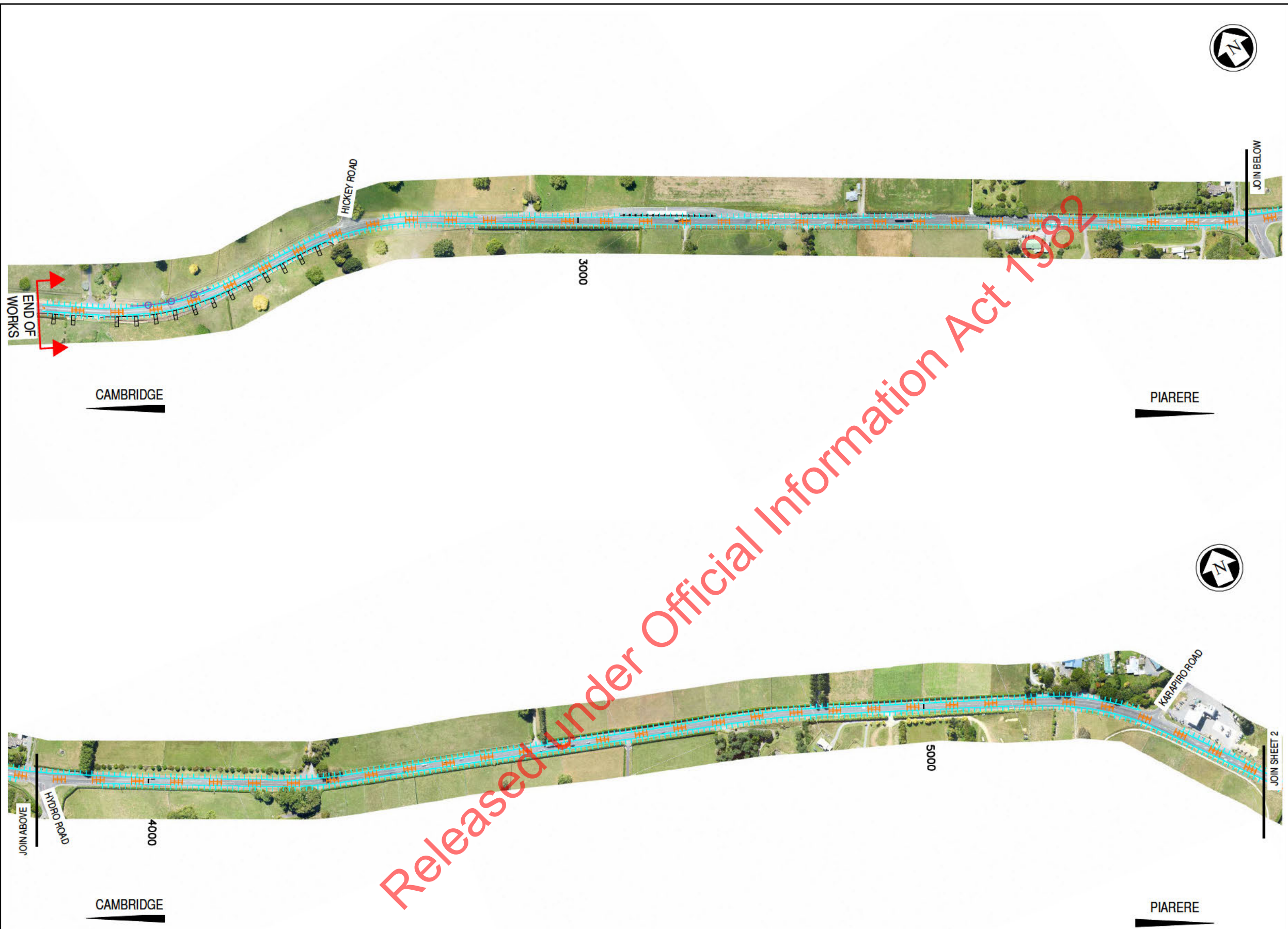
Detailed Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	Nett Project Property Cost	Nil	Nil	Nil
	Project Development Phase			
	- Consultancy Fees	Nil	Nil	Nil
	- NZTA Managed Costs	Nil	Nil	Nil
B	Total Project Development	Nil	Nil	Nil
	Pre-implementation Phase			
	- Consultancy Fees			
	- NZTA Managed Costs			
C	Total Pre-implementation	328,186		
	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees			
	- NZTA Managed Costs			
	- Construction Monitoring Fees			
	Sub Total Base Implementation Fees	328,186		
	Physical Works			
1	Environmental Compliance			
2	Earthworks			
3	Ground Improvements			
4	Drainage	566,045		
5	Pavement and Surfacing	1,254,659		
6	Bridges			
7	Retaining Walls	653,004		
8	Traffic Services	1,620,105		
9	Service Relocations	566,045		
10	Landscaping			
11	Traffic Management and Temporary Works	272,085		
12	Preliminary and General	637,816		
13	Extraordinary Construction Costs			
	Sub Total Base Physical works	5,569,760		
D	Total for Implementation Phase	5,897,945		
E	Project Base Estimate (A+C+D)	6,226,131		
F	Contingency (Assessed/Analysed) (A+C+D)		1,225,226	
G	Project Expected Estimate (E+F)		7,450,000	
	Nett Project Property Cost Expected Estimate		Nil	
	Project Development Phase Expected Estimate		Nil	
	Pre-implementation Phase Expected Estimate		390,000	
	Implementation Phase Expected Estimate		7,060,000	
H	Funding Risk Contingency (Assessed/Analysed) (A+C+D)			1,490,000
I	95th percentile Project Estimate (G+H)			8,940,000
	Nett Project Property Cost 95th percentile Estimate			Nil
	Project Development Phase 95th percentile Estimate			Nil
	Pre-implementation Phase 95th percentile Estimate			470,000
	Implementation Phase 95th percentile Estimate			8,470,000
Date of I	October 2016	Cost Index (Qtr/Year)		Dec-16
Estimate	BAH	Signed		
Estimate	CMK	Signed		
Estimate external peer review by		Signed		
Estimate accepted by 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 C – SCHEME DRAWINGS

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LEGEND

- 1000 CENTRELINE
- - - - - EXISTING WIRE ROPE BARRIER
- - - - - EXISTING W-SECTION BARRIER
- - - - - PROPOSED 1.5M WIDE CENTRELINE WITH ATP
- - - - - PROPOSED ATP EDGELINES
- - - - - PROPOSED TL4 BARRIER (WIDENING AS REQUIRED)

NOTE:
1.5M SHOULDER WHERE NO BARRIER: WIDENING AS REQUIRED

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No	Revision	By	Chk	Appd	Date

Original Scale (A3)	Design	-	-	Approved For Construction*
	Drawn	-	-	
	Eng Verifier	-	-	
	Eng Check	-	-	Date
* Refer to Revision 1 for Original Signature				

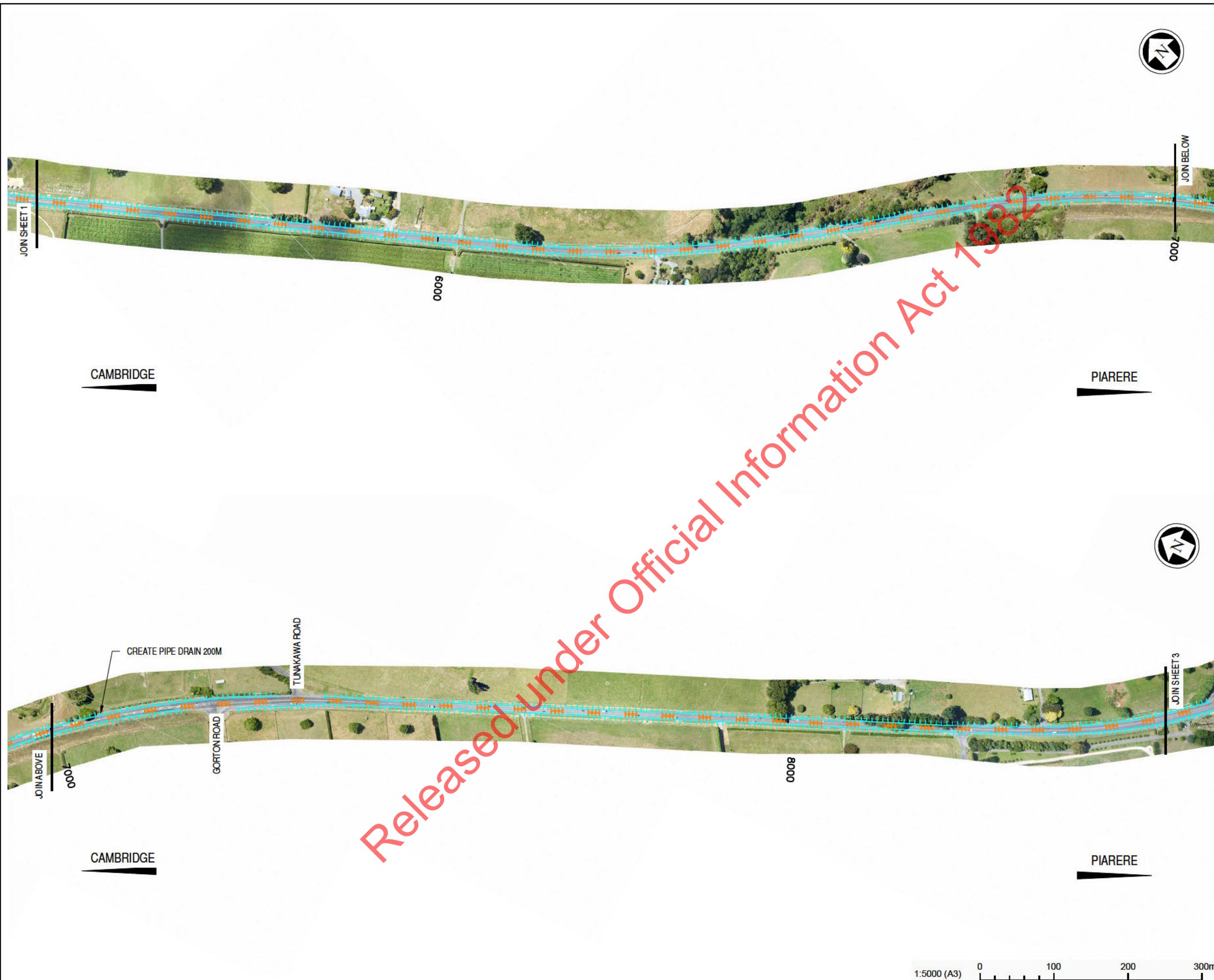


Project: STATE HIGHWAY 1
CAMBRIDGE TO PIARERE
SAFETY IMPROVEMENTS

Title: PROPOSED TREATMENT
SHEET 1

Drawing No:	SRA - 2008 - CE - 0301	Rev:	-
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LEGEND

- 1000 CENTRELINE
- - - - - EXISTING WIRE ROPE BARRIER
- - - - - EXISTING W-SECTION BARRIER
- - - - - PROPOSED 1.5M WIDE CENTRELINE WITH ATP
- - - - - PROPOSED ATP EDGELINES
- - - - - PROPOSED TL4 BARRIER (WIDENING AS REQUIRED)

NOTE:
1.5M SHOULDER WHERE NO BARRIER: WIDENING AS REQUIRED

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No	Revision	By	Ck	Appd	Date

Original Scale (A3)	Design	-	-	Approved For Construction*
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	Eng Verifier	-	-	
	Eng Check	-	-	Date

* Refer to Revision 1 for Original Signature

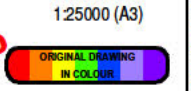


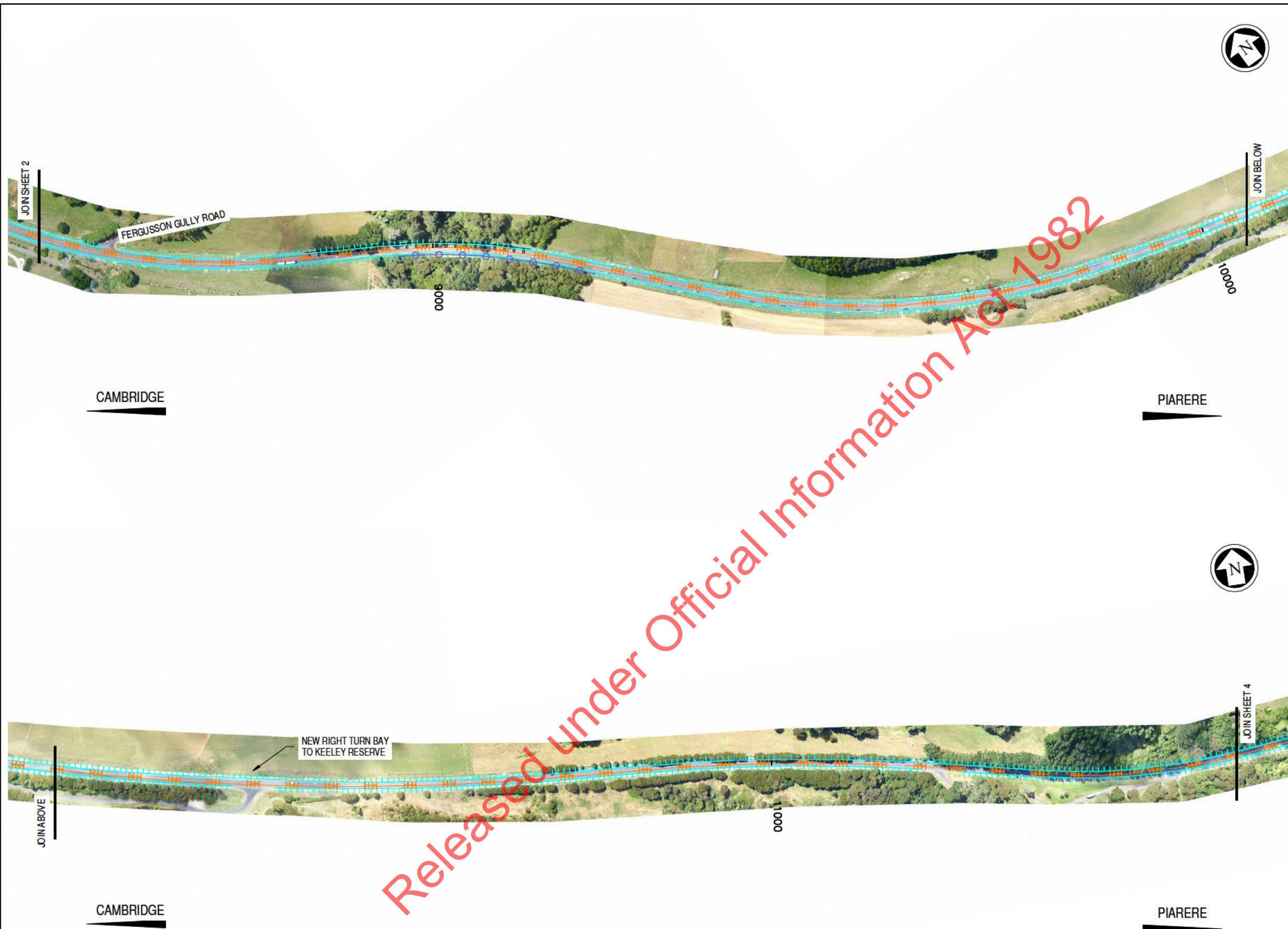
Project: STATE HIGHWAY 1
CAMBRIDGE TO PIARERE
SAFETY IMPROVEMENTS

Title: PROPOSED TREATMENT
SHEET 2

Drawing No	SRA - 2008 - CE - 0302	Rev	-
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LEGEND

- 1000 CENTRELINE
- - - - - EXISTING WIRE ROPE BARRIER
- - - - - EXISTING W-SECTION BARRIER
- - - - - PROPOSED 1.5M WIDE CENTRELINE WITH ATP
- - - - - PROPOSED ATP EDGELINES
- - - - - PROPOSED TL4 BARRIER (WIDENING AS REQUIRED)

NOTE:
1.5M SHOULDER WHERE NO BARRIER: WIDENING AS REQUIRED

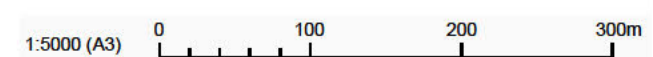
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CAMBRIDGE

PIARERE

CAMBRIDGE

PIARERE



No	Revision	By	Ck	Appd	Date

Original Scale (A3)	Design	-	-	Approved For Construction*
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	Eng Verifier	-	-	
	Dwg Check	-	-	Date

* Refer to Revision 1 for Original Signature

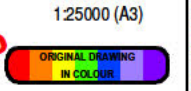


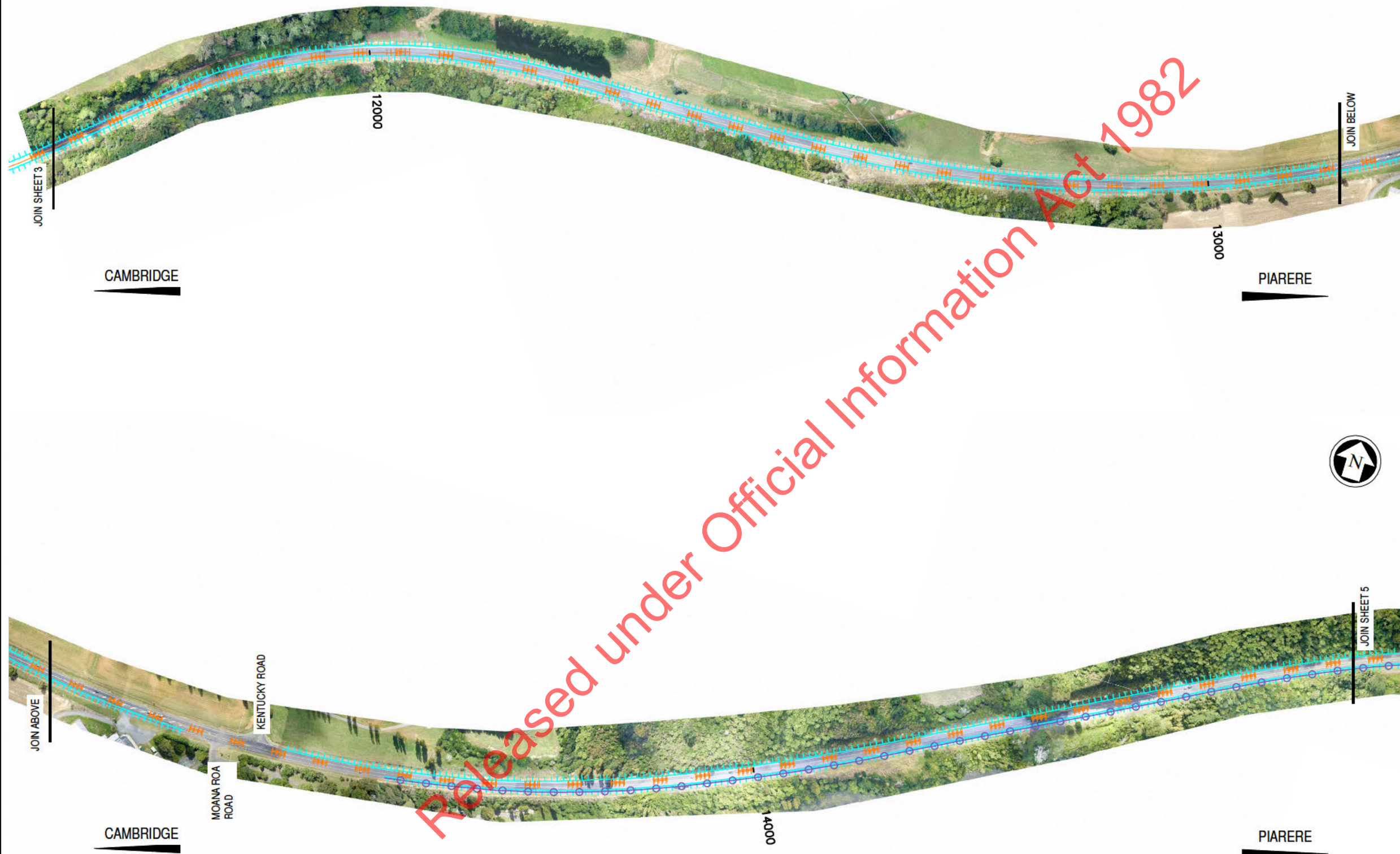
Project: STATE HIGHWAY 1
CAMBRIDGE TO PIARERE
SAFETY IMPROVEMENTS

Title: PROPOSED TREATMENT
SHEET 3

Drawing No: SRA - 2008 - CE - 0303
Rev: -

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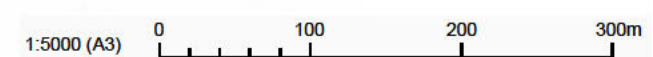




LEGEND

- 1000 CENTRELINE
- - - - - EXISTING WIRE ROPE BARRIER
- - - - - EXISTING W-SECTION BARRIER
- - - - - PROPOSED 1.5M WIDE CENTRELINE WITH ATP
- - - - - PROPOSED ATP EDGELINES
- - - - - PROPOSED TL4 BARRIER (WIDENING AS REQUIRED)

NOTE:
1.5M SHOULDER WHERE NO BARRIER: WIDENING AS REQUIRED



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No	Revision	By	Ck	Appd	Date

Original Scale (A3)	Design	-	-	Approved For Construction*
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	Eng Check	-	-	Date

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Project: STATE HIGHWAY 1
CAMBRIDGE TO PIARERE
SAFETY IMPROVEMENTS

Title: PROPOSED TREATMENT
SHEET 4

Drawing No: SRA - 2008 - CE - 0304
Rev: -

DO NOT SCALE

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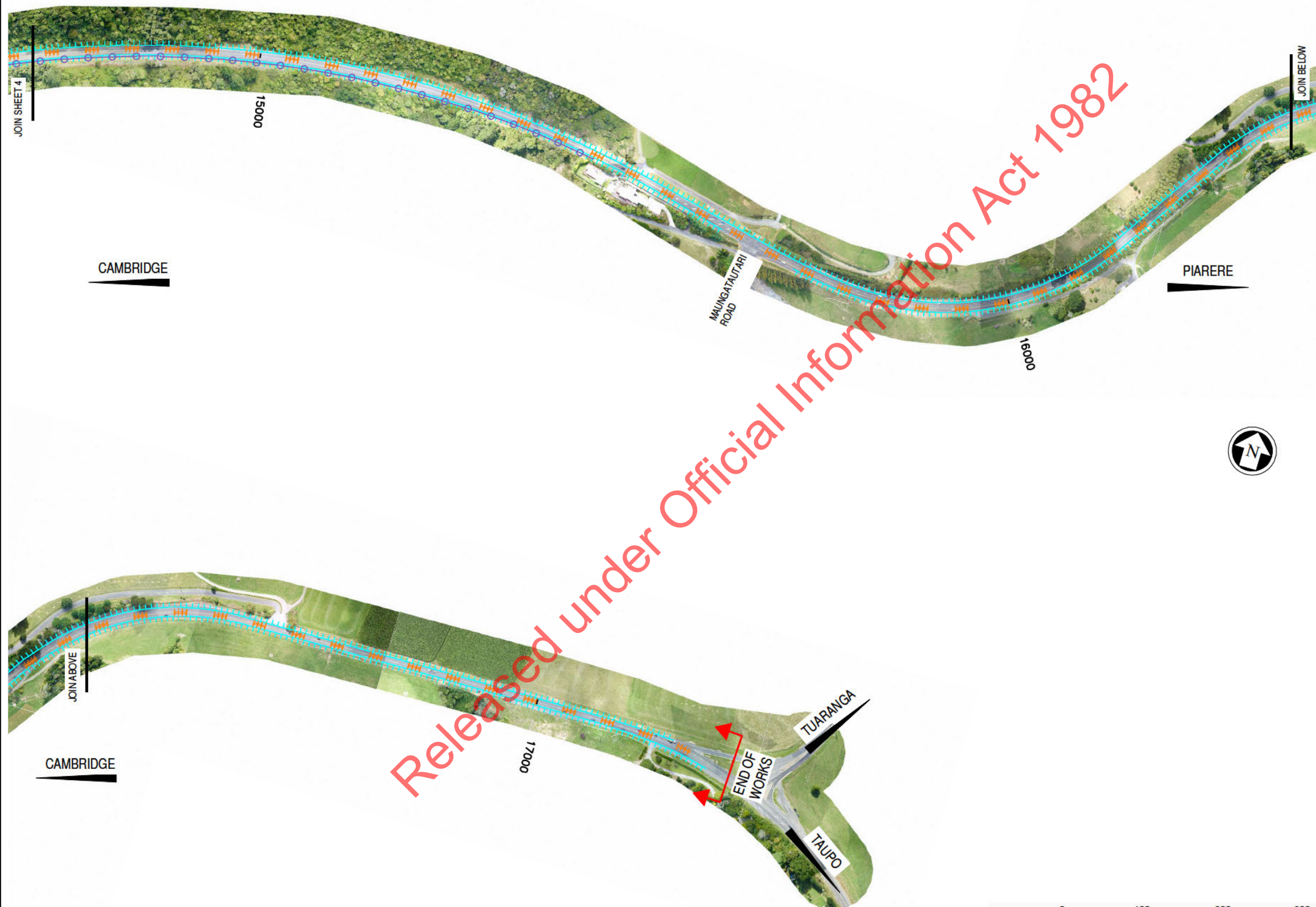
Document No. K1142710 SH1 Cambridge to Piarere100 Drawings/SRA_2008_CE_0304.dwg



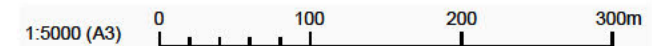
LEGEND

- 1000 CENTRELINE
- - - - - EXISTING WIRE ROPE BARRIER
- - - - - EXISTING W-SECTION BARRIER
- - - - - PROPOSED 1.5M WIDE CENTRELINE WITH ATP
- - - - - PROPOSED ATP EDGELINES
- - - - - PROPOSED TL4 BARRIER (WIDENING AS REQUIRED)

NOTE:
1.5M SHOULDER WHERE NO BARRIER: WIDENING AS REQUIRED



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No	Revision	By	Ck	Appd	Date

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	Eng Verifier	-	-	
	Eng Check	-	-	Date

* Refer to Revision 1 for Original Signature



Project: STATE HIGHWAY 1
CAMBRIDGE TO PIARERE
SAFETY IMPROVEMENTS

Title: PROPOSED TREATMENT
SHEET 5

Drawing No: SRA - 2008 - CE - 0305
Rev: -

APPENDIX D – WORKSHOP ENGAGEMENT

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MINUTES			
Meeting:	SH1 Cambridge to Piarere – Online Safety Improvements Stakeholder Workshop	Date:	16/02/2016
Present:	Safe Roads Alliance: s 9(2)(a) (PM), s 9(2)(a) (Safety), s 9(2)(a) (Safety), s 9(2)(a) (Business Case Writer) NZTA: James Bevan JB (Transport Planning Manager), Michelle Te Wharau MTW (Principal Safety Engineer), Ben Peacey BP (Outcome Planning), Adrian Khan AK (Project Manager – Efficiency Scheme) Road Transport Association: s 9(2)(a) Area Executive NZAA: s 9(2)(a) Waikato Regional Council: s 9(2)(a) NZ Police: s 9(2)(a) Waipa District Council: s 9(2)(a)		
Apologies:	Andrew McKillop (NZTA Planning and Investment), Rob Campbell (NZTA Network Operations), s 9(2)(a) (South Waikato District Council), s 9(2)(a) (Safe Roads Alliance)		

Workshop Purpose

- Define safety specific problems
- Agree Investment Objectives
- Agree a short list of options for assessment

Project Background and Context

Refer to the workshop information pack. Key points;

- SH1 Cambridge to Piarere Programme Business Case 2015 recommended three tranches of work; Short term online safety improvements (0 to 3 years), SH1/29 Intersection Improvements (6 to 10 years), Longer term efficiency and safety improvements (10 years+)
- Online safety improvements scope;
 - Online (generally existing corridor)
 - Benefits calculated over a 10-year period

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- Considers intersections (inc. SH1 / SH29)
- Excludes efficiency improvements

Safety Problems

Refer to the workshop information pack for crash history and other details illustrating the safety problems along the route.

Refer Annex 1 for specific issues raised in the workshop

Problem Statement

The programme Business Case problem statements (refer to the information pack) were reviewed. It was agreed the problems statement would be reworded to better capture the safety problems and distributed to attendees to confirm agreement. The following is the reworded statements for review;

Problem 1: Human error, coupled with high traffic volumes, and an inconsistent and unforgiving road corridor, results in crashes that commonly lead to severe injury or death, even at legal travel speeds of 100 km/h. (70%)

Problem 2: The number and layout of intersections and accesses coupled with the high SH1 traffic volumes currently results in a significant crash rate at intersections (30%)

Investment Objectives

Discussion appropriateness of the National Programme Business Case Investment Objectives – refer Workshop Information Pack.

Agreed that the proposed statements are still appropriate but that for this route a 50% reduction in DSIs is too low given its One Network Road Classification (ONRC) of 'High Volume'. Agreement that a higher level of DSI reduction should be achieved and a higher level of investment may be required to achieve this.

Short List of Options

A long list of possible treatments was presented by the Alliance team. The workshop attendees developed the following short list of options that ranged from low investment cost to high investment cost.

1. Baseline low cost intervention. There was no specific discussion on what this might include as the group considered this would be an inappropriate level of investment given the problems discussed.
2. Wide Centreline + ATP/markings + Improved transition from expressway + SH1/SH29 rural intersection activated warning sign (RIAWS)



3. Wide Centreline + ATP/markings + Improved transition from expressway + SH1 /SH29 RIAWS & other minor intersection improvements
4. Median Barriers + side barriers at high risk locations + Improved transition from expressway (including potential out of context curve realignment) + higher level intersection treatments (eg Roundabout at SH1 /SH29, roundabout at Karapiro Road, conversion of Hydro Road to LILO)
5. 2+1 lanes + median barrier + side barrier + Improve transition from expressway + higher level intersection treatments (eg Roundabout at SH1 /SH29, roundabout at Karapiro Road, conversion of Hydro Road to LILO)
6. 4 laning based on the longer term potential option for this corridor

The group agreed that an intervention approximately around options 3–5 feels appropriate for the corridor based on the information presented. The group also acknowledged that the application of treatments may differ between the northern part of the corridor (typified by high frequency of side accessways) compared with the southern part of the corridor (typified by wider and more open road cross-section plus less access points).

PS – all options will require some degree of access rationalisation

BM – Safety management interventions appear to be missing from the selection

PS – Could the [Karapiro] School Bus Stop be relocated?

Agreement that the Safe Roads team should progress with evaluation of the shortlisted options.

Agreement that a follow up workshop should include the same stakeholder group.

Agreement that the Safe Roads team should progress to implementation of the Keeleys Right Turn Bay but include some assessment to make sure the layout futureproofs provision of a centre barrier.

Way Forward

- Safe Roads Alliance assessment of Options
- Second workshop with Stakeholders and NZ Transport Agency to agree a preferred option (late March/ April)
- Finalise the business case before sending it to the Transport Agency Decision-Making team
- Pre-Implementation (design phase)



Annex 1 – Problems raised in the Workshop for consideration during scheme development

BP – The Board has signed off on the Programme Business Case for this corridor. The short term safety business case and longer term efficiency business case are at different stages of progress which requires some consideration on alignment.

AK – A procurement strategy is going to the NZ Transport Agency for the longer term efficiency business case. It is likely to be out to market Feb/March.

MTW – As a result of the Expressway opening we are hearing of people now looking for U-Turn opportunities at driveways, or in the new weigh station, or at Hydro Road. This has increased the crash risk and should be considered

FG – There is anecdotal evidence that people are getting to end of expressway thinking they can turn to Cambridge from the interchange. They then drive on looking for u-turn opportunities. Changes to the signage in relation to the off ramp destinations at the Victoria Road interchange are being progressed within the agency.

MTW – there was an assessment undertaken of the south transition from expressway to existing road and the team found it very difficult to get appropriate median barriers and turn around facilities. Provision of appropriate turn around facilities may not be straight forward.

FG – The intersection of Hydro Road is very busy with boats and trailers trying to turn in and out. There have been serious and minor crashes – but they also hear of near misses

BH – the intersection of Karapiro Road and SH1 is very busy due to the school, service Station, and the Quarry. There is also a low radius curve at this location which adds to the risk. Concerns have been raised by the School principal regarding the right turning movements at this intersection.

MTW – There are proposed changes to the Mobil and any safety improvements at this location should take due consideration on what is being proposed.

TF – Trucks right turning at the intersection from the quarry need a large gap and are finding that this is becoming increasingly difficult as traffic volumes increase. There is anecdotal evidence of minor and un-notified incidents. Could slip lanes be considered? It was noted this may not be possible within the existing corridor.

TF – Gorton Road is one of the best marked intersections along this route which is surprising given its relatively lower turning volumes.

BH – Right turn changes are proposed at Keeley's Reserve and a design has been prepared for the physical works. Also noted recent tree clearance along this section of the route which was undertaken to remove tree shading issues onto the road.

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BM – South of Ferguson Gully Road toward the intersection of SH1 /29 the route tends to exhibit a generally higher standard of road geometry with larger radius curves and fewer intersections and accessways.

MTW – Between Ferguson Gully Road and the SH29 intersection there tends to be more rear end crashes. One theory that had been discussed is that perhaps traffic heading north from Kaimai's become more relaxed due to more open nature of this section of road.

GC – The right turn pocket at the start of the passing lane by Maungatautari Road has an elevated risk and is no longer considered an acceptable way of commencing a passing lane. There is a risk of confusion when traffic pulls into the right turn bay as to whether then intend to slow for a right turn or speed up to overtake traffic.

STATE HIGHWAY 29 INTERSECTION SLIP LANE

BH – Not a safe intersection given the high traffic volumes and small gaps available for turning traffic.

MTW – Adding give-way on the slip lane has improved the left turn movement – perhaps because people tend to slow down more for the turn.

BP – People tend to indicate late for the left turn which then means right turning traffic miss gaps.

MTW – Explained Rural Intersection Activated Warning Signs (RIAWS)

<https://www.nzta.govt.nz/assets/network/operating/safely/doc/riaws-info-sheet.pdf>.

This could be an option for a short term intersection improvement option.

BP – We should understand the payback period associated with a short term safety improvement options such as RIAWS. If payback is within a 10 year window then it might be a viable option. MTW action to confirm RIAWS payback

BC – Roundabouts provide good safe U-turn ability. There are also examples of more cost effective smaller roundabouts from overseas. This could be considered a safety improvement for the SH1 /29 intersection and should be considered in the options. This is where the short term safety programme and long term efficiency scheme start to blur.

FG – Nervous about the proposed 10year horizon for the safety scheme. Concern raised that the SH1 /29 intersection shouldn't be left for 10 years and that something more

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significant needs to be done now. Near misses are not being recorded and there are lots. Traffic is increasing and by 2020 all Expressway traffic will be using this intersection.

TF – Supports FG comments – Roundabouts needs to be done now. Can the slip lane be marked better in the short term? Noting that the Tauriko intersection is a good example. Also noted that a slip lane could be a suitable option for Karepiro Intersection by the Mobil for traffic travelling through to Cambridge.

MTW – Roundabout is good short term despite efficiency loss and should be on the table ahead of a grade separation option.

BM – WRC asked for intersection improvements to come forward and WRC considers that a roundabout would be good short term solution.

AK – construction of a roundabout wouldn't preclude a future grade separation option.

TF – Safety is of greater concern for this intersection than the level of efficiency

CK – there are ore 23m trucks on the road and at this intersection the gaps are reducing as traffic increase.

MTW – There is a perception that trucks won't like a roundabout solution due to a drop in efficiency – but this needs to be tested. Suggestion for the team to investigate this further or for discussion within the NZ Transport Agency.

BC – noted possibility that a well-designed 2+1 (possibly with some limited lengths of 1+1) will meet the traffic need for a substantial period beyond the notional 10-year payback period.

JB – Suggest that the Safe Roads Alliance team considers two roundabout options:

'Smart' Roundabout based on the Victoria examples discussed by BC

Standard Rural Roundabout

NZTA advised of other works along the route

1. Removal of the first passing lane south of the Expressway (Hickey Road) and installation of a weigh station (MH/BH to follow up with NZTA for drawings).

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2. Right turn Bay at access to Kelly's Recreational Reserve (MH to follow up with Mark Lilley for a copy of the drawings). *Post meeting note: MH met with Mark Lilley – Mark will advise if works are to be progressed tis construction season.*
3. Possible development of Mobil into full service rest facility – unsure on availability of details. MH: to follow-up.

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Workshop 1

Invites to the Stage 1 workshop were issued to the following key stakeholders who were identified as most relevant to this corridor project: NZ Transport Agency, Road Transport Association, NZAA, Waikato Regional Council, NZ Police, and Waipa District Council.

The following stakeholders attended the workshop:

Table 14: Stakeholder workshop attendees

ORGANISATION	INDIVIDUAL
NZTA	James Bevan (Transport Planning Manager), Michelle Te Wharau (Principal Safety Engineer), Ben Peacey (Outcome Planning), Adrian Khan (Project Manager - Efficiency Scheme)
Road Transport Association	s 9(2)(a)
NZAA	
Waikato Regional Council	
NZ Police	
Waipa District Council	

Apologies were received from Andrew McKillop (NZTA Planning and Investment), Rob Campbell (NZTA Network Operations) and s 9(2)(a) (South Waikato District Council).

The following table lists the key outcomes from Workshop 1.

Table 15: Stakeholder workshop key outcomes

ISSUE	OUTCOME
Discussion of corridor specific issues	<p>Workshop attendees discussed issues specifically related to road user safety for the corridor. The following is a summary of key issues discussed:</p> <ul style="list-style-type: none"> Thinking that a higher level of investment is needed in the short term given the significance of the corridor and the high crash rate Expressway transition needs further safety assessment Karapiro Road and the Mobil need specific safety consideration Concern regarding the proposed 10-year investment horizon for the safety scheme. A view that the SH1/29 intersection should not be left for 10 years and that improvements should be included in the short term scheme - preferably a roundabout upgrade. <p>The Workshop 1 minutes are attached and include a full list of issues discussed (refer Appendix D)</p>
Problem statement	<p>The programme Business Case problem statements (refer to the information pack) were reviewed and reworded as follows:</p> <p>Problem 1: Human error, coupled with high traffic volumes, and an inconsistent and unforgiving road corridor, results in crashes that commonly lead to severe injury or death, even at legal travel speeds of 100 km/h. (70%)</p>

ISSUE	OUTCOME
	Problem 2: The number and layout of intersections and accesses coupled with the high SH1 traffic volumes currently results in a significant crash rate at intersections (30%).
Investment objectives	<p>Discussed appropriateness of the National Programme Business Case Investment Objectives</p> <p>Agreed that the National Programme Business Case Investment Objectives are still appropriate, but that for this route, a 50% reduction in DSIs is too low given its One Network Road Classification (ONRC) of National 'High Volume'.</p> <p>Agreement that a higher level of DSI reduction should be achieved and a higher level of investment may be required to achieve this.</p>
Short list of options	A long list of possible treatments was presented by the Alliance team. The workshop attendees developed a short list of options that ranged from low investment cost to high investment cost. These options are discussed further in the option assessment.
Way forward	<p>A way forward was agreed which included:</p> <ul style="list-style-type: none"> • Safe Roads Alliance assessment of options • Second workshop with stakeholders and NZ Transport Agency to agree a preferred option (late March/April) • Finalise the business case before sending it to the Transport Agency Decision Making team • Pre-implementation (design phase)

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Options assessment workshop April 2016

The following individuals attended the workshop:

Table 6: NZTA Stakeholders workshop attendees

ORGANISATION	INDIVIDUAL
NZTA	James Bevan (Transport Planning Manager) Michelle Te Wharau (Principal Safety Engineer) Adrian Khan (Project Manager – Efficiency Scheme) Andrew McKillop (NZTA Planning and Investment) Mark Lilley (NZTA Safety Engineer) Rob Campbell (NZTA Network Outcomes)
Safe Roads Alliance	s 9(2)(a)
Apologies	Ben Peacey, Keryn Zimmerman (Outcomes Planning)

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APPENDIX E – CRASH ANALYSIS REPORT

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Crash Analysis Report – SH1 Cambridge to Piarere

Project Name	SH1 Cambridge to Piarere		
Route Positions	1-574/2.4 to 1-594/0.2	Length	17.05km
AADT	2014 Estimate: 11,650, HCV – 12%	One Network Road Classification	National Strategic

Executive Summary

This crash analysis report has been prepared as a technical appendix for the State Highway 1 Cambridge to Piarere corridor safety improvement project business case in the Safe Road Alliance Contract. The findings of the report should support the design of treatment options.

Two different approaches are used to identify road safety along the project corridor.

Firstly, the road safety star and risk ratings are presented to identify whether the project corridor is categorised as high risk rural road and subsequently, the appropriate improvement approach advised in the NZ Transport Agency High Risk Rural Road Guide. The road safety ratings and the Road Protection Scores which are retrieved from the KiwiRAP via the SafetyNet, provide an overview of the current safety status of the project corridor. To aid understanding of the KiwiRAP road safety and risk ratings, an overview of the methodology is provided at the beginning of the report. Based on the published information, the project corridor has:

- A current 3-Star rating (3.18)
- A Collective Risk rating of 'Medium-High' (0.23 DSI/year/km)
- A Personal Risk rating of 'Low'

With these ratings, this corridor constitutes a high-risk rural road as per the NZ Transport Agency criteria set out in the High Risk Rural Road Guide (HRRRG). Based on the HRRRG, the corridor is classified as a high-risk rural road. To improve safety through the corridor, a "Safer Corridor" approach is required.

Secondly, the NZ Transport Agency Crash Analysis System (CAS) has been used to retrieve crash history and key contributing factors for a 10-year period between 2005 and 2014 inclusively. Crash trends and key contributing factors are identified to provide further insights from the crash data. Key findings of the CAS data analysis are:

- A total of 246 crashes are recorded on the project corridor over the 10-year period from 2005 to 2014, of which: 96 (39%) were injury crashes (9 fatal, 15 serious injury and 72 minor injury).
- The total DSI count for the 10-year period is 39 resulting in a 0.23/yr/km DSI ratio which is higher than the given threshold of 0.12/yr/km for the Safe Road Alliance projects.
- The DSI ratio is 0.18/yr/km between 2010 and 2014 which is lower than the 10-year ratio of 0.23/yr/km.
- Although the total number of crashes has decreased over the 10-year period, the impact of the crashes and crash related social costs have not necessarily decreased in the same proportion.
- 73% of all crashes and 77% of all injury crashes occurred at midblock locations. 79% of the DSI count resulted from midblock crashes.
- Hydro Road intersection has a higher crash count and severity compared to the other intersections on the project corridor.
- Adverse environmental conditions are not key causes in the majority of the crashes.

- Majority (a total of 93%) of the DSI counts are related to factors including: “Failed to keep left”, “Failed to Give Way/Stop”, “Fatigue” and “Too Fast”.
- The findings of the most recent crash records in 2015 are generally consistent with the previous year.
- A summary of DSI distribution of fatal and serious injury crashes between intersection, Head-on and Run-off road in the table below shows that:
 - A significant proportion of 72% (28 out of 39) of the DSI is caused by head-on crashes
 - 15% of the DSI is caused by run-off road crashes, and
 - 10% of the DSI is caused by intersection crashes.

Fatal and Serious Injury DSI Counts													
Crashes	2005	2006	2007	2008	2009	5-year Total	2010	2011	2012	2013	2014	5-year Total	10-year Total
Head-on	1	3	3	8	3	18 (75%)	2	2	0	0	6	10 (67%)	28 (72%)
Run-off Road	0	1	0	2	0	3 (12.5%)	0	0	1	2	0	3 (20%)	6 (15%)
Intersection	1	1	1	0	0	3 (12.5%)	0	1	0	0	0	1(6.7%)	4 (10%)
Other	0	0	0	0	0	0 (0%)	0	0	0	0	1	1(6.7%)	1 (3%)
Yearly Total	2	5	4	10	3	24	2	3	1	2	7	15	39
5 –year Total	24					-	15					-	-
10-year Total	39											-	39

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1. Background

1.1. Project Introduction

This crash analysis report has been prepared as a technical appendix for the SH1 Cambridge to Piarere corridor safety improvement project business case. The locality of the project corridor is illustrated in Figure 1 below. The findings of the report should support the design of treatment options.

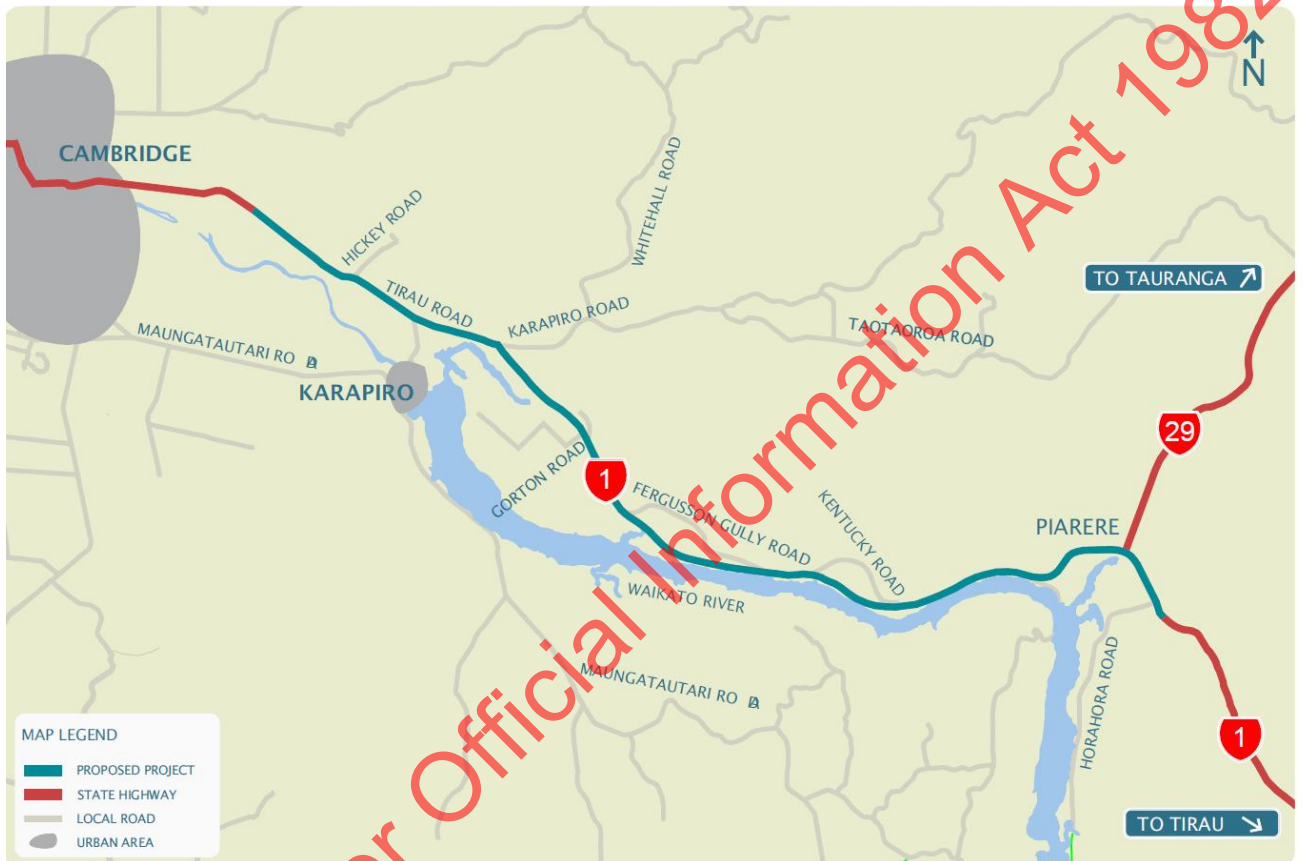


Figure 1: Project Corridor Locality

The following sections provide an overview of the project corridor. The road safety rating has been retrieved from KiwiRAP via the SafetyNet. The Crash Analysis System (CAS) has been used to retrieve crash history and key contributing factors for a 10-year period between 2005 and 2014 inclusively.

1.2. KiwiRAP

The KiwiRAP Road Assessment Programme has been undertaken on all NZ State Highways with the objective of reducing deaths and injuries. KiwiRAP does this by:

- Understanding the actual historic crash data by mapping the risk relative to other sections of the State Highway network
- Performance tracking of crash rates to establish whether fewer or more people are being killed or seriously injured
- Star rating of the road – which includes the assessment of the inherent risk features on a corridor comprised from risk road protection scores (RPS)

KiwiRAP correlates the actual reported crash rate with the star rating and traffic volume of the road. This information allows us to determine a more reliable prediction of crashes over time which can be assigned to a route. Therefore, future benefits can be more reliably assessed.

While it is acknowledged that the crash record can be an indicator of a specific underlying issue, the random nature of crash occurrence, and in particular the less common fatal and serious crashes, means that prior fatal and serious crash locations are not a reliable indicator of the future crash occurrence. Use of the crash record alone can lead to chasing random crashes around a network.

1.3. Risk Mapping and Safety Improvement

The road, the vehicle, the speed and the driver/rider each contribute to risk. Collective Risk and Personal Risk are the two different measures used for risk mapping.

Collective Risk is also described as the Crash Density. It is a measure of the total number of fatal and serious injury crashes per kilometre over a section of road. Collective risk can be used to help determine where the greatest road safety gains can be made from investment on cost-effective infrastructure improvements.

Personal Risk is also described as the Crash Rate. It is a measure of the danger to each individual using the State Highway. It takes into account the traffic volumes on each section of state highway. Personal Risk shows the risk to road users, as individuals and is of most interest to the public. In many cases infrastructure improvements on these roads are unlikely to be cost effective and other Safe System interventions such as safer road use and safe speeds need to be explored.

1.4. Risk Levels

The bands for the different risk levels were determined by spreading the number of links equally over the five risk categories. Many of the higher collective risk links are high volume state highway road network areas. Conversely, some of the higher personal risk lengths are in the less travelled road network areas.

The current risk thresholds for the bands remained the same between 2008 and 2012 and is demonstrated in the table 1 below.

Table 1 – Risk Level Thresholds

RISK RATING	COLLECTIVE RISK Average annual fatal and serious injury crashes per km	PERSONAL RISK Average annual fatal and serious injury crashes per 100 million vehicle-km	COLOUR
Low	≤ 0.039	< 4	Green
Low-medium	$0.04 \leq 0.069$	$4 \leq 4.9$	Yellow
Medium	$0.07 \leq 0.10$	$5 \leq 6.9$	Orange
Medium-high	$0.11 \leq 0.189$	$7 \leq 8.9$	Red
High	$0.19+$	$9+$	Black

1.5. Star Rating

Star Ratings are derived from a Road Protection Score (RPS); this risk score is determined via evaluation of each of the road's design elements such as shoulder width and median barrier. The RPS is calculated for every 100-metre section of road using the three primary crash types, namely head-on, run-off road and intersection crashes.

The RPS score for each individual crash type is a function of underlying crash risk associated with the road layout or more particularly the type of traffic using that type of road, the impact that the presence or

absence of the various road engineering features will have on the underlying crash risk and factors for each crash type. Table 2 below describes road features associated with each star rating.

Table 2 – Road Features and Star Rating

RATING SCALE	DESCRIPTION OF FEATURES	
	DIVIDED ROAD	UNDIVIDED ROAD
5-star ★★★★★	Straight with good line marking, wide lanes and sealed shoulders, safe roadsides and occasional grade separated intersections. Roads with a local, minor or major at-grade intersection cannot achieve a 5-Star Rating.	No undivided road can achieve a 5-Star
4-star ★★★★	Deficiencies in some road features such as lane width, shoulder width or roadside hazards.	Straight with good overtaking provision, good line marking and safe roadsides. Such a road will not achieve a 4-Star Rating if it has high traffic volumes.
3-star ★★★	Major deficiencies in some road features. These may include poor median protection against head-on crashes, many minor deficiencies and /or poorly designed intersections at regular intervals.	Deficiencies in some road features such as alignment, roadsides, and /or poorly designed intersections at regular intervals.
2-star ★★	Many major deficiencies such as poor alignment, poor roadside conditions and median protection, and poorly designed intersections at regular intervals.	Major deficiencies in some road features such as poor roadside conditions and /or many minor deficiencies such as insufficient overtaking provision, narrow lanes, and /or poorly designed intersections at regular intervals.
1-star ★	Poor alignment, in mountainous terrain, narrow lanes, narrow shoulders, severe roadside conditions and many major intersections.	Poor alignment, in mountainous terrain, narrow lanes, sealed shoulders, poor line markings and severe roadsides conditions.

2. Corridor KiwiRAP Published Information

2.1. Corridor Overall Risk and Star Rating

Based on the published KiwiRAP information, the project corridor has:

- A current 3-Star rating (3.18),
- A Collective Risk rating of 'Medium-High' (0.23 DSI/year/km), and
- A Personal Risk rating of 'Low'.

With these ratings, this corridor constitutes a high-risk rural road as per the NZ Transport Agency criteria set out in the High Risk Rural Road Guide (HRRRG). Based on the HRRRG, the corridor is classified as a high-risk rural road. In order to improve safety through the corridor, a "Safer Corridor" approach is required as the project corridor falls into the bottom right quadrant as indicated in Figure 2.



Figure 2: HRRRG Treatment Philosophy

Figures 3, 4, 5 and 6 are extracted from the SafetyNet and illustrate risks and star ratings of the project corridor. They are all based on 5-year crash data from 2010-2014. Key statistics from the figures are summarised below:

Figure 3 – Collective Risk

- Approximately 7.4km (44% of the project corridor) has a “Medium-High” collective risk rating
- Approximately 5.5km (32% of the project corridor) has a “Medium” collective risk rating
- The rest of the route, approximately 4.15km (24% of the project corridor) has a “Low” collective risk rating.

Figure 4 – Personal Risk

- Approximately 14km (82% of the project corridor) has a “Low-Medium” personal risk rating
- The rest of the route approximately 3.05km (18% of the project corridor) has a “Low” personal risk rating

Figure 5 – Intersection Risk Rating

Eleven local or private roads intersect with the project corridor. Out of these intersections:

- Two intersections, Hydro Road and Karopiri Road are rated with “Medium” risk
- The remaining intersections are rated with “Low” risk

Figure 6 – Star Rating

- Approximately 0.8km (5% of the project corridor) has an 1 star rating
- Approximately 0.8km, (5% of the project corridor) has a 2 star rating
- The rest of the route approximately 15.4km (approximately 90%), has a 3 star rating.

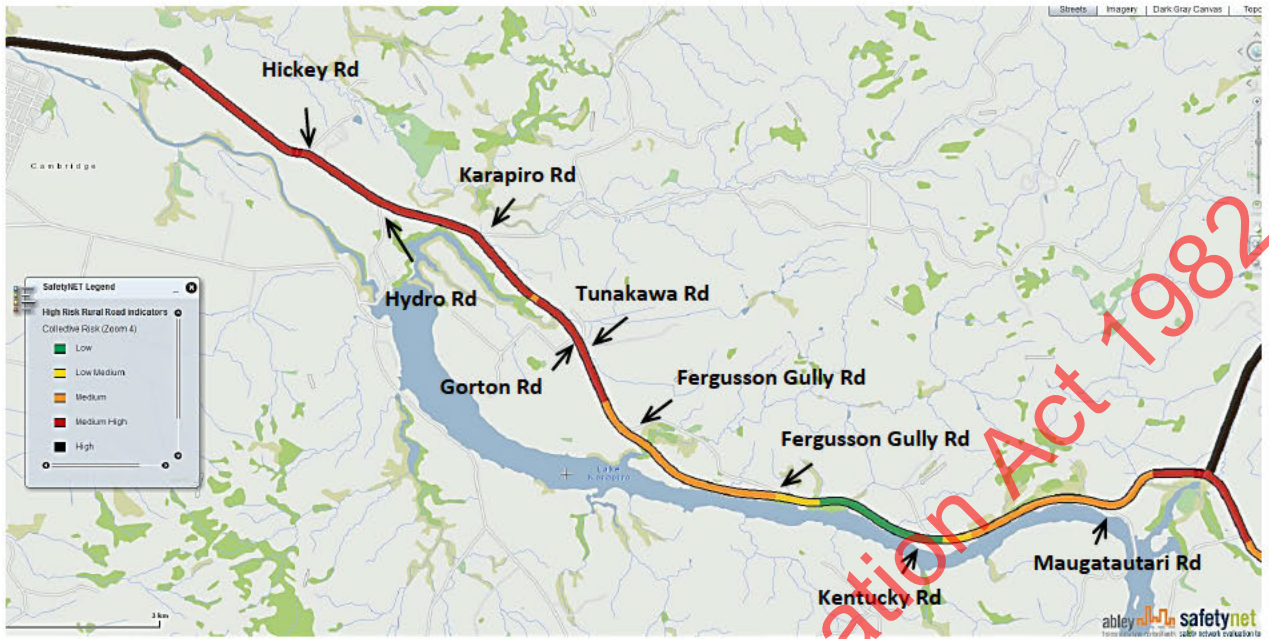


Figure 3 – Project Corridor Collective Risk Star Rating

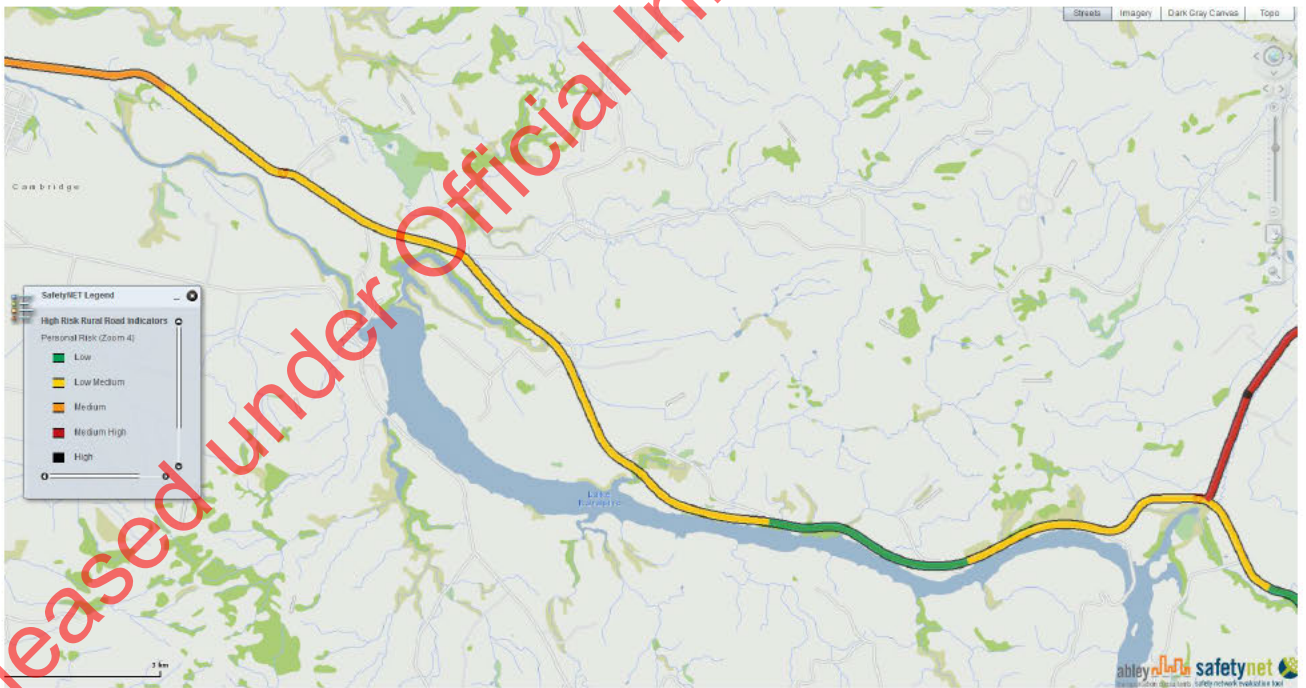


Figure 4 – Project Corridor Personal Risk Star Rating

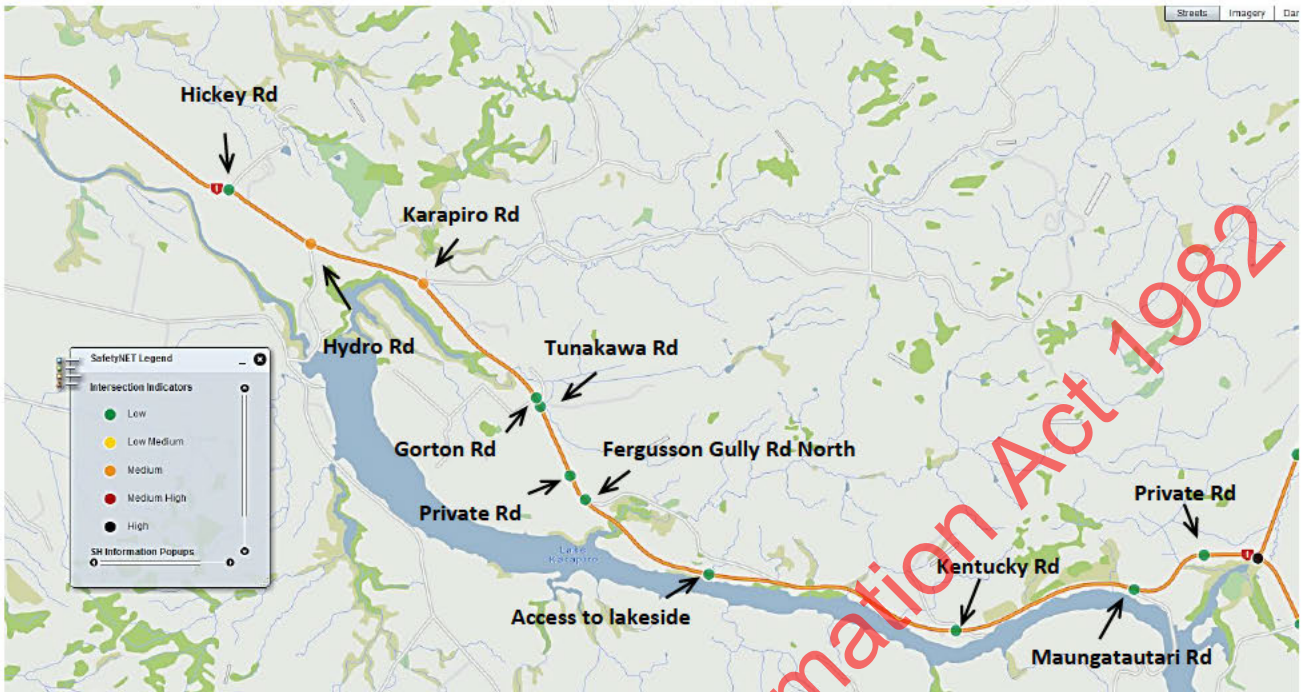


Figure 5 – Intersection Risk Rating

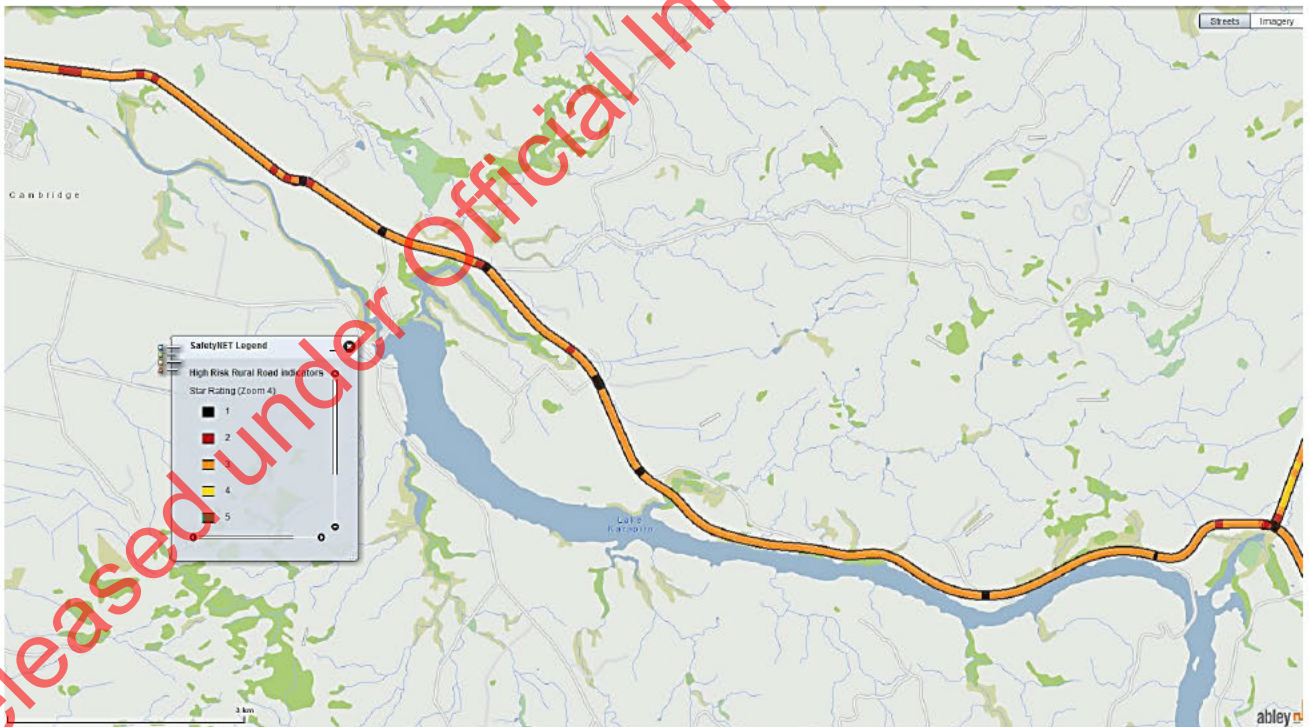


Figure 6 – Project Corridor Star Rating

2.2. Corridor Road Protection Score (RPS)

The overall RPS and star rating for the project corridor is summarised in Table 3 below. It shows that:

- Average head-on RPS of 10.76 is in the medium to high risk range and correlates with a 3-star rating which is below the target average of a 3.5-star rating. Factors on this section of SH1 which

contribute to the high risk of head-on crash are: narrow shoulder width, limited median separation, absence of median barriers and a high AADT.

- Average run-off road RPS score of 5.68 is in the medium risk range and correlates with a 3-star rating which is also below the target average of a 3.5 star rating. Factors which contribute to the level of runoff road risk include but are not limited to: presence of substandard curves alignment, narrow shoulders and road side hazards such as matured trees, steep ditches and tall banks.

Table 3 – Project Corridor Road Protection Score and Star Rating

Scoring Summary	
Average head-on RPS	10.76
Average intersection RPS	0.12
Average run-off road RPS	5.68
Ratio of head-on RPS to run-off RPS	1.89
Average RPS	8.81
Average Star Rating (calculated)	3.18
Average Star Rating (published)	3

2.3. Corridor Specific Risk Mapping

Figures 7, 8 and 9 are extracted from the SafetyNet and illustrate specific risks based on road protection scores of the project corridor. They indicate that:

Figure 7 - Head on Risk Severity

- Significant portion, approximately 12.6km (74% of the project corridor) has “High” head on crash risk
- The rest of the corridor, approximately 4.5km (26% the project corridor) has “Moderate” head on crash risk.



Figure 7 – Head on Risk Severity

Figure 8 – Run Off Road Risk Severity

- 7.1km (21% of the project corridor) lane length has “Severe” run-off road risk
- 20.2km (59% of the project corridor) lane length has “Moderate” run-off road risk
- 3.4km (10% of the project corridor) lane length has “Minor” run-off road risk
- 3.4km (10% of the project corridor) lane length has “Negligible” run-off road risk

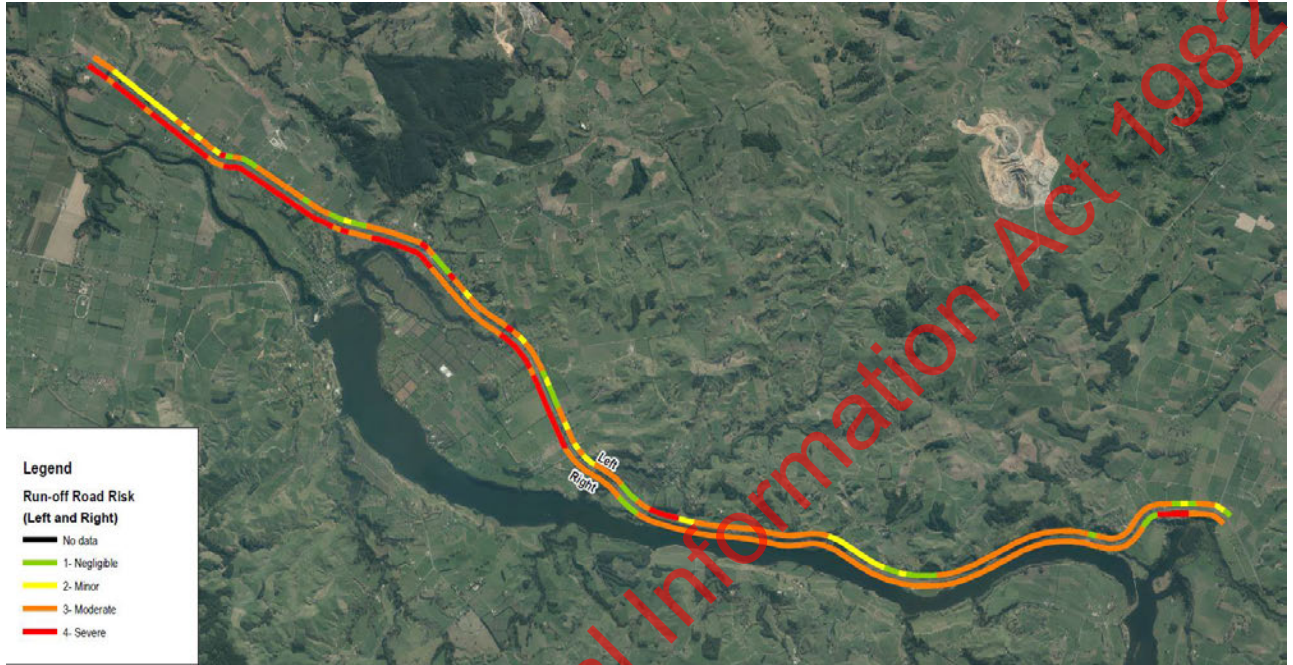


Figure 8 – Run Off Road Severity Risk

Figure 9 – Out of Context Curves

- Four curves are greater than 20kph out of context
- One curve is 15kph - 20kph out of context



Figure 9 – Out of Context Curves

Figure 10 below is an RPS line graph, the dotted black line denotes RPS for each 100-metre section of road along the project corridor. This graph indicates that there are six 100-metre sections of roads that have an RPS above 25. This demonstrates that these sections have a high probability of crashes and are rated 1-Star. Factors contributing to the high risk include, but are not limited to combinations of narrow shoulders, limited medium separation, substandard curves and road side hazards.

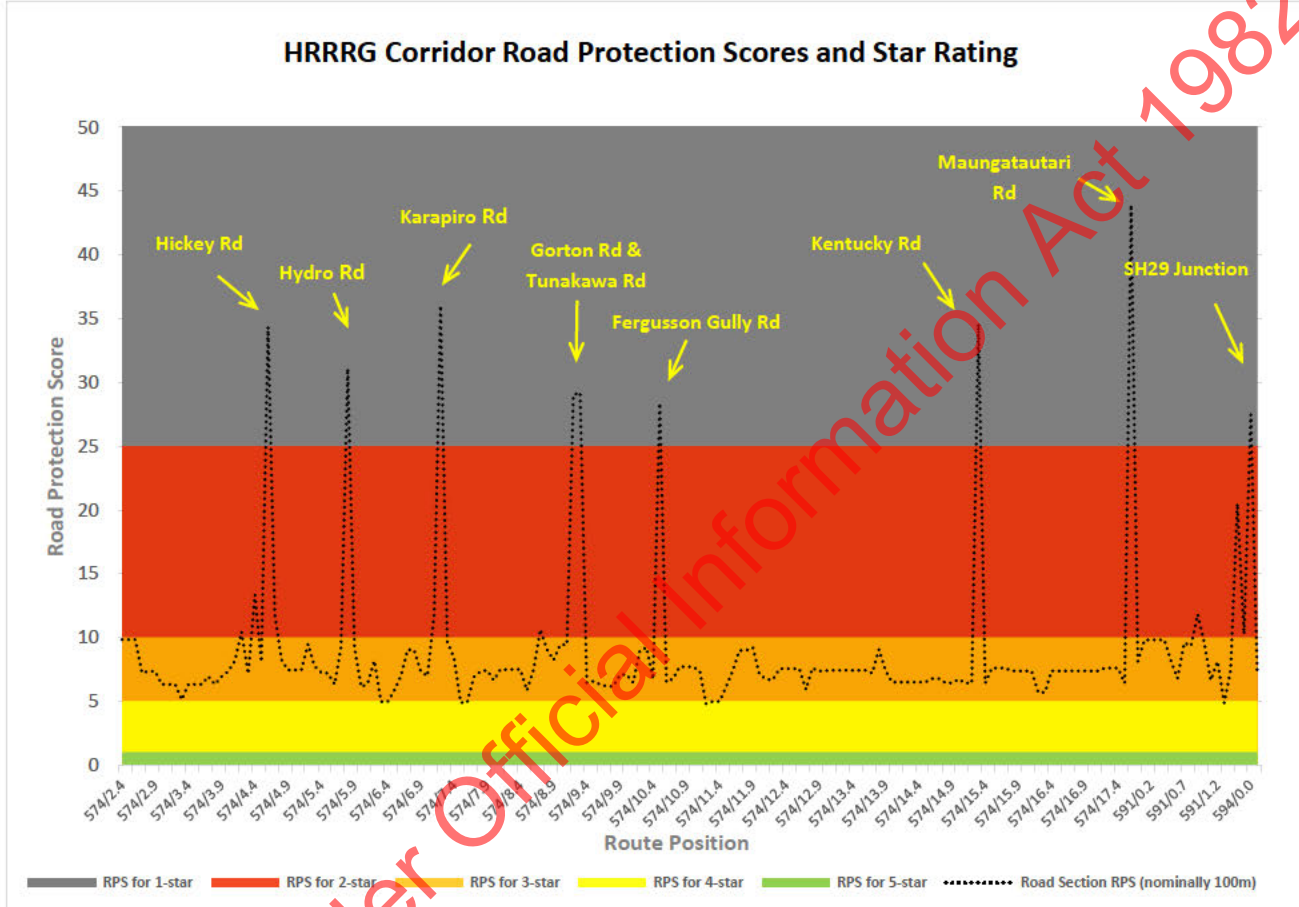


Figure 10 – Project Corridor Road Protection Score and Star Rating

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3 CAS Data and Analysis

3.1. Overview

Tables 4 and 5 below summarises 10-year and 5-year crash types by injury severity and proportions out of the total number of crashes.

10-year Statistics

- There are a total of 246 recorded crashes on project corridor over the 10-year period from 2005 to 2014, of which 96 (approximately 39%) were injury crashes,
- 9 fatal and 15 serious injury crashes are recorded over the 10-year period, and
- The total DSI count for the 10-year period is 39 resulting in a 0.23/yr/km DSI ratio which is higher than the given threshold of 0.12/yr/km for the Safe Road Alliance projects.

Table 4 – 10-Year Project Corridor Crashes

10-year Crashes	Numbers	Minor	Serious (DSI)	Fatal (DSI)	%	DSI
Total Injury Crashes	96	72	15 (21)	9 (18)	39%	39
Total Non-Injury Crashes	150	-	-	-	61%	-
Total	246	72	15	9	100%	
% of total crash / Ratio	-	29%	8%	4%	100%	0.23/yr./km

5-year Statistics

- There are a total of 88 recorded crashes over the second 5-year period from 2010 to 2014, of which 36 (approximately 41%) were injury crashes,
- 5 fatal crashes occurred during the second 5-year period resulting in 5 deaths and 6 serious injuries, and
- 8 fatal and serious injury crashes have been recorded during the 5-year period with a total DSI count of 15, and
- The DSI ratio is 0.18/yr/km which is lower compared to the 10-year ratio of 0.23/yr/km.

Table 5 – 5-Year Project Corridor Crashes

5-year Crashes	Numbers	Minor	Serious (DSI)	Fatal (DSI)	%	DSI
Total Injury Crashes	36	28	3 (4)	5(11)	41%	15
Total Non-Injury Crashes	52	-	-	-	59%	-
Total	88	28	3	5	100%	
% of total crash / Ratio	-	32%	3%	6%	100%	0.18/yr/km

10-year Trends

The graph in Figure 11 demonstrates the 10-year trends of crashes and crash severities. It is apparent that there has been a significant (44%) reduction in total number of crashes, from 158 crashes to 88 crashes.

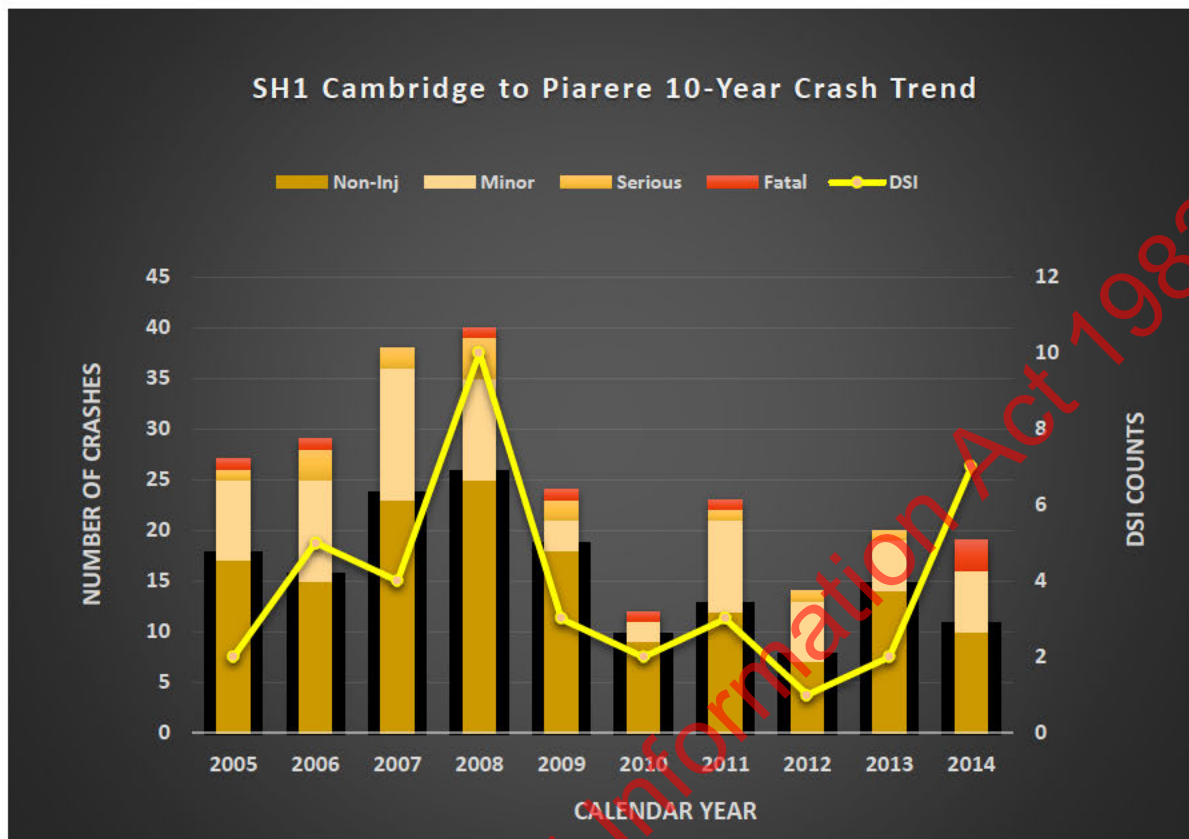


Figure 11 – Project Corridor Road 10-Year Crash Trend

It should be noted that five out of nine fatal injury crashes occurred in second 5-year period and resulted in 50% of the total fatalities in the 10-year period. The average DSI count per fatal and serious injury crash increased to 1.9 during the second 5-year period compared to 1.5 in the first 5-year period.

Table 6 summarises the differences between 2010-2014 and 2005-2009.

Table 6 – 2005-2009 and 2010-2014 5-Year Project Corridor Crash Stats Change

5-year Difference	Numbers	Minor	Serious (DSI)	Fatal (DSI)	%	DSI
Total Injury Crashes	-24	-16	-9(-17)	+1 (-7)	+2%	-24
Total Non-Injury Crashes	-46	-	-	-	-2%	-
Total	-70	-16	-9	5	100%	-
% of total crash / Ratio	-	+3%	-5%	+2%	100%	0.05/yr/km

3.2. Corridor Crash Mapping

Figures 12 and 13 illustrate injury crashes that occurred in the 5-year period between 2010-2014.

Key statistics for the 5 year injury crashes are:

- A total of 88 crashes were reported, of which:
- 5 were fatal injury crashes resulting in 5 fatalities and 6 serious injuries,
- 3 were serious injury crashes resulting in 4 serious injuries, and
- 28 were minor injury crashes.



Figure 12 – Project Corridor Road 5-Year Injury Crash Map



Figure 13 – Project Corridor Road 5-Year Injury Crash Map – Head on and Loss of Control

Figure 14 generated from CAS demonstrates the locality of injury crashes on the project corridor for the 10-year period between 2005 and 2014.

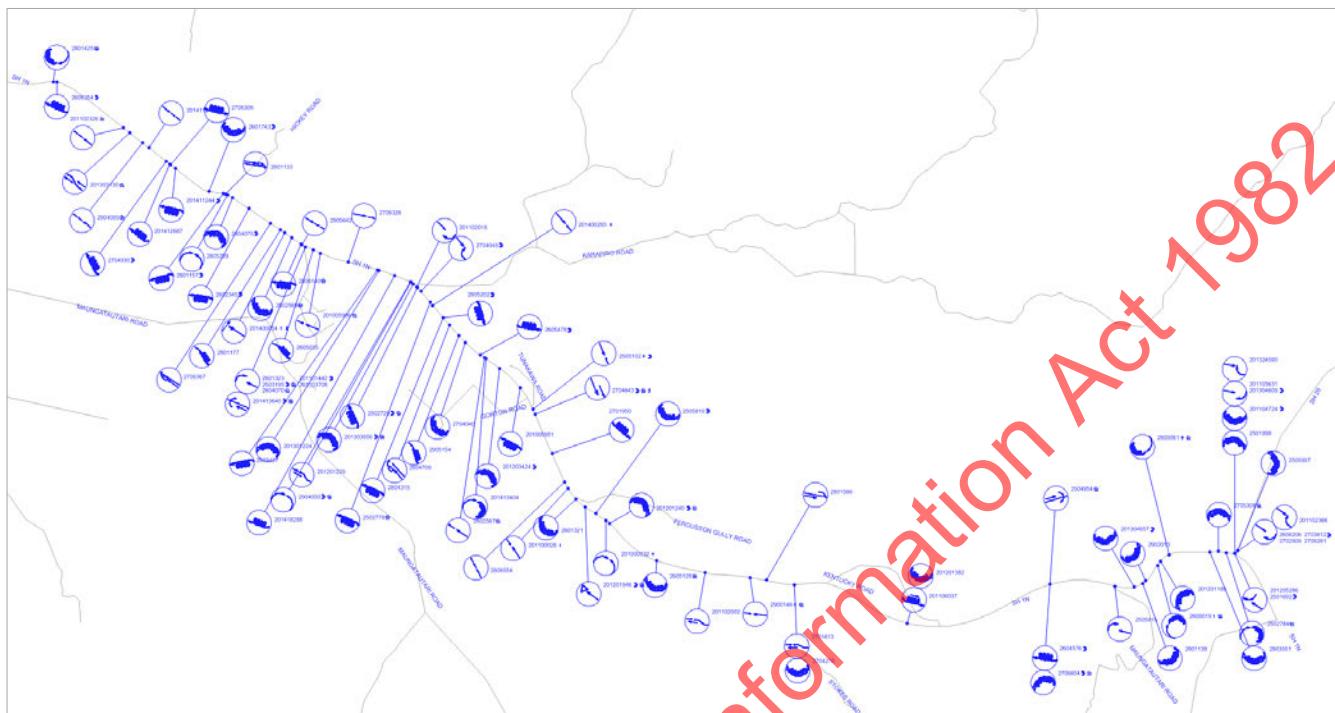


Figure 14 – Project Corridor Road 10-Year Injury Crash Diagram

3.3. Key statistics and Observations:

a) Vehicle Movements

- The top three vehicle movements in the recorded crashes are “Bend – Lost Control / Head On” (78, 32% of all crashes), “Crossing/Turning” (57, 23% of all crashes) and “Straight Road Lost Control” (54, 22% of all crashes).
- The top three vehicle movements in the recorded *injury crashes* are the same as the above with “Bend – Lost Control / Head On” (30, 31% of all injury crashes), “Crossing/Turning” (25, 26% of all injury crashes) and “Straight Road Lost Control” (24, 25% of all injury crashes).
- The top three vehicle movements related to the highest DSI count are “Bend – Lost Control / Head On” (17, 44% of the total DSI count), “Straight Road Lost Control / Head On” (13, 33% of the total DSI count) and “Crossing/Turning” (5, 13% of the total DSI count).
- The “Crossing/Turning” movement has a significantly higher proportion (26%) of injury crashes than the national rural state highway average (7%).

b) Intersection / Midblock

- 73% (179) of all crashes occurred at midblock locations
- 77% (35) of all injury crashes occurred at midblock locations
- 79% (31) of the DSI count resulted from midblock crashes
- 23% (22) of the injury crashes occurred at intersections. This is considerably higher than the national average of 16%.

Table 7 summarises all intersection crashes in the 2005-2014 period. Hydro Road intersection,

Maungatautari Road intersection and SH29 Junction appear to have considerably more crashes compared to other intersections on the corridor.

Table 7 – 10-Year Project Corridor Intersection Crashes

Intersection	Total Crashes	Total Injury Crashes	Total FSI Crashes	Number of DSIs	Other Notes
SH1 / Hickey Road	3	2	1	4	Crossing / turning
SH1 / Hydro Road	16	6	1	1	Failed to give way
SH1 / Karapiro Road	8	1	0	0	No FSI crashes
SH1 / Gorton Road	1	0	0	0	No injury crashes
SH1 / Tunakawa Road	0	0	0	0	No crashes
SH1 / Fergusson Gully Road	2	1	1	1	Lost control due to fatigue
SH1 / Kentucky Road	1	0	0	0	No Injury crashes
SH1 / Maungatautari Road	15	3	0	0	No FSI crashes
SH1 / SH29 Junction	21	10	2	2	Failed to give way
Total	67	23	5	8	

c) Environmental Factors

- 70% crashes occurred in daylight hours
- 73% crashes occurred in dry conditions
- The crash injury ratio during light hours (82%) is noticeably higher than the national average (68%)
- Crashes during light time account for 82% of the total DSI count
- Crashes in dry conditions account for 82% of the total DSI between 2005 and 2014 and 100% between 2010 and 2014. This indicates that adverse wet weather conditions are not key causes in the majority of the crashes.

d) Vehicle Involved

- 69% of crashes involved cars
- 66% of injury crashes involved cars
- 20% crashes involved vans / utes and/ SUVs
- 24% of injury crashes involved vans / utes / SUVs, which is considerably higher than the national average of 15%
- 95% of the total DSI count is related to crashes involving cars
- 38% of the total DSI count is related to crashes involving vans / utes / SUVs

e) Key Crash Factors

- 52% of crashes are related to striking objects such as trees, ditches and cliff banks
- Object struck crashes account for 47% injury crashes
- Object struck crashes contribute to 26% of the DSI count
- “Failed to keep left” is a key contributing factor in the fatal and serious injury crashes and relates to 28% of the DSI count. It accounts for 10% of the total injury crashes which is significantly higher than the national average of 2%
- “Failed to Give Way/Stop” is also a key contributing factor in the injury crashes. It accounts for 23% of the total injury crashes which is significantly higher than the national average of 6%
- “Fatigue” related injury crashes account for 21% of the injury crash and 21% of the total DSI count
- “Too Fast” contributes to 11% of the injury crashes and 21% of the DSI count.

3.4. Recent Crashes

Taking into consideration the most recent crashes, further searches were conducted in CAS and other media for reported crashes occurring in 2015. The findings below are generally consistent with the previous year:

- 13 crashes are recorded between January and mid-Aug 2015, which does not and
- Out of the recorded crashes, two were fatal injury crashes: one involved a “Rear End” caused by suspected “Alcohol / Drug” use. Another was a “Head On” caused by “Lost Control”. The two crashes resulted in two fatalities and one serious injury.
- Three recorded serious injury crashes were related to illegal U-turning, “Overtaking” and / or “Head On”. The three serious injury crashes resulted in four DSI, and
- The remaining crashes are three minor injury and four non-injury crashes.

Figure 15 is a crash diagram demonstrates 2015 crashes recorded in CAS as of Jan 2016.

One other fatal head on crash was reported in the media on 7 Dec 2015. The crash occurred just south of Hydro Road intersection with one person fatally injured and two people seriously injured.

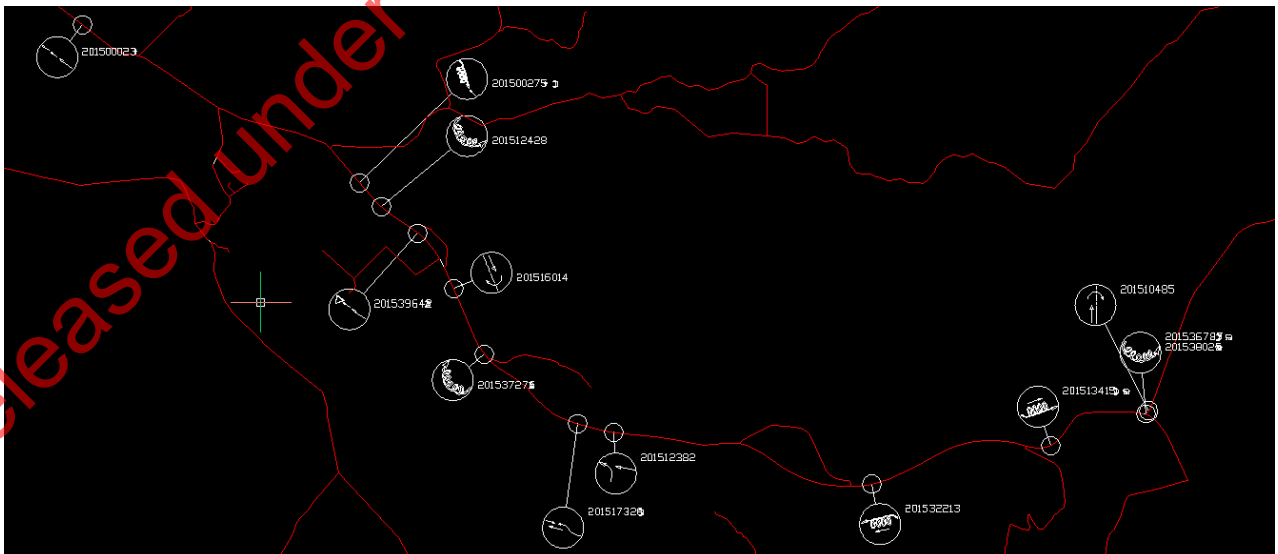


Figure 15 – Project Corridor Road 2015 Crash Diagram

3.5. Summarises of the Key Statistics

Tables 8 and 9 below provide a summary of crash types and factors for 10-year and 5-year periods inclusively and can be found at the end of this report.

1.6. Fatality and Serious Injury Count

Table 10 provides a summary of DSI distribution of fatal and serious injury crashes between intersection, Head-on and Run-off road.

It shows that:

- A significant proportion of the DSI, 28 out of 39 DSI approximately 72%, is caused by head-on crashes,
- 15% of the DSI is caused by run-off road crashes, and
- 10% of the DSI is caused by intersection crashes.

Table 10 - Fatal and Serious Injury DSI Counts													
Crashes	2005	2006	2007	2008	2009	5-year Total	2010	2011	2012	2013	2014	5-year Total	10-year Total
Head-on	1	3	3	8	3	18 (75%)	2	2	0	0	6	10 (67%)	28 (72%)
Run-off Road	0	1	0	2	0	3 (12.5%)	0	0	1	2	0	3 (20%)	6 (15%)
Intersection	1	1	1	0	0	3 (12.5%)	0	1	0	0	0	1(6.7%)	4 (10%)
Other	0	0	0	0	0	0 (0%)	0	0	0	0	1	1(6.7%)	1 (3%)
Yearly Total	2	5	4	10	3	24	2	3	1	2	7	15	39
5-year Total	24					-	15					-	-
10-year Total						39						-	39

Table 8 10-year Crash Summary of Crash Types and Factors (2005 to 2014 inclusively)

Key Crash Types and Factors	Total Crashes (%) (Both injury & non-injury)	Total Injury Crashes (%)	Rural SH in NZ	DSI Counts	DSI (%)
Crash Movement					
Overtaking Crashes	18 (7%)	6 (6%)	3,345 (10%)	3	8%
Straight Road- Lost Control/Head On	54 (22%)	24 (25%)	5,984 (18%)	13	33%
Bend - Lost Control/Head On	78 (32%)	30 (31%)	10,497 (32%)	17	44%
Rear End/Obstruction	33 (13%)	9 (9%)	10,185 (31%)	0	0%
Crossing/Turning	57 (23%)	25 (26%)	2,238 (7%)	5	13%
Pedestrian Crashes	2 (1%)	2 (2%)	-	1	3%
Miscellaneous Crashes	4 (2%)	0 (0%)	804 (2%)	0	0%
Intersection / Mid-block					
Intersection	67 (27%)	23 (23%)	5,431 (16%)	8	21%
Midblock	179 (73%)	73 (77%)	27,622 (84%)	31	79%
Environmental Factors					
Light	172 (70%)	67 (70%)	22,510 (68%)	32	82%
Dark	74 (30%)	29 (30%)	10,485 (32%)	7	18%
Wet	67 (27%)	25 (26%)	11,052 (33%)	7	18%
Dry	177 (73%)	71 (74%)	21,943 (67%)	32	82%
Vehicle Involved					
Car	228 (86%)	111 (66%)	36,817 (78%)	37	95%
Van/Ute/SUV	81 (20%)	41 (24%)	5,422 (15%)	15	38%
Trucks / Bus	37 (9%)	10 (6%)	4,561 (13%)	3	8%
Motorcycle	4 (1%)	3 (2%)	-	1	3%
Pedestrian	2 (0.5%)	2 (1%)	-	1	3%
Other	3 (1%)	1 (0.5%)	-	0	0%
Struck an Object	126 (52%)	45 (47%)	15,967 (48%)	10	26%
Key Crash Factors (note each crash may have more than one factor)					
Alcohol/ Drugs	12 (5%)	4 (4%)	-	1	3%
Too Fast	23 (9%)	11 (11%)	5,079 (15%)	8	21%
Failed to Give Way/Stop	52 (21%)	22 (23%)	2,116 (6%)	2	5%
Failed to Keep Left	20 (8%)	10 (10%)	783 (2%)	11	28%
Overtaking	12 (5%)	4 (4%)	942 (3%)	0	0%
Lost Control	49 (20%)	14 (15%)	-	2	5%
Inattention	9 (4%)	4 (4%)	-	0	0%
Fatigue	34 (14%)	20 (21%)	3,209 (10%)	8	21%
Other	35 (14%)	7 (7%)	-	7	7%

Table 9 5-year Crash Summary of Crash Types and Factors (2010 to 2014 inclusively)

Key Crash Types and Factors	Total Crashes (%) (Both injury & non-injury)	Total Injury Crashes (%)	Rural SH in NZ	DSI Counts	DSI (%)
Crash Movement					
Overtaking Crashes	9 (10%)	4 (11%)	3,345 (10%)	0	0%
Straight Road- Lost Control/Head On	15 (17%)	7 (19%)	5,984 (18%)	6	40%
Bend - Lost Control/Head On	26 (30%)	11 (31%)	10,497 (32%)	5	33%
Rear End/Obstruction	13 (15%)	3 (8%)	10,185 (31%)	0	0%
Crossing/Turning	21 (24%)	10 (28%)	2,238 (7%)	3	20%
Pedestrian Crashes	1 (1%)	1 (3%)	-	1	7%
Miscellaneous Crashes	3 (3%)	0 (0%)	804 (2%)	0	0%
Intersection / Mid-block					
Intersection	26 (19%)	10 (28%)	5,431 (16%)	1	7%
Midblock	62 (81%)	26 (72%)	27,622 (84%)	14	93%
Environmental Factors					
Light	63 (72%)	25 (69%)	22,510 (68%)	13	69%
Dark	25 (28%)	11 (31%)	10,485 (32%)	2	31%
Wet	20 (23%)	7 (19%)	11,052 (33%)	0	0%
Dry	67 (77%)	29 (81%)	21,943 (67%)	15	100%
Vehicle Involved					
Car	104(67%)	44 (69%)	36,817 (78%)	14	69%
Van/Ute/SUV	35 (22%)	15 (23%)	5,422 (15%)	5	23%
Trucks	15 (10%)	4 (6%)	4,561 (13%)	2	6%
Pedestrian	1 (1%)	1 (2%)	-	1	2%
Other	1 (1%)	0 (0%)	-	0	0%
Struck an Object	38 (44%)	16 (44%)	15,967 (48%)	4	27%
Key Crash Factors (note each crash may have more than one factor)					
Alcohol / Drugs	4 (5%)	1 (3%)	-	0	0%
Too Fast	10 (11%)	4 (11%)	5,079 (15%)	3	20%
Failed to Give Way/Stop	24 (27%)	9 (25%)	2,116 (6%)	1	7%
Failed to Keep Left	8 (9%)	3 (8%)	783 (2%)	6	40%
Overtaking	7 (8%)	3 (8%)	942 (3%)	0	0%
Lost Control	15 (17%)	8 (22%)	-	0	0%
Inattention	1 (1%)	0 (0%)	-	0	0%
Fatigue	10 (11%)	5 (14%)	3,209 (10%)	2	13%
Other	9 (10%)	3 (8%)	-	3	20%

APPENDIX F – ENVIRONMENTAL AND SOCIAL RESPONSIBILITY SCREEN

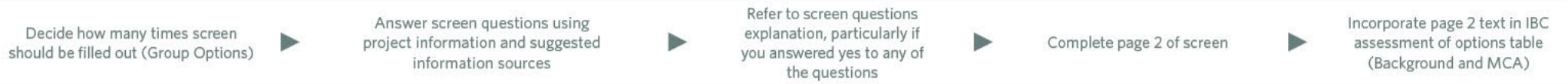
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ENVIRONMENTAL AND SOCIAL RESPONSIBILITY SCREEN V2.FEBRUARY 2016

Use to assess options in the [Indicative Business Case](#)

Use this screen to identify opportunities and risks and assess options for state highway projects. Complete the screen for each option to distinguish them from one another or bundle options where appropriate. Screen results will signal where technical assessments are required and provide a written record to support the alternatives assessment required for statutory applications. For further assistance contact the [EUD Team](#).

Additional instructions and content, including information sources, to help complete the screen can be found on the [Highways Information Portal Screen pages here](#)



PROJECT LOCATION: PROJECT PURPOSE: DATE: OPTION DESCRIPTION:

CATEGORY	QUESTION	ANSWER	USEFUL INFORMATION SOURCES
GENERAL	G1 What is the zoning of adjacent land? Are there any encumbrances on the land? e.g. Maori Reserve or other reserve/covenants	Rural <input checked="" type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Residential <input type="checkbox"/> High density residential <input type="checkbox"/> Parks/open space <input type="checkbox"/>	District/Unitary Plan Zoning Maps
	G2 Does the option disturb previously undisturbed land?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	G3 What is the construction timeframe?	>18 months <input type="checkbox"/> <18 months <input checked="" type="checkbox"/>	
NATURAL ENVIRONMENT	NE1 Are there any outstanding/significant natural features (e.g. geological or geothermal)/landscapes?	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	NZTA MapHub Environmental and Social Risk Map- Natural Environment Regional Plan Maps and Schedules District Plan Maps and Schedules Department of Conservation
	NE2 Will the option affect the coastal marine area, wetlands, lakes, rivers, streams or their margins?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	NE3 Will the option affect areas of the conservation estate, or areas of known significance for biodiversity or known habitats of uncommon or threatened species?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	NE4 Is the option in an area of potential hazard risk e.g. fault lines, significant erosion, flooding, sea level rise etc?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	NE5 Will more than 0.5 hectares of vegetation be removed? What type? <input type="text"/>	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
CULTURAL AND HISTORIC HERITAGE	CH1 Are there sites/areas of significance to Maori within 200m of the area of interest?	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	Iwi NZTA MapHub Environmental and Social Risk Map- Culture and Heritage Heritage New Zealand List NZ Archaeological Association District Plan Maps and Schedules Regional Plan Maps and Schedules IPENZ Heritage List NZTA GIS predictive models
	CH2 Are any recorded, scheduled or listed archaeological sites within 200m of the area of interest?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	CH3 Are any scheduled, listed or other important heritage buildings/structures within 200m of the area of interest?	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	
	CH4 Will the option affect the setting of any historic building/structure or archaeological site?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	CH5 Is a group of archaeological sites or an area of historic built environment (even partially) within 200m of the area of interest?	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	
HUMAN HEALTH	HH1 What is the One Network Road Classification?	National <input checked="" type="checkbox"/> Regional <input type="checkbox"/> Arterial <input type="checkbox"/> Collector <input type="checkbox"/>	NZTA MapHub Environmental and Social Risk Maps- Human Health and Community which includes: - Designated airsheds (including one network classification) - Highly sensitive receivers Regional Council Contaminated sites Team
	HH2 Is the area of interest designated as a non-compliant airshed?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	HH3 Are there medical sites, rest homes, schools, child care sites, residential properties, maraes or other sensitive receivers located within 200m of the area of interest?	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	
	HH4 Does land use within 200m of the area of interest include industrial sites, chemical manufacturing or storage, petrol stations, vehicle maintenance, timber processing/treatment, substations, rail yards, landfills or involve other activities that may result in ground contamination? OR Are there HAIL or SLUR (contaminated) sites within 200m of the area of interest?	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	
SOCIAL	S1 Does the option affect access to community facilities i.e. libraries, open space etc (either temporarily or permanently)?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/> Which? <input type="text"/>	NZTA MapHub Project Team District Plan Maps Council and Community Strategy Documents
	S2 Does the option affect community cohesion and accessibility including vehicular connectivity on the local road network?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
URBAN AND LANDSCAPE DESIGN	ULD1 Are there opportunities to enhance infrastructure for, and/or improve access to, public transport and/or active modes of travel such as walking and cycling?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	NZTA MapHub Environmental and Social Risk Map- Natural Environment (Scenic Routes) Regional Land Transport Plan Project Team Strategies and District Plan
	ULD2 Does the option enhance the development potential of adjacent land where appropriate?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	ULD3 Is the option located on a themed highway? Is the option part of or near a national cycle or walking route?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	
	ULD4 Are there opportunities to enhance the urban character, landscape character and visual amenity?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	

Answers and Comments Refer to [screen questions explanation](#) to help complete this part.

1. Summarize the potential environmental and social risks/impacts associated with this option. Consider short and long term risks and impacts.

NATURAL ENVIRONMENT:

The corridor passes through a naturalistic but modified landscape which is zoned Rural under the Waipa District Plan (WDP). Moving eastwards from Cambridge, the corridor follows the alignment of the Waikato River, passing the outskirts of Karapiro village before following the northern shore of Lake Karapiro. Dominant features of the landscape include the Maungakawa foothills which frame the northern side of the highway and the Waikato River to the south. The rural environment is predominantly set aside for pastoral purposes and sporadic pine plantation. From Gordonton Road eastwards, the landscape is notated as 'River and Lake' environs under the WDP with parts of the corridor also adjoining sections of 'Significant Natural Area'. The easternmost part of the corridor transitions from Waipa District to Matamata Piako District for a distance of approx. 1.7km and is also Rural.

CULTURAL AND HISTORIC HERITAGE:

The NZAA database indicates that there are approximately 16 recorded archaeological sites within 200m of the corridor, 15 of which are located within the Waipa section of the route. The sites are predominantly 'borrow pits' but also include a 'pa' site (T15/57) at or about NZTM 1831494 E, 5796711 N. Of the 16 recorded sites, only one site (T15/293) appears to be within 20m of the road corridor, and therefore care will be needed in the vicinity of this site if corridor widening or land take proves necessary in this location. All other sites are sufficiently removed from the corridor to be unaffected by development works. There are no marae in the immediate vicinity of the project corridor. Nor are there any scheduled / listed buildings affected by development works.

HUMAN HEALTH:

Karapiro School is located on the northern side of SH1 at the intersection of SH1 and Karapiro Road. Access to the school would be unaffected by the safety improvement options because the school relies upon access from Karapiro Road rather than the State Highway. The Karapiro Community Hall is also located in proximity to the highway but is accessed off Karapiro Road. The Karapiro 'Mobile' service station is the only known HAIL site on the corridor but is unaffected by proposed works. The nearest medical facilities are located within Cambridge. In general, works are expected to be wholly contained within the designation corridor. If land take is required in discreet locations for shoulder widening and / or side barrier installation, it will not result in the routing of traffic closer to noise sensitive receivers. In the circumstances, no mitigation will be necessary with respect to human health.

SOCIAL:

A number of community facilities are located in the vicinity of the project corridor including but not limited to, Karapiro School and Karapiro Community Hall. The SH1 corridor also provides access to lakeside reserves such as Moana Roa and Keeley's Reserve, which get intensive use in summer months. Safety options will be designed to ensure that access to these facilities is unaffected. On the basis that the recommended option does not involve the installation of central median barriers, and only discreet use of side barriers, impacts upon community cohesion and connectivity are expected to be negligible. Due to construction works, there is the potential for disruption and inconvenience to land owners with direct access onto SH1. However, the social cost caused by the disruption is expected to be minor and of a temporary nature only.

The responses above will be used in the IBC assessment of options summary table: MCA of the Option.

URBAN AND LANDSCAPE DESIGN:

The development potential of adjacent land is limited by the Rural Zone provisions of the Waipa and South Waikato District Plans. Regardless of the Agency's preferred option, it will have a nil impact upon the development potential of adjacent land and the District Plan provisions will continue to prevail. The options are neutral with respect to access to public transport and alternative modes of travel and the project corridor does not form part of a national cycle route. Although a sensitive environment, safety improvement works are expected to have a neutral effect upon landscape character and visual amenity, largely because works are able to be contained within the designation corridor. In the circumstances, there is limited opportunity, if any, for design enhancement.

Incorporate the relevant comments from above into the economy, social and geography sections of the IBC assessment of options summary table.

2. What are the environmental, social integration, landscape design or urban design benefits or opportunities presented by this option? Particularly record opportunities that could be lost if not considered early in the design process.

Safety improvement works are expected to be wholly contained within the existing designation footprint and therefore, given the limited scope of works, there are no obvious benefits or opportunities with respect to environmental or urban design gain. Social integration will be unaffected by Option 2a because no median barriers are proposed and side barriers are to be used in discreet high-risk locations only. The limited use of side barriers will have a neutral impact upon social integration.

3. Are there any impacts, risks or opportunities which require preliminary technical assessments to help understand risks or opportunities? Is further information required to support the development of the detailed business case or can it be left until the detailed business case/pre-implementation?

There are no known technical risks at this stage, although geotechnical investigation may be necessary if shoulder widening is required in close proximity to riverside terraces. The proximity of one archaeological site (T15/293) could result in requirement for an archaeological authority if shoulder widening is required in that location. If that risk eventuates, it can be managed at the pre-implementation stage. Care will also be required over stormwater discharge if development works involve earthworks in proximity to the Waikato River.

Completed by Andrew McFarlane

Reviewed by NZTA Project Manager MacLean Hastie

Incorporated results into IBC assessment of options summary table?

Yes

No

APPENDIX G – STAKEHOLDER PROJECT ENGAGEMENT AND COMMUNICATIONS PLAN

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STAKEHOLDER AND COMMUNITY ENGAGEMENT PLAN

SH1 CAMBRIDGE TO PIARERE (C2P)

LONG TERM IMPROVEMENTS

Contract Number 2/15-011/501



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**STAKEHOLDER AND COMMUNITY ENGAGEMENT
PLAN
SH1 CAMBRIDGE TO PIARERE (C2P)
LONG TERM IMPROVEMENTS**

Contract Number 2/15-011/501



STAKEHOLDER AND COMMUNITY ENGAGEMENT PLAN SH1 CAMBRIDGE TO PIARERE (C2P) LONG TERM IMPROVEMENTS

Contract Number 2/15-011/501

Date: 2 September 2016
Ref: 232633.00
Status: FINAL

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Team Leader

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Project Director

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1 Document Control

1.1 Document Manager

The document manager for this Stakeholder and Community Engagement Plan is Craig McKibbin, Engagement Manager.

1.2 Update Information

This Stakeholder and Community Engagement Plan is a “live” document and will be updated as the project evolves.

For people with uncontrolled copies of this document, information on the latest update can be obtained from Craig McKibbin (craig.mckibbin@opus.co.nz, Ph. 027 231 3414).

1.3 Alterations Register

Date	Issue	Pages Changed	Changes Made
date			

2 Introduction

The purpose of this engagement strategy is to set out a clear framework for developing and managing our engagement and relationships with key stakeholders and the community regarding the SH1 Cambridge to Piarere Short and Long Term Improvements Project (the Project or C2P). This strategy aims to guide the process and implementation of stakeholder and community engagement so that the appropriate people are kept informed, provided with opportunities to give feedback (where appropriate), and ultimately are supportive of both the short term improvements and long term Project outcomes.

The engagement strategy has been developed in accordance with International Association for Public Participation (IAP2) best practice, as well as the New Zealand Transport Agency’s (the Agency) ‘Draft State Highway Public Engagement Guidelines 2016’. In addition, the strategy fulfils the requirements of the Land Transport Management Act 2003 (LTMA), Resource Management Act 1991 (RMA), Heritage New Zealand Pouhere Taonga Act 2014 (HNZPT), the Wildlife Act 1953 and the Agency’s Stakeholder

Relationship Management System for consultation with Maori.

This strategy identifies and describes the principles and objectives for engagement, the process and proposed methods. It provides direction for undertaking engagement throughout the Project, including identifying who will be engaged, responsibility for engagement and the timing of engagement. This strategy covers engagement with the Agency, key stakeholders and the wider community, who could be affected by and/or interested in the Project.

This strategy is a living document which will be added to and updated (as required) throughout the duration of the Project. This will facilitate flexibility and adaptability in the engagement process, in order to respond to the specific needs of the Agency, stakeholders and community. It is noted that as a result, alternative and/or additional stakeholders and methods may be identified and utilised in the course of delivering the Project.

This engagement strategy is an overarching document that provides a platform for the development and delivery of an integrated short and long term Implementation Plan for specific engagement activities to occur during the various Project phases. The Implementation Plan is provided in Appendix A (note these will be added to and updated over time).

3 Project background and context

The following sections outline the background to the Project, including the case for change, as well as the context which will shape the Project and engagement.

3.1 Project background

SH1 between Cambridge and Piarere is part of a number of key journeys which link Auckland and Hamilton with Tauranga, specifically the Port of Tauranga via SH29, as well as the central and lower North Island via SH1. SH1 is a national high volume route and an important artery for freight and general traffic as it connects Auckland and Hamilton with the rest of New Zealand. SH1 (between Cambridge and Piarere) caters for a mix of local and strategic long distance traffic (12% heavy vehicle traffic), operating at a generally acceptable level of service.

The key problem currently experienced on this stretch of SH1 is related to road safety and the number of deaths and serious injuries which take place on this corridor. Also, the frequent side roads and private access has resulted in a medium/high risk profile for the corridor, causing closures of the road along the corridor for substantial amounts of time affecting reliable journey times.

This section of SH1 is the link to the completed Cambridge Section of the Waikato Expressway (WEX) where drivers travelling south will transition from the high standard expressway to a two-lane rural road with passing lanes. Traffic demand is predicted to increase, not only as a result of growth in traffic volumes, but also as a result of how customers use the wider State Highway network following the opening of the Waikato Expressway.

The increasing conflict between local and through traffic is likely to negatively impact on journey time reliability and undermine the benefits of the Waikato Expressway. Following completion of the Waikato Expressway it is expected that there will be an

increase in traffic volumes by up to 2000-3000 vehicles a day with a further increase in future years.

The Hamilton to Waiburu Strategic Case, the Hamilton to Tauranga Strategic Case and the National Safer Journeys Roads & Roadside Programme Business Case confirmed the case for change; however the Programme Business Case for Cambridge to Piarere did not confirm the preferred long term form of SH1, nor how it connects to the Waikato Expressway, SH29, and SH1 either at or south of Piarere. This will be explored and determined through the indicative and detailed business cases to be undertaken for this Project.

The Safe Roads Alliance (Alliance) is undertaking a business case to assess what short term safety improvements should be made to the SH1 corridor from the southern end of the Waikato Expressway to the SH29 intersection at Piarere. The Alliance has already commenced a limited engagement process for their works and it is imperative that their engagement process integrates with that being undertaken for the long term Project.

The Alliance's business case process is nearing completion with the short term solution to be presented for approval in September 2016. Engagement to date by the Alliance has focussed on a core group of stakeholders including: Road Transport Association, Automobile Association, Waikato Regional Council, NZ Police, Waipa District Council and South Waikato District Council. Furthermore, the Alliance has engaged with Karapiro School and the Karapiro Mobil service station. No further engagement is anticipated for the business case phase (informing the short term design solution) outside of the above mentioned stakeholders. The final component of Alliance engagement (for the business case phase) will be to inform these stakeholders of the decision made in regard to the short term safety improvements.

As the Alliance moves into implementation of the short term solution, engagement with key stakeholders and the wider community along the corridor (to inform of the short term solution design improvements and how they support the long term Project objectives) will be integrated within long term Project engagement undertaken by Opus.

3.2 Project context

Project context is best described as the setting or environment in which the project is being undertaken and is key to ensuring the engagement design is appropriate. Context in this instance is shaped by:

- 1 International, national and regional trends;
- 2 Community factors;
- 3 Organisational factors; and
- 4 Project team factors.

3.2.1 Trends

The response to similar roading projects has generally been positive with many seeing the Waikato Expressway as being key to increasing road safety and reducing travel time. Media coverage of the Project to date has been largely positive with reports that the completion of the Cambridge to Piarere section will make a logical termination point for the Waikato Expressway. This may or may not be the final solution, but Central Government has approved funding for the Agency to undertake an indicative and detailed business case with a view to determining a preferred solution. In accordance with national trends, the Agency's expectation is for a high level of engagement on significant roading projects such as C2P.

3.2.2 Community factors

Engagement with the community on the Cambridge and Hamilton section of the Waikato Expressway has recently ended and occurred over a number of years. As a result, there is a risk of engagement fatigue with the wider community losing interest in being involved in any further engagement processes for another roading project. In order to address this matter and ensure that adequate, value-added feedback is provided from the community requires an innovative and genuine approach to engagement for C2P.

3.2.3 Organisational factors

Transport Agency

The Project is important to the Agency as it will address a number of pressing issues including reducing the crash rate, improving travel time reliability

and supporting economic growth. However, understanding expectations of both the national and regional office regarding the level of engagement to be undertaken will be key to ensuring that the engagement process is robust and genuine, whilst not exceeding budgets. It is anticipated that the Cambridge to Piarere Steering Group will provide a single point of instruction from the Agency in terms of the engagement approach to be adopted.

Local Authorities

The Alliance for the short term works has to date engaged with the Waipa and South Waikato District Council's. The Transport Agency has also had some engagement with Waipa District Council in regard to the long term works. Further engagement with the above and also Matamata Piako District Council will need to take place to better understand their respective positions on the long term improvements for C2P. However, our understanding is that all local authorities and the Waikato Regional Council are eager to see a marked improvement on the status quo for this stretch of road.

3.2.4 Project team factors

Opus has a locally based team of Project dedicated specialists that are eager to assist the Transport Agency in taking the long term Project through a methodical, well defined business case process. The associated engagement process will support and inform the long term business case for C2P.

The Alliance also has a locally based team of dedicated specialists, working as the delivery arm of the Transport Agency to achieve a short term reduction in deaths and serious injuries through the C2P section, whilst long term Project investigations are carried out.

The Alliance will integrate key messages for the short term improvements into all long term Project engagement platforms, allowing Opus to provide the lead on all engagement activities. The Alliance's specialist team will be available to support Opus with this.

4 Project scope

A number of objectives have been set for both the short and long term aspects of the Project, to demonstrate why this Project is being undertaken, why it is a priority and why this section of road has become a key focus. These objectives (outlined below) originated as part of the Programme Business Case (PBC) but have been amended at the beginning of the Indicative Business Case to ensure that they are still relevant going forward.

4.1 Project objectives

The project objectives are:

- 1 Identify a long-term solution (and the necessary project footprint) for a preferred transport corridor between the Waikato Expressway Cambridge Section and the Sh1/29 intersection, that meets the Project's Investment Benefits; and
- 2 Provide an improved customer level of service and safety for inter-regional and local traffic for a planning horizon of at least 40 years.

4.2 Community engagement model

The IAP2 community engagement model outlined below provides an ideal platform for demonstrating that for this particular Project the Transport Agency will be responsible for defining and managing the engagement process, including defining the problem or opportunity to be solved, and who will lead the actions that arise from any decisions that are made.

These profiles are not necessarily always mutually exclusive. Understanding the roles and contribution of all involved in achieving the purpose, goals and outcomes helps to shape an appreciation of the people and organisations involved in or impacted by the action.

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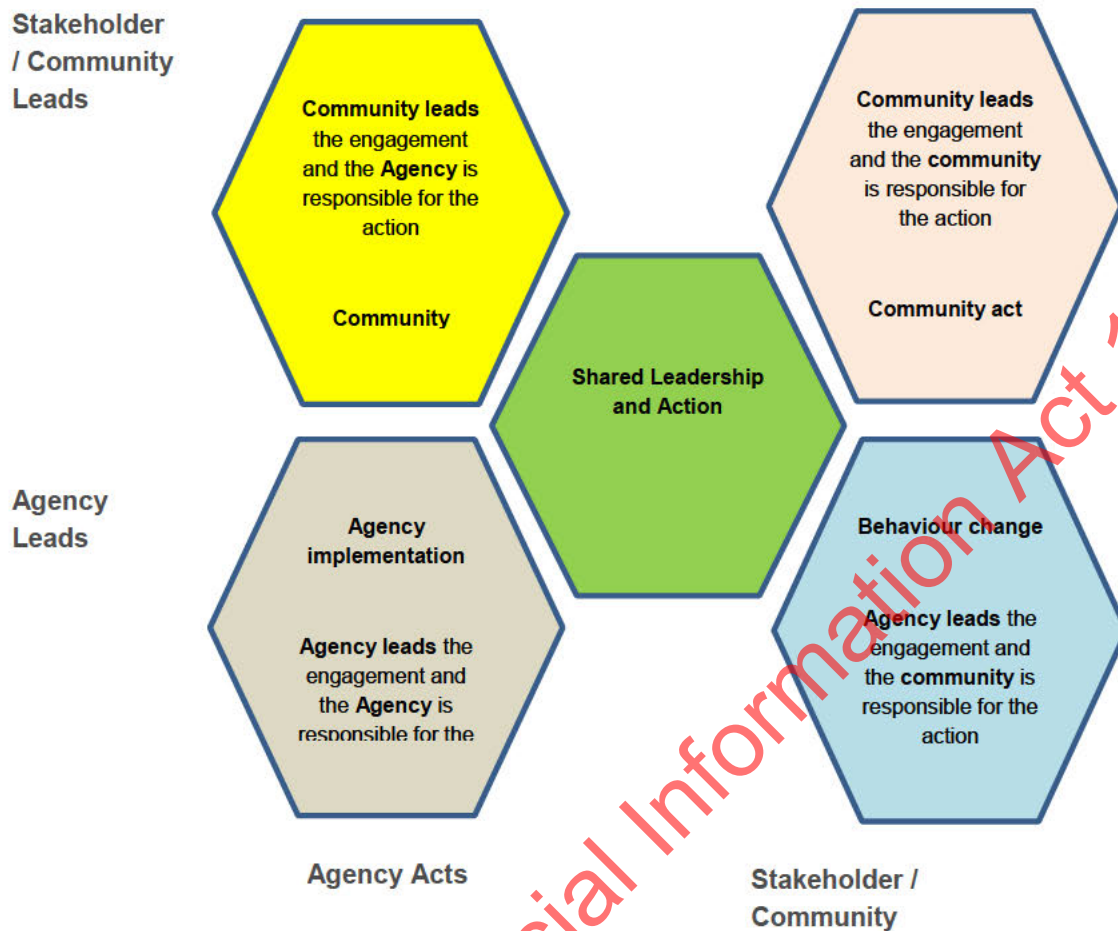


Figure 4.1 IAP2 – Community Engagement Model

For this Project, community engagement will fall into the 'Agency leads/Agency Acts' portion of the above model. This means that the Agency will lead engagement with support of the Opus and Alliance Project teams and will seek input from stakeholders and the wider community to help determine the preferred long term alignment of the Cambridge to Piarere section. Final decision making will rest with the Agency and the Agency will be responsible for implementing any agreed actions that arise from engagement undertaken.

4.3 Will engagement influence the decision?

Engagement with key stakeholders has informed the recommended Project options for achieving reduced deaths and serious injuries in the short term proposal.

Engagement with stakeholders and the community will form an important part of the long term Project as it will help the Agency to explore and understand potential road alignment alternatives/options that achieve the best outcomes. A preferred road alignment is to be determined by the end of the indicative business case.

4.4 What is negotiable and what is not?

The Alliance's short term proposal has identified the most economically viable Project options to achieve short term objectives. To this end there are no further elements negotiable to inform the short term business case, however the Alliance team are open to consider any other 'easy' Project options to improve safety as the long term Project investigations are carried out. There may also be minor changes that may be considered on implementation.

There is an opportunity for stakeholders and the wider community to contribute to the shape, design and implementation of the long term Project. However, to ensure a successful engagement process, it is important that the Agency and Project team clearly communicate to stakeholders and the community what aspects of the Project they are able to influence. The table below specifies what aspects of the Project are negotiable and what is non-negotiable. The engagement process shall only focus on the negotiable aspects of the Project as the non-negotiable aspects are considered to be a given.

Non-Negotiable	Negotiable
Do nothing or leave the road as is between Cambridge and Piarere. Sufficient evidence already provided to demonstrate that changes need to be made to the road.	Alignment, number of lanes and whether it is completely online, off-line or a combination of both.
Start and end points for the Project.	Landscaping and other features to accompany the roading solution.
Limiting private access directly to SH1.	

Table 4.1 Negotiable and Non-negotiable elements of the Project

5 Stakeholders, community and the IAP2 spectrum

Key to the success of this Project is understanding the stakeholders and community to be engaged with (Engagement Partners). One way to gain this understanding is to group Engagement Partners by the roles that they play and the potential influence that they have on the Project.

In this instance:

- 1 The Agency will lead all engagement and will be supported by the Project team;
- 2 Key stakeholders are those that have a vested interest in the Project (including affected

landowners) that is greater than the general public and potentially have greater influence over Project outcomes (this includes other departments within the Agency); and

- 3 The wider community includes the general public and other interested parties, businesses and groups that have an interest in the Project, want to be kept informed and provided with an opportunity to participate in engagement.

The IAP2 spectrum of public participation ranges from 'inform' to 'empower' as shown below and can also be applied equally to stakeholders.

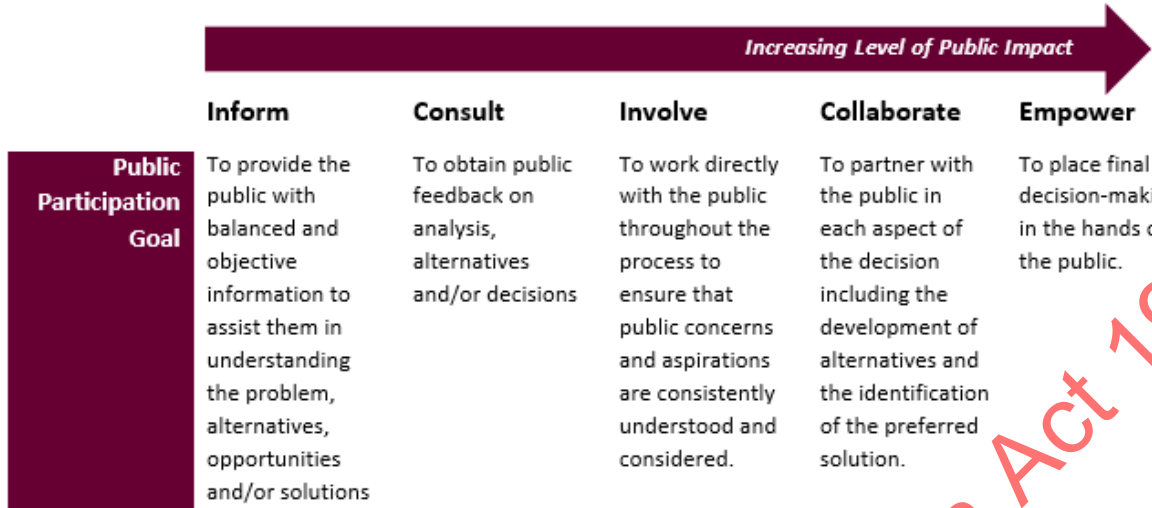


Figure 5.1 IAP2 – Spectrum for Public Participation

Using this spectrum, the Engagement Partners have been further grouped to allow the assignment of appropriate engagement methods as shown in the figure below. The Project team will ‘inform’, ‘consult’, ‘involve’ and ‘collaborate’ with stakeholders, whilst we consider it is more appropriate to engage with the wider community at the ‘inform’ and ‘consult’ levels of the participation spectrum.

The engagement methods selected for each group are discussed in further detail in section 7 of this engagement strategy. Outcomes of engagement will inform the indicative and detailed business case processes. Business case findings will be fed back to stakeholders and the wider community demonstrating how their feedback helped to shape the business case processes.

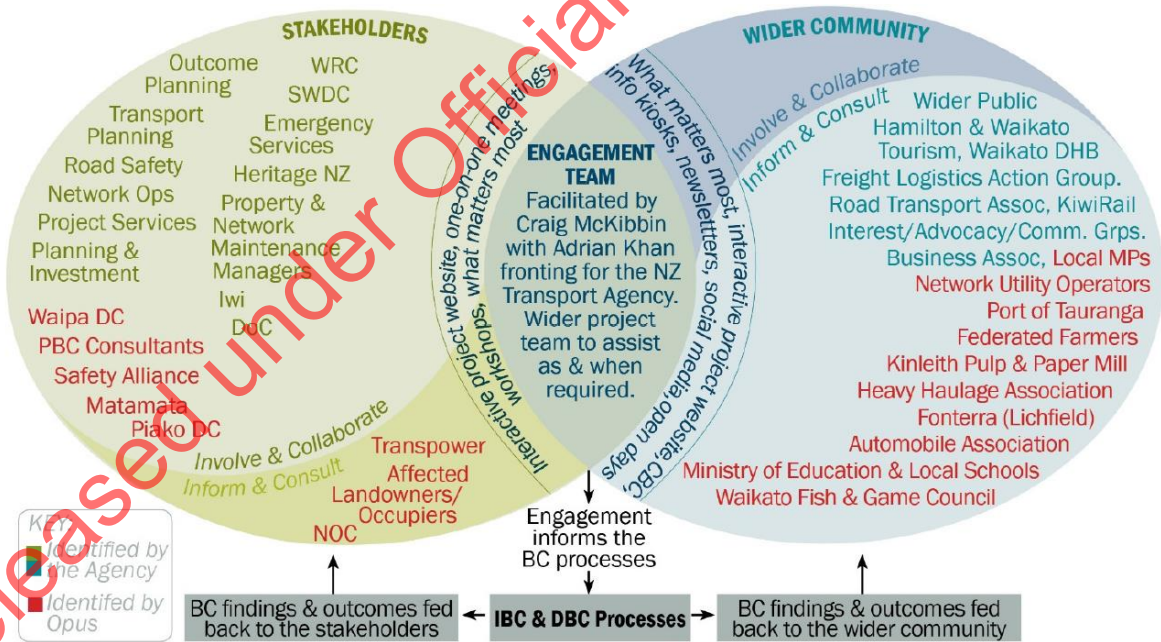


Figure 5.2 Identification of Key Stakeholders and Community Affected by C2P and the Level of Engagement Required

Taking the Engagement Partners listed above in Figure 5.2 and the level of engagement anticipated with those Engagement Partners, Table 5.1 below

provides this information as a checklist that can be used to easily identify the level of engagement we propose with each listed Engagement Partner.

Engagement Partners	Level of Engagement
Stakeholders	
Agency Stakeholders: Outcome Planning Transport Planning Road Safety Network Operations Planning & Investment Property & Network Maintenance Managers NOC	Involve & Collaborate
Waipa District Council South Waikato District Council Matamata Piako District Council Waikato Regional Council	Involve & Collaborate
Program Business Case Consultants – AECOM	Involve & Collaborate
Safe Roads Alliance	Involve & Collaborate
Emergency Services – Police, Fire and Ambulance	Involve & Collaborate
Heritage NZ	Involve & Collaborate
Department of Conservation	Involve & Collaborate
Iwi- Ngāti Raukawa, Ngāti Hauaa and Ngāti Koroki Kahukura	Involve & Collaborate
Transpower	Inform & Consult
Affected Landowners/Occupiers	Inform & Consult
Wider Community	
Wider Public	Inform & Consult
Community Boards	Inform & Consult
Hamilton & Waikato Tourism	Inform & Consult
Waikato DHB	Inform & Consult
Transport Representatives: Freight Logistics Action Group, Road Transport Assoc, Heavy Haulage Assoc, Automobile Association & KiwiRail	Inform & Consult
Local MPs	Inform & Consult
Network Utility Operators	Inform & Consult

Engagement Partners	Level of Engagement
Industry: Port of Tauranga, Kinleith Pulp and Paper Mill, Fonterra (Lichfield), & Federated Farmers	Inform & Consult
Interest/Advocacy/Community Groups (E.g. Waikato Fish and Game, Cycle Action Waikato)	Inform & Consult
Ministry of Education & Local Schools	Inform & Consult

Table 5.1 Engagement Partners and Level of Engagement

6 Engagement purpose and goals

The following table outlines the key purposes for undertaking engagement, what the engagement goals are and success criteria to measure whether these goals have been achieved.

Purpose	Goal	Success Criteria
Decision-making	To shape the decisions or actions made by the Agency based on the perspectives and needs of the Engagement Partners.	Reach – identified Engagement Partners obtain information. Participation levels are maintained and sustained. Stakeholders and communities report confidence in the process and are responsive. A clear line of sight between decision or action and stakeholder/community input.
Identify a problem/opportunity to address	To create understanding of the existing issues with the C2P section and the consequences of these issues, as well as the opportunities and potential to address these issues. Identify issues raised by Engagement Partners with alternatives being considered.	Engagement Partners readiness to communicate emerging problems and opportunities. Reach - identified Engagement Partners obtain information. Diverse range of ways to communicate with the Agency. Capacity within the Agency and Project team to respond to Engagement Partners input and communication in a timely way.
Generate alternatives, new ideas and options propositions	To create an expanded set of potential alignments for the Cambridge to Piarere section.	Increase in awareness and understanding of Project. Understanding of Engagement Partners reactions, issues and concerns and ideas for improvement.

Purpose	Goal	Success Criteria
		Creation of new problem definition and potential solutions. Strengthen relationships with Engagement Partners.
Understand reactions and implications or consequences of different alignments		Representation – adequacy and diversity of representation across the Engagement Partners. Understanding of Engagement Partners perspectives. Value-added feedback provided from Engagement Partners.

Table 6.1 Engagement Purpose and Goals

6.1 Key Outcomes

The following key outcomes of the business case process for this Project shall underpin all engagement undertaken with our Engagement Partners:

- 1 Assess a broad range of options and alternatives to identify the preferred long term form of SH1 and how it connects to the Waikato Expressway, SH29 and SH1 near to Piarere (the preferred investment); and
- 2 Confirm the preferred alignment and layouts of connections at the interfaces with the existing road network that:
 - a Deliver on the Investment Objectives (including performance criteria that support the Investment Objectives);
 - b Meet the Agency's economic, social, environmental and legal responsibilities;
 - c Develop a broad base of support from the public, key stakeholders and Iwi;
 - d Obtain support from the Agency's technical subject matter experts in property, safety, environment and urban design, legal and journey management/operations;
 - e Provide sufficient flexibility in the required footprint for the Notices of Requirement to enable innovation in latter stages of the Project;
 - f Propose mitigation for the environmental effects of the preferred option to the extent that would be considered less than minor under the RMA processes;
 - g Mitigate the loss of local connectivity and access through an agreed approach with Local Authorities to manage the network in a holistic, effective and efficient manner as appropriate; and
 - h Demonstrate that the preferred option can be delivered and is affordable in context with other key projects planned for the Waikato/Bay of Plenty Region.

7 Engagement principles/approach

7.1 IAP2 guiding principles and Draft State highway public engagement guidelines

A number of principles will guide the engagement process for the Project. These principles are based on IAP2 best practice and the Agency's draft State highway public engagement guidelines:

- 1 We know why we are engaging and we communicate this clearly;
- 2 We know who to engage;
- 3 We know the history and background;
- 4 We begin early;
- 5 We are genuine; and
- 6 We support and encourage best practice.

In working to these principles we will:

- a Build and maintain effective and constructive relationships with all stakeholders, including Iwi and the community with the aim of building support for the Project;
- b Engage and communicate with all stakeholders and the community proactively and in an open and honest manner, so that there are 'no surprises';
- c Educate members of the Project team so that they understand the importance of, and make a commitment to, good engagement and communication;
- d Keep stakeholders and the community informed with appropriate, consistent, accurate and timely messages so they understand the rationale, objectives and benefits of the Project; and
- e Provide opportunities for stakeholders and the community to have input/give feedback (as appropriate) and respond in a timely manner, with reasons.

7.2 Engagement framework

The following sections provide an overview of the legislative framework in which engagement will be undertaken.

7.2.1 Resource Management Act 1991

There is no statutory requirement to consult under the RMA, however best practice suggests that for a Project of this scale, consultation and engagement is necessary in order to understand stakeholder and community opinion and to identify matters of concern,

and where practicable to address these through the option selection, design and mitigation of effects process. Consultation under the RMA is, however, primarily for the purpose of addressing RMA matters and, in particular the effects of a proposal on the environment. Undertaking engagement early in the Project will help strengthen both the Notice of Requirement and Resource Consent applications which will be prepared at a later date.

7.2.2 Land Transport Management Act

The Land Transport Management Act 2003 (LTMA), and amendment acts (LTMAA 2008 and 2013) set out to provide for an integrated approach to land transport management, planning and funding. The Agency is also required to exhibit a sense of social and environmental responsibility, which includes taking into account and responding to:

- a Community reliance on a safe and sustainable land transport system;
- b The need to minimise adverse effects on the environment;
- c The views of affected communities including Maori; and
- d The need for an early and full evaluation of land transport options, integration and alternatives for achieving objectives.

7.2.3 Heritage New Zealand Pouhere Taonga Act

When applying for an archaeological authority under the HNZPT Act 2014, the application is required to be submitted with a statement as to whether consultation with tangata whenua, the owner of the relevant land (if the applicant is not the owner), or any other person likely to be affected—

- a has taken place, with details of the consultation, including the names of the parties and the tenor of the views expressed; or
- b has not taken place, with the reasons why consultation has not occurred.

The engagement methods and programme outlined below have been designed to meet this requirement reducing the potential for delay should an archaeological authority need to be applied for later on in the Project.

8 Engagement methods

The following table outlines the engagement methods that can be implemented for stakeholders and the wider community and the expected outcomes of each method. Following this table, a more in-depth description of each engagement method is provided along with detail on how the methods and feedback obtained can be evaluated.

Where necessary, key messages in terms of the short term works are to be incorporated into these engagement methods.

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Engagement Method	Target Group	IAP2 level of participation	Reason for Method	Expected outcomes
<p>Interactive Project website</p> <p>Using Maptionnaire or Engagement HQ to provide:</p> <ul style="list-style-type: none"> ▸ Online live Q+A ▸ Surveys ▸ Project update videos ▸ Citizens Budget Calculator ▸ 'What Matters Most?' 	Stakeholders & Wider Community	Inform & Consult	Potential to reach a wide audience in an engaging and interactive manner. Easy to collect and evaluate feedback which will inform option selection.	Detailed information is both provided and collected in databases about the options, from a wide range of stakeholders and the wider community. People understand the broader issues and are able to provide realistic assessments of the options
Newsletters	Wider Community	Inform	Quick way to disseminate key information to a wide audience.	Information shared community-wide by using multiple, targeted platforms. Material is distributed through all known media platforms
Media Releases	Wider Community	Inform	Quick way to disseminate key information to a wide audience.	
Social Media	Wider Community	Inform	Quick way to disseminate key information to a wide audience.	
Information Kiosk	Wider Community	Inform	Builds trust and shows engagement is genuine. Provides a 'people element' to engagement and an opportunity to build rapport with the community.	A broad cross section of the community seek and receive up to date information about the Project directly from Agency & Project staff at a range of events
Open Days	Wider Community	Inform & Consult	Provides a 'people element' to engagement, an easy way to distribute information and an opportunity for participants to ask questions.	A broad cross section of the community seek and provide information about the Project by engaging with staff and provided materials. Feedback

Engagement Method	Target Group	IAP2 level of participation	Reason for Method	Expected outcomes
				about the Project is collected from members of the community.
One-on-one Meetings	Stakeholders	Involve & Collaborate	Builds trust and shows engagement is genuine. Allows the Agency to explore and resolve key issues with stakeholders.	Selected stakeholder representatives engage with the Project, and are willing to identify, discuss, and seek to resolve sensitive issues
Workshops	Stakeholders	Involve & Collaborate	Allows an in-depth understanding of key issues, perceptions and constraints to inform option selection.	Selected stakeholder representatives engage with the Project; are willing to engage in discussion and debate; and come to a shared understanding of issues and constraints around option selection.

Table 8.1 Engagement Methods

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8.1.1 Interactive Project Website

The Project website will take online engagement beyond simply 'informing' - shifting it into the 'consultation and engagement' realms by providing:

- 1 A platform for online live Q + A sessions between the community and Project team;
- 2 Links to surveys and Project update videos; and
- 3 Interactive tools such as: Citizens Budget Calculator and a new tool we are calling 'What Matters Most?'

This multi-faceted approach brings a human element to the Project helping breakdown the 'us vs them' perception. A description of each of the components of the interactive Project website is provided below. These components will be delivered using either the Maptionnaire or Engagement HQ engagement tools, which will be linked to the Project website.

8.1.1.1 What Matters Most?

'What Matters Most?' is an online tool that has been adapted from the successful engagement tool 'Share an Idea' piloted by Christchurch City Council during consultation on the redevelopment of the Christchurch CBD. For this Project, 'What Matters Most?' will be one of the first engagement tools implemented and will underpin all subsequent engagement by canvassing public perception, potential issues, and gaining initial feedback on the Project right from the outset.

This engagement technique aims to turn consultation into a conversation by using conversation starters/key themes to get the wider community thinking about what aspects matter to them (e.g. property access along the route, safer journeys between Cambridge and Piarere and continued access to Lake Karapiro for recreational purposes).

Feedback posted to 'What Matters Most?' will be tagged into relevant key themes providing valuable information for the development of criteria and associated weighting used to assess the long list of options. 'What Matters Most?' can also be used to canvas important matters with key stakeholders ahead of workshops. This results in workshop sessions being more focussed and relevant.

8.1.1.2 Online live Q + A sessions

These sessions can be run by the Agency and Project team at set times providing a platform for participants to ask questions about the Project and receive real time answers. This method of engagement has the

potential to reach a wide audience quickly and allows participants to engage at a time that best suits them. By setting up an online pre-registration for the Q + A session, we will be able to determine whether a moderator is needed depending on expected participant numbers. Questions and responses can be recorded to provide a record of consultation.

8.1.1.3 Surveys

Links to targeted surveys can be provided on the website allowing specific feedback to be obtained. These surveys will be designed in conjunction with the Agency by Opus Research who have specialist expertise in this area. Survey questions can be formulated to allow easy evaluation of feedback.

8.1.1.4 Project update videos

Project update videos can be recorded by the Agency and Project team and uploaded to the website. These videos may simply provide an update on progress or an overview of proposals and concepts, can explain why certain decisions have been made, or may feature specialists responding to key questions from the public. This technique helps to provide a 'people' element to the Project, and allows participants to view at their own leisure and respond via the Project e-mail or by leaving questions on a related forum board. The reach of this engagement method can be measured using a view counter.

Our fee proposal for this work is based on a very simple point and shoot interview with Project team members in the office. Should the Agency seek a more professional video production this would be considered a variation.

8.1.1.5 Citizens Budget Calculator

The Citizens Budget Calculator uses sliding scales designed to challenge thinking about what Engagement Partners would be prepared to trade-off in order to achieve the most optimal route or mitigation measures. The Project website can include a secure connection to this tool for stakeholders only, as well as providing a version for the wider public. The benefit of this tool is that it can result in a more realistic option/alignment selection and will help to inform a robust assessment of alternatives.

8.1.2 Newsletters & Media Releases

Newsletters and media releases will be used to disseminate Project information informing the wider public of upcoming open days and alternative ways to engage with the Project team (e.g. Interactive

website and information kiosk). These methods are effective at reaching a wide audience in a short space of time.

8.1.3 Social Media

The Agency's established social media platforms (Facebook and Twitter) will be used as an easy and quick way to convey information regarding the Project. This method often appeals to a younger demographic and also provides an opportunity for people to ask Project related questions or post comments and ideas. This method of engagement will require moderation and frequent oversight by either the Agency or Project team to enable responses to be captured.

8.1.4 Information Kiosk

Providing a regular public interface is an important way to build trust and show that engagement is genuine. A Project information kiosk will be manned by Agency and Project team representatives at the monthly Cambridge Trash and Treasure Market. This event has the potential to reach a wide range of people and provide an opportunity for the public to discuss the Project on an informal basis. Provided that room is available within the Agency's stand at Fielddays 2017, we also consider this to be a prime opportunity to seek public feedback on the Project.

8.1.5 Open Days

Two public open days are proposed, one during each of the business case phases. Open days provide important learning opportunities for interested members of the public as well as providing a forum for people to raise concerns and issues and to celebrate progress. Open days will incorporate displays, printed handout materials, and a computer station will be set up to allow participants to access the Project website and any geospatial tools that are to be used as part of engagement.

Project team and specialist attendance at these open days will be determined through received feedback. For example, if the impacts on bats is commonly raised Roger MacGibbon would attend to engage with the community on that topic. Having the right people in attendance provides Project and engagement process credibility, meaning that a broad base of support for the Project is more likely to be achieved.

8.1.6 One-on-one Meetings

One-one-one meetings with key stakeholders and directly affected landowners will be held on an as needed basis.

8.1.7 Workshops

Key stakeholder workshops will be designed to keep participants interested and engaged. The workshops will draw on aspects of the 'focus group' method which aims to explore the opinions, knowledge, perceptions and concerns of stakeholders in relation to the Project. The workshops will be facilitated by William Gray to ensure that the right questions are asked and the workshops are focused, results driven and seen by stakeholders as a genuine opportunity for them to be involved.

8.1.8 Geospatial Tools

A variety of geospatial tools can be used to support the optioneering phase of the Project. Drone and GIS technology can be used to give Engagement Partners a first-hand view of the potential routes. The use of these tools would enable a more in-depth understanding of the existing environment and how it might change, helping to provide more targeted feedback on the potential options. These tools could also be used in association with the online 'Citizens Budget Calculator.' Examples of geospatial tools using drone and GIS technology that could support the Project are described below.

It is noted that the geospatial tools listed below are not included in our price, but can be added to the Project as a variation if the Agency has a strong desire to utilise these methods.

8.1.8.1 Virtual walk along Project

This tool involves producing a GIS map which is presented with photos and artist impressions of sections of the Project in call out boxes allowing viewers to 'walk' along the proposed alignments and see what will be on the ground. As the user clicks through the call out boxes, the corresponding position on the map also changes. The use of this tool enables the Agency to show a 'whole of concept' view in an engaging and interactive way. Key advantages of this tool include being able to present current and proposed environments, providing viewers an opportunity to pin point areas that they feel need more clarification and enabling directed discussion.

8.1.8.2 Interactive map

This tool is similar to the above in that a GIS map of the Project area is produced. The key difference is that the map has layers that are able to be turned off and on. Users can toggle in on certain layers and find out further information on aspects of the Project by clicking on buttons that link to more in-depth

information. This method is a useful way of providing viewers with a spatial understanding of the Project and is a useful way to disseminate information.

8.1.8.3 Animation or motion graphics video

This tool involves creating a series of animations to convey the vision of a car moving through the proposed alignments. This method is an engaging and interactive way for viewers to gain a more in-depth understanding of how the existing environment might change allowing more specific feedback.

8.1.9 Iwi Engagement

As this is to be an Agency lead process we have set a nominal number of hours to provide assistance to the Agency in facilitating Iwi engagement. The primary assistance would come from s 9(2)(a)

Should the Agency wish for Opus to take more of a lead role with Iwi engagement we would be happy to do so and our track record with the Hamilton and Cambridge sections demonstrates our ability to successfully facilitate and lead this important process, whilst ensuring the Agency and Adrian as the Project Manager are an integral part of that process.

8.2 How will engagement be evaluated?

Evaluating the effectiveness of the engagement process will be undertaken throughout the Project. A Project database will be used to record details of each engagement method/tool. Fields will include characteristics of respondents / participants (such as stakeholder sector or group), timing and location of engagement, and content. The level of detail will vary by method/tool.

For example, the info kiosk and open day events can record the numbers of visitors per event, whereas the interactive website tools can record demographic, sector and geographic details of participants to assess coverage and to allow comparative analysis of the responses collected through the tools. Meetings and workshop events can record uptake of invitations by stakeholder type, and qualitative data on the content of discussion can be coded by key issues (including the range of the discussion and level of agreement / resolution).

The database will be used to monitor both the coverage and content of the engagement process both to evaluate progress towards engagement objectives and as part of the continuous improvement cycle. Coverage will be assessed to identify gaps in the reach of the engagement methods so that they can be further tailored to engage across all identified stakeholders and the wider community. Content will be assessed to identify the level of consensus / dissension, emerging new issues, and gaps in responses (for example, where issues have been put forward for discussion but minimal responses have been received).

Progress updates on the coverage and content of engagement will be shared with the Agency at agreed points so that decisions can be made about subsequent priorities. For example, if certain community sectors are under-represented, alternative methods of engaging with them can be explored. Content can also be reviewed and refined to meet the emerging information needs of stakeholders and the wider community.

9 Risks and Opportunities

It is important to identify the potential risks and opportunities associated with the engagement process and determine what actions need to be taken to reduce risk and make the most of any opportunity presented. In terms of this Project the

following risks and opportunities have been identified.

Opportunities/Risks	Actions
Engagement Partners have an opportunity to inform the actual process of determining the chosen alignment for the Project and associated outcomes.	Commence the engagement process as early as possible with clear parameters and an emphasis on seeking feedback from the Engagement Partners to inform the business case process.

Opportunities/Risks	Actions
Iwi raise significant cultural issues with proposal	Early engagement to see if any such issues exist. There is potential given the already recognised pre-European archaeology along Lake Karapiro. Look to turn any perceived negative cultural impacts on their head and demonstrate where possible the opportunities for Iwi. For example, the Project may provide an opportunity for Iwi to reconnect with whenua that they have not had access to for a number of generations.
Strengthen relationships between the Agency and the Engagement Partners.	The engagement process should always be seen as an opportunity for the Agency to improve and build upon their relationships with key stakeholders and the wider community.
Adverse reaction from directly affected landowners and SH1 residents.	Engage with directly affected landowners and bring them into the process as a recognised group, rather than having them seek to find their identity through the wider community.
Grand standing takes place by a party or parties who have a particular issue with the Project to the extent that other voices are not being heard.	Avoid any engagement methods that create an 'us and them' environment (e.g. public meetings). All engagement needs to be personable based on a genuine desire to listen and understand all views held.
The end result of the Project will result in a number of significant benefits for the wider community and for a number of stakeholders. Whilst it is acknowledged that there will be adverse effects associated with the proposal that must be addressed, equally there is an overwhelming good story that also needs to be told.	Ensure that throughout the engagement process, the 'good news' story is also emphasised, whilst recognising the importance to address any potentially adverse effects that the Project will also create. One should not dominate the other.
Department of Conservation expectations and information/research requests do not align with the level of effect associated with the Project.	Given this is an on-going issue with much wider ramifications than this single Project, this matter needs to be addressed at a higher level between the Agency and DoC.
Misalignment between this Project and other BC's that are adjacent to/or within the same catchment (e.g. SRA, SH1 – SH29 Hamilton – Tauranga Strategic Case, SH1 Piarere – Taupo PBC).	Engage early with the Project Manager's for these BC's and work towards a common approach where there is overlap between respective roles.
Presumption by Engagement Partners ahead of time that the long term solution will be an extension of the Waikato Expressway down to Piarere.	Provide clear messaging from the outset that the business case approach is to start with a blank canvas and the process will determine what the final long term solution will include. This may or may not be an extension of the Expressway and no firm view is currently held by the Agency as to what the solution will be.

Table 9.1 Engagement Risks and Opportunities

10 Role Definition and Reporting Protocols

10.1 Roles and responsibilities

The Agency will 'front' key aspects of all stakeholder engagement activities, with the Project team

providing support and leading in other areas, as required.

The key personnel and their roles in Project engagement are set out below:

Role	Personnel	Contact Details
NZTA Project Manager	Adrian Khan	s 9(2)(a) adrian.khan@nzta.govt.nz
NZTA Senior Communications Advisor	Simon Brandon	s 9(2)(a) simon.brandon@nzta.govt.nz
Team Leader (Long Term)	s 9(2)(a)	s 9(2)(a) s 9(2)(a)
Engagement Manager (Long Term)	s 9(2)(a)	s 9(2)(a)
Engagement Planner (Long Term)	s 9(2)(a)	s 9(2)(a)
Project Manager (Short Term)	s 9(2)(a)	s 9(2)(a)
Stakeholder Manager (Short Term)	s 9(2)(a)	s 9(2)(a)

Table 10.1 Key Personnel

- Adrian Khan** will approve any contact, engagement and communication material and the public release of these materials. Adrian will also be responsible for communicating with the Agency CEO and Board, internal Agency staff, as well as Central Government, the Minister of Transport, Members of Parliament and their representatives.
- Simon Brandon** will develop engagement and communication materials for public release in consultation with the Project team. Simon will also maintain the website www.nzta.govt.nz/XXXXX.

- s 9(2)(a) will be the main point of contact for the Project team and the majority of communication with the Agency (relevant to design aspects) will be directed through him.
- s 9(2)(a) provide strategic engagement advice and verification (where required) and the overall approval of the Project team outputs in regard to engagement and communication.
- s 9(2)(a) will be involved in continuous stakeholder liaison throughout the Project, managing community expectations and relationships. A key part of this role is

logging issues/suggestions/ concerns from stakeholders and the community which are relevant to both optioneering and design, and being the conduit between the community and the design team to check that these comments are considered during decision making (as appropriate).

- 6 We will establish roles for **Stakeholder Relationship Managers** within the Project team. They will assist in managing the engagement process with our key stakeholders where an existing relationship already exists. They will also brief the wider Project team about that stakeholder's internal processes and requirements, helping to smooth the engagement process. Key contacts and people responsible for managing the relationship with each individual/group are identified in the Implementation Plan.

10.2 Reporting and response protocols

- 1 All engagement carried out by the Project team is to be recorded. A **communication record form** has been developed (Appendix B) and representatives of the Project team need to ensure that notes are generated at each meeting and sent to s 9(2)(a) to register, file and disseminate to those responsible for taking action.
- 2 A **Project email address** has been set up (C2P@nzta.govt.nz) and will be monitored by the Project team. The Project team will respond to all enquiries (via Stakeholder Relationship Managers as appropriate), with information and input provided by the Agency as required. Any short-term work matters raised via the email address will be directed to the Alliance for their consideration and response.
- 3 An **engagement and communication database** will be set up for the Project and will be administered by the Project team. This database will record any engagement and communication undertaken, including contact details, communication / meeting times, issues raised, feedback received, actions to be undertaken and by whom, and when action has been taken. The database will be updated over the course of the Project as engagement and communication occurs.

- 4 In accordance with the Project Quality Plan the communications between the Project team and the Agency shall be undertaken via weekly email updates, monthly meetings, and monthly progress reports (to include cost, programme and quality aspects of the Project as well to communicate Project progress against key milestones). If required, monthly meetings with the Alliance will also be arranged to discuss engagement integration opportunities, although it is anticipated that correspondence between Opus and the Alliance will occur on a regular basis.
- 5 The monthly Project Progress meeting will be used to highlight any key engagement and communication matters, and the monthly report will include a brief section summarising any engagement and communication that has occurred within that month.

10.3 Approval processes

10.3.1 Media Management

All media enquiries will be referred to and managed by the Agency.

10.3.2 Release of public materials

All materials prepared by Opus and/or the Alliance that are to be issued to the public require sign off by the Agency Project Manager before being released. Opus and the Alliance will also undertake a review of any such material to ensure consistency and accurate messages are being given in regard to the short and long term projects.

11 Implementation Plan

The Implementation Plan in Appendix A sets out the method and timing of engagement for the various phases of the Project.

11.1 Project timing

The current Waikato Expressway projects are expected to be completed in 2020. It is anticipated that the SH1 Cambridge to Piarere section will be ready for construction post this date, however in order to meet this timeframe the detailed business case for this Project will need to be approved by the Agency's Value Assurance Committee (VAC) by the end of June 2018.

Following confirmation of the preferred route and approval of the detailed business case, the preparation of resource consents and a notice of requirement (NOR) process will commence. The engagement process followed during the business case phases has been designed to also provide a robust grounding for engagement regarding resource consents and the NOR.

The Project programme is driven by effective engagement with the Engagement Partners, keeping them well informed and receiving their feedback to inform decision making at all stages of the Project.

Engagement will run throughout the Project, as outlined in Figure 4.2. This figure shows the consultation process and how it will inform the business case process.

The programme includes two intensive design periods, being the development of the short list options (Indicative Business Case), followed by the development of a scheme design (Detailed Business Case).

Currently the high level timeframes for the Project are:

- 1 **August 2016:** Confirm the problem as identified and objectives to be achieved from the Project. Short term solution update to key stakeholders via email
- 2 **September/October 2016:** Develop long list options. Short term solution update at stakeholder workshop and approvals process
- 3 **November/December 2016:** Short list options. Short term approvals. Tendering for construction commences

4 **January 2017:** Recommend preferred option. Short term solution implemented

5 **January - May 2017:** Evaluate preferred option and deliver final indicative business case. Short term solution implemented.

Appendix A
Implementation Plan

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Appendix B

Communication Record Form

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Follow up Actions	Responsibility	By when

Decisions Made	Responsibility	By when

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APPENDIX H – OPTIONS WORKSHOP MINUTES

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MINUTES			
Meeting:	SH1 Cambridge to Piarere Short Term Safety Improvements Options Assessment Workshop	Date:	27/04/2016
Present:	Safe Roads Alliance: s 9(2)(a) (Delivery Manager), s 9(2)(a) (Safety), s 9(2)(a) (Business Case Writer) NZTA: James Bevan (Transport Planning Manager), Michelle Te Wharau (Principal Safety Engineer), Andrew McKillop (NZTA Planning and Investment), Rob Campbell (NZTA Network Operations), Mark Lilley (Safety Engineer), Adrian Khan (Project Manager Long Term Scheme)		
Apologies:	Ben Peacey & Keryn Zimmerman (Outcomes Planning),		

Summary

The workshop purpose was to endorse a recommended option this was not achieved however there was agreement in principle That Option 2+ would deliver short term safety benefits and contribute to an overall safety objective for the corridor through both the short term (online) and long term schemes.

Option 2+ includes; wide centreline and ATP markings with the addition of SH29 treatments, side barriers in high risk locations, potentially median barrier),

Key Points

1. the long term scheme target programme dates are; preferred route late 2017, start of works, late 2020, opening late 2023
2. safety investment objectives will be set across the corridor and delivery of the objectives would through both short term and long term schemes. Specific safety objectives for the short term scheme will drop out of the overall safety objectives.
3. delivery risks for the long term scheme were acknowledged; designation, land acquisition, consenting and funding. To allow for this the short term scheme will still assess benefits over 10 years.

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4. major SH29 safety improvements sit in the long term scheme, lower level treatments to be considered in the short term.
5. short listed options to be assessed in the business case are; Option 2 (+SH29 treatments, side barriers in high risk locations, potentially median barrier), Option 3 & 4 with lower level intersection treatments in lieu of roundabouts and Option 5 less the roundabouts (although they may form part of a better turnaround strategy).
6. agreed in principle (subject to further analysis) that the recommended option would be Option 2 wide centreline and ATPs with the addition of SH29 treatments, side barriers in high risk locations and potentially median barrier.
7. short term improvements must have a low delivery risk profile so implementation can be achieved in a short time frame (2016/17)
8. short term improvements will be developed based on 10 year economic viability (eg widening and wide centreline throughout), with the expectation that future components to improve safety could be added (eg median barrier and roundabouts) in the event that the long term scheme was delayed.
9. any option would need a BCR above 1.0 to demonstrate value for money
10. communication on the short and long term improvements will be developed jointly between the Alliance and Agency Comms and project teams.
11. A further internal Agency / Alliance meeting will be convened to endorse a recommended option before going back to the key stakeholders.

Safe Roads Alliance Actions

1. assess the short list of options above and focus on what can be delivered in the short term and potential for further investment
2. work with all to agree investment objectives
3. gather evidence of the U turn issue south of the expressway
4. circulate further work (the draft business case) and reconvene a meeting with all attendees to finalise the recommended option
5. An Alliance member will sit on the long term scheme steering group.

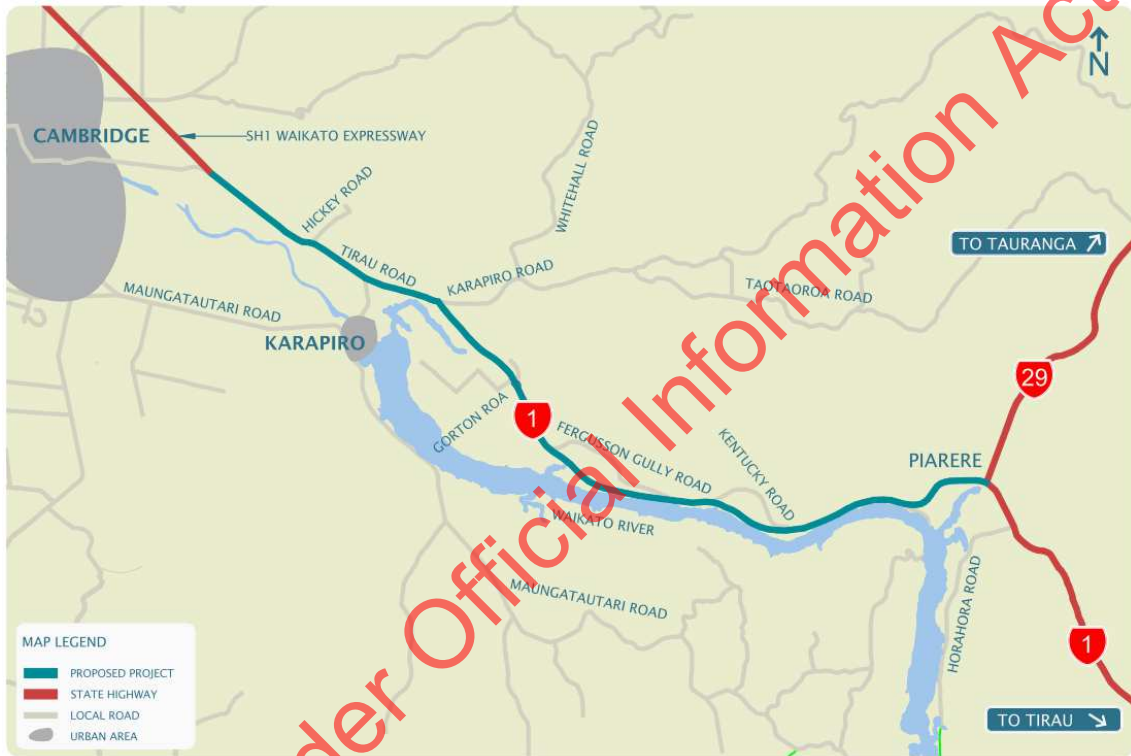
APPENDIX I – DMT MEMO: POST OPTIONS WORKSHOP UPDATE

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To:	Waikato Bay of Plenty DMT	Date:	27/05/2016
From:	s 9(2)(a) (Project Manager)		
Topic:	SH1 Cambridge to Piarere Short Term Online Safety Improvements Post Options Assessment workshop update		

Corridor Map:



Corridor Map: SH1 Cambridge to Piarere

Summary:

This is a positioning paper to inform DMT of the findings of assessment work undertaken following the Options Assessment workshop (held 27th April 2016) and to seek agreement in principle of the recommended option for short term online safety improvements.

The Alliance is tasked with progressing a single stage business case for online improvements to address safety problems on the corridor. This work follows on from recommendations in the National Programme Business Case and SH1 Cambridge to Piarere programme business case to address safety, efficiency, and resilience problems on the corridor.



The investment objectives for the corridor are to reduce deaths and serious injuries (DSIs) by 50% or more over the 10 year period 2017–2026 following implementation of short-term safety improvements, and provide a 4-star KiwiRAP rating by 2017.

The objectives will be delivered by both short-term online improvements (years 0–3) and a longer-term project, which will also address efficiency and resilience. The longer-term scheme is targeted to be fully operational by 2024 and may be online, offline, or a combination of both.

It is recommended that **option 2a** be taken forward to pre-implementation and implemented in the 2016–2017 construction season. **Option 2a** includes wide centreline (which could be retrofitted with median barrier) and associated widening throughout, ATP (rumble strips) on centre and edge lines throughout, upgraded signage, and side barriers in high-risk locations. By itself, **Option 2a** would only reduce DSIs by 30% over a 10-year period.

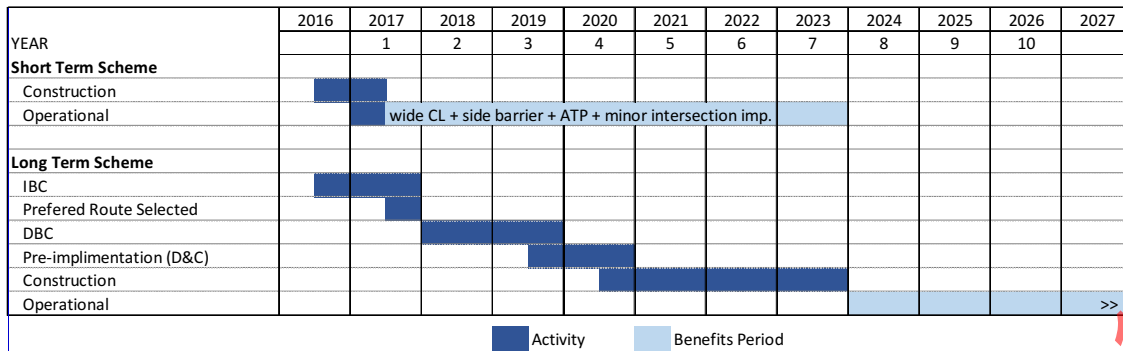
Implementation of **option 2a** is necessary in the short-term to achieve the 50% reduction in DSIs over the 10-year period. However, due to the high number of head-on crashes and the inherent ongoing risk, a median barrier along the full extent of the corridor is necessary to achieve the 10-year investment objectives.

The long-term preferred route decision is targeted for the end of 2017. Once agreed, and with greater certainty on delivery of the long-term scheme, a decision can be made on whether there is a need to retrofit median barriers and associated turnarounds to **Option 2a**.

The 50% reduction in DSIs can be delivered in two ways:

1. **Option 2a** without median barrier operational in 2017, plus the long-term scheme (full corridor median barrier). However, the long-term scheme must be operational in early 2024.
2. **Option 2a** operational in 2017, plus full corridor median barrier and associated turnarounds operational by 2019.

The figure below illustrates possible timing for design and construction activities (dark shading), and associated benefit streams (light shading).



Outline Programme: SH1 Cambridge to Piarere

Next Steps:

1. DMT endorsement in principle of the recommended option for short term online safety improvements.
2. Following DMT endorsement in principle, conduct a workshop with key stakeholders (Waikato District Council, Waikato Regional Council, Road Transport Association, Automobile Association, and Police) to communicate proposals for both the long and short term improvements.
3. Complete the short term business case and obtain DMT approval to proceed to pre implementation of the preferred option.

Background

This memo follows on from the SH1 Cambridge to Piarere options assessment workshop held Wednesday 27th April 2016.

The Transport Agency Board approved the Cambridge to Piarere corridor programme business case in July 2015. The corridor problems were weighted 70% safety and 30% efficiency, and the objective set to reduce deaths and serious injuries by at least 50% over 10 years. The recommendation was to progress three activities:

- Short term online safety improvements (0 3 years)
- SH1/29 intersection improvements (6 10 years)
- Longer term efficiency and safety improvements (10 years+)

The Alliance is progressing online safety improvements to be implemented in the short term (0 3 years). The Transport Agency is progressing an indicative business case to develop the long term solution with a target to be operational in 2024. In addition to safety, the long term IBC will include addressing efficiency and resilience along with the SH1 / SH29 intersection.



The Alliance commenced the single stage business case investigating short term online safety improvements in mid 2015. The first stakeholder workshop was held in February 2016 where the safety problems were agreed, investment objectives set, and a short list of options agreed. It was also agreed that the options assessment workshop would include the same stakeholder group.

Options Assessment Workshop (27th April 2016)

The internal Transport Agency and Alliance options assessment workshop was held on 27th April 2016.

The purpose of the workshop was to endorse a recommended option; however, this was not achieved. There was agreement in principle that option 2, with additional improvements and referred to as option 2a, would deliver short term safety benefits and contribute to an overall safety objective for the corridor through both the short term (online), and long term schemes.

Option 2a includes wide centreline and associated widening throughout, ATP (rumble strips) on centre and edge lines throughout, upgraded signage, side barriers in high risk locations, and the provision to retrofit with median barrier.

Action items from the workshop were:

1. Develop overall safety objectives for the 10 year assessment period, which could be delivered by both the short and long term schemes.
2. Assess the short list of options with the focus on option 2a.
3. Gather evidence on U turns south of the expressway.
4. Reconvene another meeting with the participants from the Options Assessment workshop.

Update on the above actions

1. 10-year Safety objective

Workshop attendees agreed that a single safety objective for DSI reduction for the 10 year period 2017-2026 would be set for the corridor, to be delivered through both short term and long term schemes.

Feedback from stakeholders associated with the Cambridge to Piarere corridor programme and short term safety single stage business cases, was that the corridor safety objective should be to reduce deaths and serious injuries by 50% or more. There were 39 DSIs on the corridor in the 10 year period 2005-2014, a 50% reduction translates to 20 or more DSIs.



Ultimately, the long term scheme will provide a high quality alignment delivering substantial safety benefits into the future. To ensure value for money, the benefits of the online safety improvements are calculated over the 10 year period 2017 2026, rather than the usual 40 year pay back period. The benefits resulting from the short term scheme will be significantly reduced when the long term scheme is operational.

Achieving 50% (or greater) reduction in DSIs over 10 years

The effectiveness of Option 2a has been assessed with and without median barrier. Achieving a 50% DSI saving objective becomes dependent upon the NZ Transport Agency's ability to deliver the long term scheme by the end of 2023. Initial discussions with the NZ Transport Agency have identified several delivery scenarios for the long term scheme including the following:

- By the end of 2023 and operational by 2024
- By the end of 2024 and operational in 2025
- By the end of 2026 and operational in 2027, i.e. beyond the short term scheme 10 year assessment period.

The table below highlights the impact of the long term scheme completion date on projected DSI reduction. It shows that a high level of DSI saving can only be achieved by implementing median barrier in the short term safety scheme. It also shows that delays to delivery of the long term scheme will quickly erode DSI savings.

	Long term scheme fully operational in year		
	2024	2025	2027
Option 2a - no median barrier	50% ^a	40% ^b	30% ^c
Option 2a - part median barrier (southern half only)	>50% ^d	50% ^e	40% ^f
Option 2a - full median barrier	>60% ^g	60% ^h	55% ^j

Implementation scenarios DSI reduction

Key assumptions in the above assessment:

- Option 2a without median barrier would be constructed during the period 2016 17, and be operational in 2017.
- Median barrier, if retrofitted in the southern section, would be constructed during the period 2017 2018, allowing time for consultation on any access changes, which would allow consideration of the long term preferred route.



- Median barrier, if retrofitted in the northern half, would be constructed during the period 2018-2019. This is a conservative estimate to allow time to work through consultation on access changes and potential land take. It would also allow consideration of the long-term preferred route.
- Based on a high-level predictive assessment of the likely reduction in DSIs.

Commentary on the above scenarios:

- For a, b, and c (option 2a with no median barrier) to achieve 50% reduction in DSIs, the long-term scheme would need to be completed in 2023, and be fully operational by 2024.
- For d, e, and f (option 2a with median barrier in the southern half only) to achieve a 50% reduction in DSIs, the long-term scheme would need to be operational by 2024. Although less complex to implement median barrier in the south, it would not address the highest head-on risk sections, which are in the north of the corridor.
- For g, h, and j (option 2a with full median barrier) all are likely to achieve a 50% reduction in DSIs.

All fatalities on the corridor in the past 10 years have been due to head-on crashes. The only way to reduce significantly the likelihood and severity of future head-on fatalities is to install median barrier.

2. Option 2a

Option 2a was developed based on feedback from the Options Assessment workshop. It was developed to take consideration of the Transport Agency's long-term corridor improvement plan, and a combined consideration of DSI savings.

Option 2a would include:

- Wide centreline throughout, suitable for retrofit with median wire rope barrier.
- ATP (rumble strip) centre and edge lines throughout.
- Side barriers in high-risk locations.
- Minor intersection improvements at Karapiro Road and Hydro Road.

There would also be the option to retrofit median barrier and construct associated turnaround facilities if required, following a decision on the long-term preferred route.



Note: Option 2a is similar to option 5 presented at the options assessment workshop, but without roundabouts at Karapiro road and SH29. The SH29 intersection upgrade will be included in the long term scheme.

Option 2a delivery

Land take: Work to date indicates the wide centreline could be delivered without land take. However, there are pinch points where the road corridor is narrow. It is likely an engineered solution can be developed to remain within the road boundary. Turnaround facilities associated with median barrier would need to be developed

Access to land: Access to land would be required for investigation works this would be included in the engagement strategy.

Staging: The wide median would be delivered as an initial phase, with retrofit of median barrier in subsequent stages if required.

Appropriate level of infrastructure: Current guidance on the level of infrastructure appropriate for a high volume road indicates that a minimum 2.5 metre shoulder would be appropriate throughout. It is possible that some or all of the existing alignment will be revoked and become a local road following construction of the long term scheme. This would likely require an engineering down of the existing wide carriageway and roadside infrastructure to make it suitably self explaining and safe as a local road. It would be appropriate to work with the maintenance and traffic & safety teams to minimise the widening, whilst ensuring an acceptably safe and resilient scheme.

Efficiency

Option 2a with median barrier is estimated to cost \$12.2 million, and would reduce DSIs by 22 (56%) with a residual collective risk of 0.09 (medium high) and personal risk of 1.75 (Low). The BCR would be 1.1, with an investment profile of H/ H/ priority order 3.

Option 2a without median barrier is estimated to cost \$7.5 million, and would reduce DSIs by 12 (30%) with a residual collective risk of 0.14 (high) and personal risk of 2.84 (Low). The BCR would be 1.1, with an investment profile of H/ M/ priority order 3.

BCRs are based on rough order cost estimates and a 10 year benefits realisation period, rather than the usual 40 year period.



Engagement

Clear, joint, long and short term communications and messaging strategies should be developed well in advance of engagement.

The next step in the engagement process is to conduct a meeting with stakeholders to communicate both the long term scheme ambitions, and the short term scheme objectives and proposals.

Stakeholders, including the wider community, are aware of the short term improvements, and will need to be updated on proposals. Engagement would need to commence in parallel with the detailed design of the short term scheme, to enable access to land for ground investigation where required, and discussions on accesses and other stakeholder issues.

3. U-turn Movements

Feedback from Police and Transport Agency staff has identified that vehicles are making U turn movements on the straight section of road located south of the Cambridge section of the expressway.

The Alliance has carried out a survey of U turns performed south of the expressway and noted the following occurrences:

- Wednesday 4th May from 1:45–4:45 p.m. One U turn
- Monday 9th May from 4:45–6:45 p.m. One U turn
- Thursday 12th May from 6:25–8:20 a.m. One U turn (approximately 7:00 a.m.)

Both U turns were vehicles travelling south on the expressway, U turning, and then travelling to Cambridge via the northbound SH1 exit and Tirau road into Cambridge.

This is evidence that U turns are being performed, however, it does not appear to be a frequent enough manoeuvre to consider avoiding travel through Cambridge.

U turns performed in this location, given the high volume of traffic movement in the locality, should be discouraged. This could be effected through the placement of RD1U (RG 15) 'No U turn' signs.

Another potential reason for drivers performing U turns in this location is that they have missed taking the last southbound exit to Cambridge at Victoria road. Improvements to the signage at both expressway exits to Cambridge are currently being investigated.

APPENDIX J – RISK REGISTER

Released under Official Information Act 1982

Risk Type	Rank	RID	Risk Title	Description/ Cause/ Consequence	Risk Owner	Risk Owning Org	Date Raised	Risk Status	Phase	Established Controls	Conseq.	Likelihood	Risk Score	Individual actions to be recorded in the Actions Register (Tab 4)	Conseq.	Likelihood	Risk Score	Commentary & Closure Statement
Delivery			Programme Delays	Description Delay in programme Cause Unrealistic programme assumptions, delays to detail design, inadequate resourcing, delays in funding approvals, changes to NZTA governance structure and process, consenting, weather delays Consequence Reputational damage, increased cost and continued poor safety record	Campbell McKegg	Safe Roads	29/11/2016	Live - Treat	Pre Implementation	Regularly updated programme	High	High	21	Project Manager - Communicate programme expectations, ensure adequate resourcing, allow contingency	High	Medium	19	
Stakeholders			Comms and Engagement	Description Inconsistent and inadequate engagement between short and long term projects Cause Poor communication between short and long term engagement teams Consequence Reputational damage with key stakeholders and/or public for either short and long term projects	Stefan Darke	Safe Roads	29/11/2016	Live - Treat	Pre Implementation	Single comms and engagement plan between the both projects, regular meetings between project teams	High	Very High	22	Timely and appropriate engagement with stakeholders and public by both short and long term projects	High	Medium	19	
Cost			Financial Viability	Description Physical site constraints rendering preferred option unaffordable Cause Physical constraints Consequence Option does not provide value for money	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Pre Implementation	Reasonable contingency included in business case estimate	High	Medium	19	Timely identification of final scope and cost, retest of project economics as required	High	Medium	19	
Cost			Maintenance Cost	Description Improvements reduce the life of existing assets Cause Poor integration, and design and construction of treatment Consequence Increased maintenance interventions and associated costs eg. Removal of ATP reducing expected seal life	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Operation	Regular discussion with NOC teams regarding design details and construction methodology	Medium	High	17	Transport Agency Network Manager to agree final construction methodology	Medium	Medium	15	
Cost			Maintenance Cost	Description Improvements increase the cost of maintaining existing assets Cause Maintenance activities made more difficult as a result of improvements Consequence Increased maintenance cost eg. Side barriers impeding vegetation control	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Operation	Regular discussion with NOC teams regarding design details	Medium	High	17	Transport Agency Network Manager to agree final design details	Medium	Medium	15	
Cost			Financial Viability	Description Over investment in short term improvements Cause Infrastructure that is no longer required on completion of the long term scheme Consequence Sunk costs due to over investment	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Operation	Regular meetings with long term scheme project team, benefit cost reviews	High	High	21	Ensure clear understanding of the relationship between long and short term improvements	High	Medium	19	
Delivery			High Volume Route	Description High volume route and traffic management requirements Cause Unable to close traffic lanes during day light hours Consequence Slows construction, increased cost and road user frustration	Campbell McKegg	Safe Roads	29/11/2016	Live - Treat	Implementation		Medium	High	17	Positive traffic management in accordance with COPTTM, staging of work to increase productivity	Medium	Medium	15	
Quality / Legacy			Financial Viability	Description Investment objectives not realised Cause Crash reduction assumptions do not match future crashes Consequence Reputational risk and missed opportunity	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Operation	SSBC to identify most appropriate option to meet the objectives, flexibility to change preferred option subject to long term outcomes	High	Medium	19	Ensure clear understanding of the relationship between long and short term improvements, hold point on completion of long term IBC	High	Low	16	
Cost			Maintenance Forward Works Programme	Description Poor integration of works with existing NOC forward works programme Cause Poor planning and asset management Consequence Increased maintenance cost, reputational damage and unrealised cost savings	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Operation	Regular discussion with NOC teams regarding integration with forward works programme	Medium	High	17	Project Manager to agree project scope and integration with existing NOC forward works programme prior to tender	Medium	Low	11	

Risk Type	Rank	RID	Risk Title	Description/ Cause/ Consequence	Risk Owner	Risk Owning Org	Date Raised	Risk Status	Phase	Established Controls	Conseq.	Likelihood	Risk Score	Individual actions to be recorded in the Actions Register (Tab 4)	Conseq.	Likelihood	Risk Score	Commentary & Closure Statement
Quality / Legacy			Achieving Project Objectives	Description Long term scheme delivered later than expected Cause Design, value for money, funding approvals, stakeholders, consenting, Kaikoura earthquake reallocating priorities Consequence Option 4 will not achieve the investment objectives (50%-60% DSI Savings)	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Operation	Regular meetings with long term scheme project team	High	Very High	22	Mid 2017 trigger to review preferred option once long term IBC is complete. If necessary Option 5 (central wire rope barrier) will be progressed	High	Low	16	
Delivery			Delay in SH29/SH1 Intersection Improvements	Description Delay in SH29/SH1 intersection improvement due to long term scheme deferral Cause Design, value for money, funding approvals, stakeholders, consenting, Kaikoura earthquake reallocating priorities Consequence Unacceptable safety risk and reputational damage	Transport Agency	Transport Agency	29/11/2016	Live - Treat	Operation	Regular meetings with long term scheme project team	High	Very High	22	Mid 2017 trigger to review preferred option once long term IBC is complete, if necessary improvements to SH29/SH1 intersection to be accelerated	High	Medium	19	
Stakeholders			Stakeholder Expectations	Description Not delivering on stakeholder expectations Cause Poor engagement and not understanding stakeholder expectations Consequence Reputational damage for both short and long term projects eg not providing intersection improvements to expectations	Campbell McKeegg	Safe Roads	29/11/2016	Live - Treat	Operation	Comms and engagement strategy with both short and long term	High	Very High	22	Timely and appropriate engagement with stakeholders and public by both short and long term projects, critical that the relationship between short and long term is understood by customers	High	High	21	
Stakeholders			Post Construction FSI Crashes	Description Serious and fatal crash events post construction of short term improvements Cause Still a residual risk on completion of short term Consequence Media/reputational damage	Campbell McKeegg	Safe Roads	29/11/2016	Live - Treat	Operation	Comms and engagement strategy with both short and long term	High	High	21	Engagement with customers and stakeholders regarding the residual risk following short term improvements, promote the positive outcomes of the project	High	Medium	19	
Environmental			Environmental Damage	Description Environmental damage during construction eg sediment discharge to Waikato River Cause Poor environmental management and controls Consequence Local iwi relationship damage and regional council prosecution/abatement notice. Effects both short and long term	Campbell McKeegg	Safe Roads	29/11/2016	Live - Treat	Implementation	Limited environmental effects during design process	Very High	High	24	Robust Sediment and Erosion Control Plan	Very High	Medium	23	
Stakeholders			Road Boundary	Description Legal boundaries not consistent with existing road corridor Cause Historical boundary formalisations Consequence Relationships with landowners causing delay or suspension of planned works	Campbell McKeegg	Safe Roads	29/11/2016	Live - Treat	Pre Implementation	Risk locations identified through design	Medium	Very High	18	Early identification and engagement with landowners	Medium	High	17	
Delivery			Construction Resource	Description Capacity of construction industry Cause Lack of available construction resource Consequence Delay to programme, increased cost, compromised quality	Campbell McKeegg	Safe Roads	29/11/2016	Live - Treat	Implementation	Alliance procurement programme distributed to industry	High	Medium	19	Advertise tender prior to issue	High	Low	16	
Public / Media			Political Attention	Description Heightened political attention Cause Election year 2017, prominent corridor and likely to become accelerated by current government Consequence Unrealistic programme pressure and heightened stakeholder risks	Campbell McKeegg	Safe Roads	29/11/2016	Live - Treat	Implementation	Comms and engagement strategy signed off by Transport Agency regional director and Minister visibility of programme	Very High	High	24	Minister to be given opportunity for ground breaking, regular and consistent reporting to the Agency	Very High	Medium	23	
Delivery			Funding	Description Funding risk due to marginal BCR above 1 0 Cause Short term return period 10 years and the balance between overinvestment short term versus long term plan Consequence Funding uncertainty and programme delay	Campbell McKeegg	Safe Roads	29/11/2016	Live - Treat	Pre Implementation	SSBC to identify most appropriate option to meet the objectives	Very High	High	24	Assessment of benefit cost with Waikato DMT	Very High	Medium	23	

Risk Type	Rank	RID	Risk Title	Description/ Cause/ Consequence	Risk Owner	Risk Owning Org	Date Raised	Risk Status	Phase	Established Controls	Conseq.	Likelihood	Risk Score	Individual actions to be recorded in the Actions Register (Tab 4)	Conseq.	Likelihood	Risk Score	Commentary & Closure Statement

- 2 Quality / Legacy
- 5 Delivery
- 5 Cost
- 0 Health and Safety
- 1 Environmental
- 4 Stakeholders
- 1 Public / Media
- 0 Legal / Compliance

Risk Status	
Count	18
Draft	0
Live - Treat	18
Live - Parked	0
Impacted	0
Closed	0
Rejected	0
Blank	3
TOTAL	21

Current Risk S	
Extreme	10
High	8
Medium	0
Low	0
Zero	0
TOTAL	18

Total Risk S	
Extreme	4
High	13
Medium	1
Low	0
Zero	0
TOTAL	18

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