
SH12 Matakohe Single Lane Bridges

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VERSION A

Single Stage Business Case



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Executive Summary

This business case sets out the context for future investment to improve the single lane SH12 Matakohe Bridges. In doing so, it aims to enable SH12 to function as an Arterial route, supporting regional aspirations for network resilience, improved safety, economic growth and increased productivity.

This business case has identified that the desired outcome for the corridor is to provide a safe and resilient journey along SH12 between Ruawai and Maungaturoto. This has the potential to create economic growth and productivity opportunities for the local and regional economies.

The SH12 corridor is an important link in the regional state highway network, connecting Dargaville and the Waipoua Forest with SH1. There is no current investment strategy to address the strategic needs of this corridor.

The following problems have been identified:

- **Problem 1:** The Northland economy under performs compared to other regions in the country and substandard road conditions are impacting on the performance of the region. (40%)
- **Problem 2:** The physical alignment of the road exposes people to an unacceptable risk of injury should they crash (60%)

This business case also examines the resultant benefits that could address these challenges. These benefits include:

- **Benefit 1:** Improved regional economic growth (30%)
- **Benefit 2:** Improved network resilience (20%)
- **Benefit 3:** Increased safety (50%)

The business case analysis has found that there is an opportunity to enhance the economic prospects and safety of the Northland region through long-term investment in this State Highway corridor.

Investment Objectives have been developed with reference to the key benefits sought. These objectives are:

- **Investment Objective 1:** We will facilitate Tai Tokerau growth by providing a simple, legible journey experience for tourists, consistent with the rest of the Twin Coast Discovery route, that provides greater resilience for the Far North by 2018”
- **Investment Objective 2:** We will improve safety at the Matakohe Bridges so there are no loss of control, head-on or rear-end crashes on the bridges (or their approaches) by 2018.”

A number of options were developed and assessed to determine those that best perform against these Investment Objectives as well as against a range of other criteria including affordability, feasibility, public / stakeholder perspectives, cultural, social and environmental effects and opportunities.

On the basis of this evaluation, the recommended option for investment is two new two-lane bridges following a new alignment to the north of the existing corridor.

This option was selected as the recommended because it delivers the best outcomes against the Investment Objectives and best delivers against the economic assessment criteria. It has the smallest

impact on hydrology and the Coastal Marine Area and is least likely to affect sites of significance to local iwi.

Overall, the corridor has been given a **medium** strategic fit as the problems and benefits supported by currently available evidence, are aligned with achieving the Government's goals for land transport. They are also consistent with the Transport Agency's commitments on improved network resilience. Without this intervention, the problems will continue to worsen and importantly the benefits associated with the desired tourism and economic growth in the area will not be fully realised.

It is noted that the recommended option achieves a BCR of 1.4 and therefore meets the criteria for funding through the National Land Transport Fund (NLTF). The problem definitions and currently available supporting evidence for each indicates that the stated benefits are achievable and that there is a strong case for investment.

This business case seeks approval to move the project to the pre-implementation phase.

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THE CASE FOR CHANGE

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1. Introduction

The SH12 corridor is an important link in the regional state highway network, and is part of the Twin Coast Discovery Route connecting Dargaville and the Waipoua Forest with SH1. There is no current investment strategy to address strategic needs of this corridor.

There are 15 single lane bridges on the Northland State Highway network; two of these are located on SH12. This is shown in Figure 1.



Figure 1: Matakōhe Bridges Location

These bridges represent weak points on the network. They are often located in low lying areas prone to flooding, representing a route resilience issue. The Northland economy is constrained by this network disruption. When these routes are closed, local communities are isolated, with no access to essential deliveries. Tourism traffic is not able to access its destinations and freight traffic is not able to access key markets to the south, representing high economic costs for important local primary industries such as logging and dairy tankers from the Maungaturoto Fonterra facility as well as local tourist-related businesses.

This Business Case specifically addresses the two single-lane bridges in the vicinity of Matakohe (Davies and Anderson). The bridges are located on poor alignments, approximately half way between the townships of Ruawai and Maungaturoto, approximately 25km from the intersection with SH1. The township of Matakohe is located to the south of these bridges and the route serves tourism associated with the Matakohe museum. Figure 2 shows the location of the site.

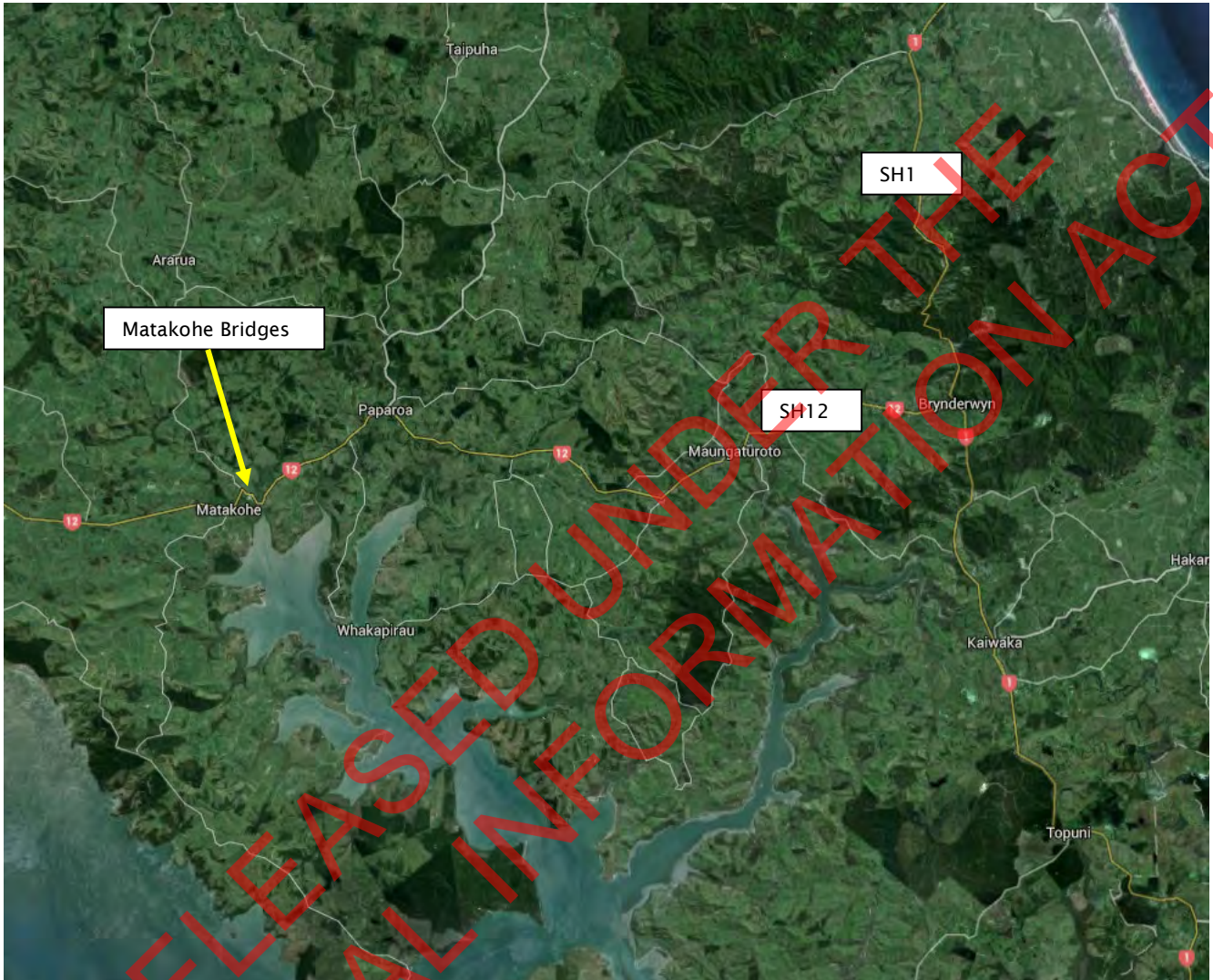


Figure 2: Site Location

The bridges carry approximately 1,850 vehicles per day with 12% heavy vehicles. The bridges are narrow, with no provision for pedestrians and cyclists and guardrails are frequently damaged. Significant maintenance on the structures is required including resurfacing and deck replacement. The bridge is located at a resilience risk location.

The alignment of the bridges is poor, with very tight curves connecting short straight sections, which exacerbates safety problems. There have been a number of crashes at this location, due in part to its awkward arrangement.

Tourism is a significant contributor to the Northland economy and the Matakohe bridges are located on the Twin Coast Discovery Route, providing access to Dargaville, the Waipoua Forest and Opononi. Tourism is an identified area of the economy with potential for significant regional growth. The route

does not currently provide provision for cyclists or pedestrians, both of which are important components of the tourist economy.

During the peak visitor season, traffic demand is significantly higher than usual and delays occur regularly during that period. There are also safety issues associated with the bridge which are exacerbated during periods of peak visitor demand.

Addressing these issues will contribute to the following priorities identified in the Regional Land Transport Plan (RLTP) 2015:

- Route resilience
- Economic growth and productivity
- Road safety

Improvements to these bridges have been considered over many years and a number of options, including one that is preferred, developed to Scheme Assessment level. As the problem is well defined and supported by appropriate strategies and business cases, it is considered that the business case is the most appropriate point of entry for the business case process.

The strategic case for this project was endorsed in principle by VAC and this business case reconfirms the problems and potential benefits in this corridor. The purpose of the business case is to develop options to maximise the opportunities available and to provide sufficient confidence and detail to allow the project to progress to the pre-implementation phase.

These issues are discussed in the following sections.

1.1 Decision sought

This business case seeks approval to move the project to the pre-implementation phase to allow project implementation dates to be achieved.

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2. Partners and Key Stakeholders

The activities and problems relating to the Matakohe single lane bridges affect a number of different organisations and customers. In order to confirm the development of the business case, meetings were held with the following key partners and stakeholders:

- Partner - NZ Transport Agency - Highway Networks Operations
- Partner - NZ Transport Agency - Planning and Investment
- Stakeholder - Kaipara District Council
- Stakeholder - Northland Regional Council
- Stakeholder - Te Uri o Hau,

Engagement with the key partners and stakeholders collectively through the development of the strategic case and this business case has been important as many of the problems, potential benefits and desired outcomes have required an integrated and collaborative approach.

These partners and stakeholders were identified through their regulatory or customer interest in the project and through previous engagement. Specifically, partners and stakeholders who could make a difference in setting the scene from a problem and benefits perspective were identified. Additionally, those who will be important in the implementation and support for the project moving forward were also identified.

As this project continues through pre-implementation and implementation phases, we will continue to engage with the project partners and stakeholders. This will allow the views of these key groups to be considered and imbedded in the project outcomes moving forward.

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3. Strategic Assessment – Outlining the Need for Investment

This chapter presents the investment story. As part of the strategic case, an initial set of problems and benefits were identified. A workshop was held with NZ Transport Agency stakeholders to develop these problems further.

3.1 Defining the Problem / Opportunity

The following problems were identified in the strategic case:

- **Problem 1:** The Northland economy (of which tourism is a big part) under performs compared to other regions in the country and substandard road conditions are impacting on the performance of the region. (60%)
- **Problem 2:** The physical alignment (out of context curves) of the road expose people to an unacceptable risk of injury should they crash (40%)

The following sections describe these problems in more detail.

3.1.1 Problem 1: Economic Growth and Productivity

General Growth

The Tai Tokerau Regional Growth Study¹ describes Northland's economy as small and underperforming relative to other New Zealand regions and its resource base. It indicates that the Far North has a concentration and hence competitive advantage in primary industries. Northland's economy accounts for 2.6% of New Zealand's GDP, despite having 3.6% of its population. Its unemployment rate is 2% higher than the New Zealand average and real GDP per capita is 26% less than the national average.

The report indicates that *“Northland's relatively low population density and geographic remoteness have contributed to its economic underperformance. Even though Northland is in relatively close proximity to the strongly performing Auckland economy, travel times and limitations to transport connections make it difficult to benefit from that proximity.”*

The report identifies a number of major industry development and investment opportunities in Northland including the visitor industry, forestry and related processing, dairy and related processing, aquaculture, marine manufacturing and horticulture.

SH12 plays a particularly important role connecting the Fonterra factory at Maungaturoto, significant areas of forestry and a number of key tourism destinations with SH1.

The ability of the region to take up the identified investment opportunities depends on a number of cross cutting areas being addressed. One of these key cross cutting areas is improving road and rail infrastructure.

¹ Tai Tokerau Northland Growth Study Opportunities Report, Martyn Jenkins, February 2015

The report identifies that there are areas of poor resilience on key tourism and freight routes. Diversion routes do not always have capacity to accommodate freight vehicles. The interaction of heavy vehicles and tourism traffic impacts on the visitor travel experience.

The report indicates that further investment is needed to ensure that the network will be able to accommodate increased freight and tourism and provide for the dual needs of tourism and primary industries for transport and safety.

The Upper North Island Freight Study highlights that substantial growth of freight movements is expected for the Northland region, with anticipated freight movements increasing by 60-65% between 2006/7 and 2031. Consistent with the Tai Tokerau report, it also indicates that high volumes of heavy vehicles coupled with the need to maintain journey reliability to remain competitive highlights the importance of network resilience for freight movements in Northland.

Tourism

Tourism is an important industry for Northland and is also an important component of its economic growth.

The SH12 corridor provides access to regionally significant tourist destinations include Tane Mahuta in the Waipoua Forest and the Kauri Museum at Matakohe. A new national park is also proposed for this corridor. The corridor does not meet desirable customer levels of service for a key tourist route. This high tourism demand in the area is shown by the seasonal differences in traffic count. Data extracted from the TMS database shows that in 2015, traffic demand was 22% higher in the summer months, compared with the rest of the year. Figure 3 shows the demand profile for 2015.

Figure 3: Average daily traffic volume²



² From TMS database SH12 recorded 2km west of SH1 for 2015

The Northland Visitors Strategy (2008-2013) was developed by the Tourism Development Group in 2008 to outline the future tourism needs, planning, infrastructure and major initiatives for the region as well as update the strategic objectives of the 2003-08 Visitors Strategy. The strategy highlights the importance of maintaining connectivity with Auckland and the wider North Island region to maintain and grow levels of tourism within the area. Figure 4 shows the tourism visitor flow in the Northland region. SH12 plays an important role connecting the south with key destinations of Dargaville, Waipoua Forest and Opononi on the Twin Coast Discovery tourist route. Figure 5 shows key tourist destinations accessed from SH12.

Figure 4: Northland tourism visitor flow (Source: MBIE for all travellers in 2005)



Figure 5: Northland tourism destinations



This evidence supports the problem identified in the strategic case that, “The Northland economy under performs compared to other regions in the country and substandard road conditions are impacting on the performance of the region”

Resilience

A Network Resilience Business Case was prepared for the Transport Agency in 2013³ to identify key problems with respect to the Northland State Highway network. This document describes the key

³ Draft Network Resilience Business Case, Opus, June 2013

resilience problem as “the Northland economy is constrained by State Highway network disruption as a result of significant and/or recurrent weather events”.

The key features affecting the resilience of the network are:

- It traverses difficult terrain that is prone to slipping due to its geological composition. Periods of heavy rain will often mobilise these slippages.
- The frequency and intensity of severe weather events is forecast to increase due to climate change.
- There are many river crossings with rivers that are subject to significant level rises in storm events
- There are limited detour options that provide safe, all-weather alternatives. As a result, detour routes generally involve considerably longer travel times.

Due to the location of the Matakohe bridges, with a harbour to the south, a significant detour route is required if the bridges are unavailable, as shown in Figure 3. The detour route is on largely unsealed roads not suitable for heavy vehicles or in extreme weather events and is approximately 33km and 48 minutes longer.

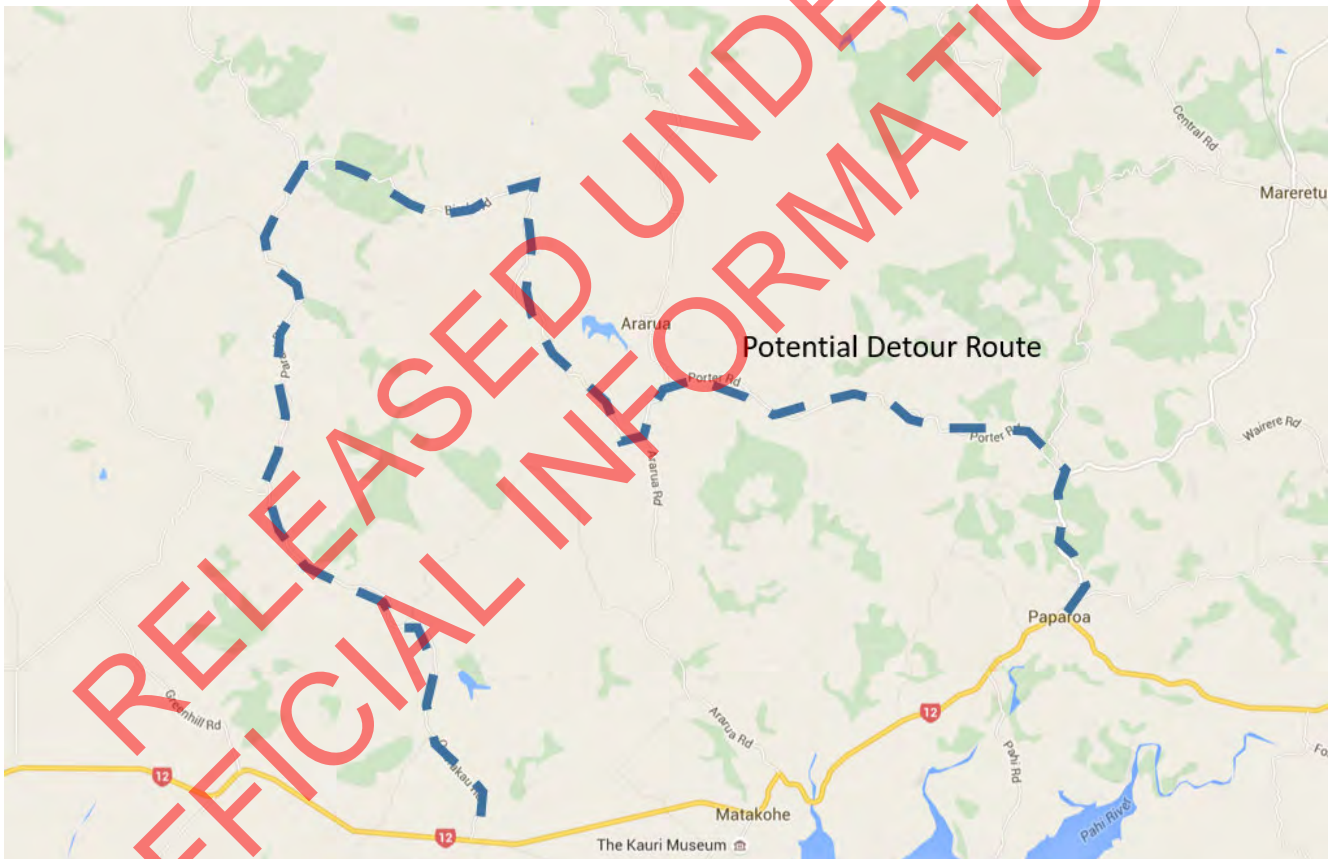


Figure 6 : Potential Detour Route

The Transport Agency has recognised the effects of poor network resilience through a number of documents. The most significant is the Agency’s Statement of Intent (2012-2015), which is to create an efficient transport system that supports high levels of economic productivity, provides strong international connections for freight, business and tourism, and meets international obligations. This will be achieved through, amongst other actions, a resilient and secure transport network and more efficient freight supply chains.

For a freight journey in particular, the unreliability of journey time or delays to vehicles imposes a very high cost on the economy. In many cases, effective freight logistics chains depend on a high level of certainty of the expected arrival time of vehicles.

These dependencies impact both demand considerations (just-in-time delivery, quick response goods (food, beverages, and retail trade), port and airport deadlines and hub-and-spoke operations (i.e. express parcels and time sensitive deliveries) as well as supply considerations (loading/unloading, delivery consolidation, driving hours implications, scope for round the clock operation, order management and warehouse processing).

Longer journey times, higher freight vehicle operating costs (due to poorer quality road infrastructure) and travel time unreliability, all contribute to reducing productivity, and therefore undermining the confidence of firms to invest in this area.

3.1.2 Problem 2: Road Safety

Problem 2: The physical alignment (out of context curves) of the road expose people to an unacceptable risk of injury should they crash (60%)

The topography is rolling in the vicinity of the bridges. The length of road has poor horizontal and vertical geometry and includes two single lane bridges and three side road intersections. The speed limit is 100km/h but the operating speed is much lower due to these geometrical constraints.

An assessment of the surrounding area has been carried out using the NZTA's CAS database, which interrogates crash records around the proposed site over the period 2005-2014, including all available data in 2015. The study included all crashes recorded at the two Matakohe bridges, the road network connecting them and within a 200m radius surrounding the bridges.

The crash history of the surrounding area identifies the following trends and issues:

- A total of 15 crashes were reported within the search area of which, four crashes resulted in injuries.
- Three head on crashes occurred on one-way bridges from vehicles failing to give way, two on the Davies Bridge and one on the Andersons Bridge. Of those, one resulted in one serious injury and two minor injuries.
- Six crashes occurred from vehicles losing control, of which one resulted in two minor injuries, and one resulted in one serious injury.
- A head on collision occurred at the intersection between Ararua Road and SH12. This resulted in one serious injury and one minor injury.
- Three rear end crashes occurred within close proximity to the Andersons Bridge from vehicles stopping/slowing for queues. No injuries were recorded.
- The remaining crashes occurred from a vehicle colliding into a cliff bank and another vehicle crashing into a ditch. No injuries were reported.

Improvements to the alignment at this location would reduce the risk of loss of control crashes. Providing a two-lane bridge would significantly reduce the risk of head on crashes and those that involved queued vehicles.

3.2.2 Benefit 2: Improved network resilience (20%)

Improvements to the Matakohe Bridges will reduce the likelihood that the Matakohe, Ruawai and Maungaturoto townships and surrounding areas may not be accessible by road for a period. This lack of accessibility could have serious implications for affected people, including loss of economic productivity, loss of access to public healthcare, loss of access to education, loss of utility provision and increased public security concerns.

Improving the resilience of the State Highway network will support more efficient freight supply chains, particularly associated with the Fonterra factory at Maungaturoto, and higher levels of economic productivity by reducing the likelihood that a freight journey will be deviated via a longer, more costly route or delayed until the closure is remedied.

3.2.3 Benefit 3: Increased safety (50%)

A safer road is a key benefit sought for the corridor. A number of crashes, including several resulting in serious injuries, have occurred on or near the bridge over the last five years. Reducing the number and severity of these crashes will significantly improve the safety and customer experience of this corridor.

3.3 The Key Performance Attributes and Measures

It is important that the potential benefits of successfully investing can be assessed and measured in order to demonstrate optimum option selection. Similarly, it is also important to evaluate the success of addressing the problems or opportunities once an investment has been implemented.

The key performance attributes that will be used to evaluate the success of the selected option are set out below. These KPIs are consistent with the Transport Agency's Investment Performance Measurement: Outcome Classes.

| Investment KPI | Measure |
|--|--|
| Improved resilience along corridor (20%) | Number and duration of closures |
| Reduce journey time (30%) | Reduced HCV kilometres |
| Improve journey time reliability (20%) | Travel time variation |
| Reduced number and severity of crashes (30%) | Number of crashes, number of deaths and serious injuries |

3.4 Key Legislation and Documents

This section describes how the proposed outcomes align to relevant national, regional, sector and organisational strategies. The strategies with the most direct impact on this business case are outlined below.

3.4.1 Tai Tokerau Economic Action Plan

The Tai Tokerau Northland Economic Action Plan (February 2016) brings into focus a group of projects that together will contribute to transforming Northland's economy. It is an "all of government" action plan to improve the economic performance of Northland.

The Action Plan is short to medium term, covering 10 years and aims to encourage new projects to be included as existing projects come to completion. A broad range of organisations will contribute to the success of the Action Plan, from business and Iwi/Māori through to not-for-profit organisations and local and central government, including the Transport Agency.

The Action Plan focuses around projects that are considered to make the greatest short to medium term difference to economic outcomes in Northland. These projects have been organised together into common work areas that fall under four broad work streams. The objectives for each are:

1. **Enablers:** To bring Northland's transport, digital infrastructure, skills and capabilities and water resources to a standard that creates an enabling environment for economic development in Northland.
2. **Land & Water:** To identify and develop opportunities for more productive use of land and water resources across a range of primary industry sectors.
3. **Visitor Industry:** To reduce the impact of seasonality, improve product dispersal across the region and enhance tourism promotion.
4. **Specialised Manufacturing & Services:** To support the development of new innovation and specialised manufacturing and service sectors.

The Action Plan has identified that the lack of robust transport accessibility between Northland and the rest of the country is a contributing factor to the area's poor economic situation and has identified four 'game changers' to underpin business growth. The first of these game changers is:

- **1. Transport:** – *better connectivity with Auckland, within the region and with export markets. Northland is a place-based economy. Roading in particular, is critical for Northland to develop and affects virtually every part of the economy.*

A number of sectors, identified in the Tai Tokerau study as potential growth areas, require good links to markets and suppliers in Auckland and beyond. These activities include:-

- Improving dairy and related production and processing
- Tourism
- Forestry and related wood processing, and especially growing wood processing capability.
- Aquaculture (although the scale of this is probably more limited)
- Horticulture

Investment in the SH12 corridor will directly improve links between these key sectors, the Auckland market and beyond.

3.4.2 Northland Regional Policy Statement, 2016 (RPS)

The Northland Regional Policy Statement (RPS) provides the broad direction and framework for managing the region's natural and physical resources. It identifies significant resource management issues for the region and sets out how resources such as land, water, soil, minerals, plants, animals and structures will be managed.

The following policies support regional infrastructure provision:

- **Policy 5.2.2 - Future-proofing infrastructure:** Encourage the development of infrastructure that is flexible, resilient, and adaptable to the reasonably foreseeable needs of the community;

- **Policy 5.2.3– Infrastructure, growth and economic development:** Promote the provision of infrastructure as a means to shape, stimulate and direct opportunities for growth and economic development.
- **Policy 5.3 – Regionally significant infrastructure:** The purpose of this policy is to identify regionally significant infrastructure. This will allow regionally significant infrastructure to be protected from adverse effects, including those caused by new use and development. Placing controls on incompatible activities locating nearby will allow established regionally significant infrastructure to be effectively maintained, operated and upgraded. Where new regionally significant infrastructure is approved, for example, by way of a resource consent, it will ensure that other activities do not compromise its future construction.

3.4.3 Land Transport Management Act 2003 (LTMA)

The LTMA requires the Transport Agency to assess all potential projects against the GPS, the relevant Regional Land Transport Strategy (RLTS) and Connecting New Zealand's three key areas of focus across the transport system:

- economic growth and productivity
- road safety
- value for money.

In developing this business case, a number of key problems and potential benefits were identified using the knowledge and data that was available. A number of issues emerged from the process that were considered significant to this project including:

- the economic impact of significant delay and poor reliability associated with road closures on the movement of people and freight in Northland.
- The risk of death or serious injury as a result of poor alignment and intersection arrangement.

The resolution of these problems through investment in the SH12 corridor and Matakohē Bridges would contribute to these GPS key areas of focus.

3.4.4 Northland Regional Land Transport Plan, 2015–2021

The current Northland Regional Land Transport Plan (RLTP) identifies seven key strategic outcomes that the region seeks to achieve. These are:

- A sustainable transport system that enhances the growth and existing economic development of Northland and New Zealand.
- All road users are safe on Northland's roads.
- Northland is well connected to Auckland and to the rest of New Zealand.
- Northland's roading network is developed and maintained so that it is fit for purpose (including route resilience).
- Our people have transport choices to access jobs, recreation and community facilities.
- The transport system enhances the environmental and cultural values of Northland.
- Effective ports servicing Northland and New Zealand.

Five of the eight main outcomes are key to supporting the desired outcomes of the SH12 corridor and Matakohē Bridges.

4. Investment Objectives and Outcomes

4.1 Project Investment Objectives

SMART objectives were developed with reference to the key benefits sought. Investment objectives must provide enough information to enable an investor to make a sound investment decision. Two Investment Objectives were identified as outlined below.

4.1.1 Investment Objective One – Economic Growth

Problem 1 relates to the need for increased economic growth in Northland. Benefit 1 directly relates to this problem. The increased resilience outlined in Benefit 2 would also be an outcome of addressing Problem 1. It is also acknowledged that for the Matakohe area this economic growth is focused on tourism associated with the SH12 Twin Coast discovery route and the resultant economic benefits to the Northland economy. Linking these problems and benefits, the following investment objective was identified:

“We will facilitate Tai Tokerau growth by providing a simple, legible journey experience for tourists, consistent with the rest of the Twin Coast Discovery route, that provides greater resilience for the Far North by 2018”

Important considerations for this investment objective were:

- The focus on tourists is deliberate as SH12 is a key route for tourists and a key sector in the Tai Tokerau Northland Economic Action Plan with potential to stimulate economic growth for Northland;
- Route resilience is an important consideration to support economic growth;
- The year 2018 was chosen as there is urgency around this issue and this is considered the earliest date to achieve this outcome

4.1.2 Investment Objective Two – Safety

Problem 2 identified the unsafe nature of the road in this area of the network. Benefit 3, which directly relates to safety and is therefore directly applicable to this problem. Given the nature of the traffic on the route (being an identified tourist route) Benefit 1 also applies to this problem and improved safety also results in increased resilience being Benefit 2. Linking this problem with the applicable benefit statements the following investment objective was identified:

“We will improve safety at the Matakohe bridges so there are no loss of control, head-on or rear end crashes on the bridges (or their approaches) by 2018.”

Important considerations for this investment objective were:

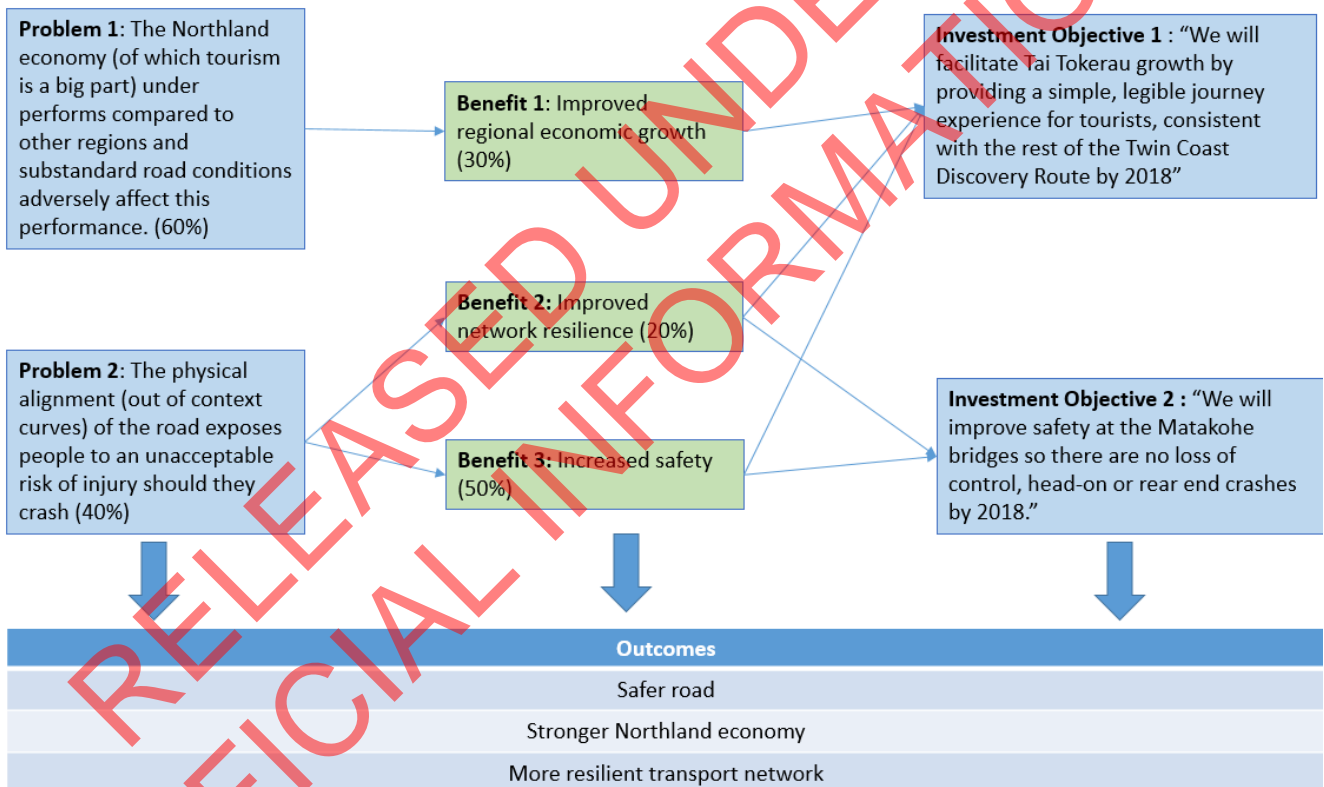
- The specific types of crashes were outlined to focus the solutions to solving the investment outcomes sought
- The year 2018 was chosen as there is urgency around this issue and this is considered the earliest date to achieve this outcome
- An aspiration of no crashes is the target as it is considered this is achievable and should be the aim of investing

4.2 Strategic Outcomes

When the project problems, benefits and Investment Objectives are considered together, this sets out the likely outcomes of investment. Figure 8 outlines these linkages and shows the following outcomes will be delivered:

- **Safer road:** This section of SH12 will be safer as a result of this project. Out of context curves will be removed and the only two one way bridges on the state highway will be removed.
- **Stronger Northland economy:** The improvement in SH12 will enhance the experience and safety of the key tourism sector. As part of the Northland Twin Coast Discovery Route, a key tourism route and experience in Northland, SH12 provides a substantive input into the Northland economy and improving this experience for tourists in particular will provide greater economic opportunities for the Northland economy.
- **More resilient transport network:** The transport network will be inherently more resilient with this project in place. Not only will this section of SH12 be more resilient with two new lanes bridges, but SH12 as an alternate route to SH1 is also strengthened.

Figure 8: Outcomes delivered



5. Options Assessment

5.1 Option Design Considerations

In developing high-level options to improve the Matakohē Bridges, a number of key design principles were considered. Importantly, this business case represents the first stage in a more detailed design process, where key principles are acknowledged, but not developed in detail. As design progresses, these details will become more developed. This section briefly summarises these high level principles.

- The bridges themselves, as well as the river and estuary are places of significance to local hapu and their ancestors. Option designs should aim to minimise the effect of the project on the environment and specifically on tidal currents, the estuarine environment and water quality. Option designs should specifically address the consequences any change would have to the river beds and the ability of the community to use the area as they currently do.
- Local hapu should be included in the design process and given the opportunity to develop culturally relevant design features on the new bridges.
- There are no known recorded areas / sites / items of specific heritage significance in the vicinity of the bridges, however, the coastal shore areas around the Harbour are noted as Areas of Significance to Maori. It is important to ensure that local cultural heritage and history is sensitively captured and that connections to Matakohē township and adjacent properties are maintained.
- The site supports tidal flows and a large estuarine habitat. The habitat supports a large mangrove ecosystem. Options should be designed to minimise disturbance, e.g. minimise the number of piles required in the waterway, avoid culverts, dredging etc.
- The bridges are located within the Coastal Marine Area (CMA) with the classification Marine 2 (Conservation) Management Area. Amenity, visual and intrinsic values are important when considering resource consents in this area. Options should aim to avoid and minimise passage over the CMA.
- Consideration should be given to landscape and visual effects and the way that options integrate with the local context.
- No outstanding natural landscape features are noted in the vicinity of the bridges.
- Options should aim to avoid vegetation clearance, specifically realignment / widening at the very western end of the site should be avoided.
- New land designation is likely to be required and private property is also likely to be required. Options should aim to minimise effects on private property
- Options with the least requirement for cut and fill are desirable.
- Adequate road space should be allocated to on-road cyclists.
- There have been a high number of crashes at intersections on the approaches to the bridge, Option designs should seek to address this issue.

These elements are captured qualitatively in the multi-criteria option evaluation process.

The draft State Highway Geometric Design Manual recommends a minimum sealed width of 10.0m for rural roads with an AADT of between 2000 and 4000 vehicles, where the B/C is greater than 1. This comprises two 3.5m lanes with 1.5m sealed shoulders.

The Safety Audit recommendation is also for 1.5m sealed shoulders, based on Austroads Guide to Road Design Part 3, Table 4.5. This is based on the AADT being greater than 3,000 vehicles, which it

is unlikely to reach for some time. An AADT of between 1,000 and 3,000 vehicles requires only a 1.0m sealed shoulder.

However, this is part of the Twin Discovery Route and there is some expectation that the road will be used by cyclists. A route from Paparoa to Ruawai has been mentioned by the local community.

It is therefore considered appropriate to provide 3.5m traffic lanes with 1.5m sealed shoulders

Therefore, all options were designed using the same cross section, as follows:

- Two 3.5m traffic lanes;
- Two 1.5m sealed shoulders;
- One 1.5m footway /cycleway;
- TL4 / TL5 side barriers
- 12.98m overall bridge width
- Straight alignment
- No super elevation
- 1,500m radius sag curve

Bridge lengths varies depending on design option.

A design speed of 100 km/h has been adopted, based on the posted speed limit.

In addition to these high level principles, a number of other more detailed elements will be considered as design proceeds through pre-implementation and implementation project phases including:

- The Transport Agency's Bridge Manual and Urban Design Guidelines: Bridging the Gap contain a number of detailed recommendations with respect to good practice urban design that should be addressed at more detailed option development stages.
- As option design develops, it will become increasingly important to describe the kit of parts that affects bridge aesthetics, e.g. form, elements, lighting etc.
- More developed option designs should address expected sea level increases associated with climate change.

5.2 Long List Options

A number of options have been considered in the corridor over a number of years from a variety of studies. The range of realignment options is constrained by the rolling terrain of the country and the alignment of small streams and inlets from the Kaipara Harbour. Figure 9 shows these options.

Detailed technical investigation and reporting has been developed to support these options. This information is provided in the following reports:

- Option Comparison Report, Opus, May 2016
- Northland One Lane Bridges, Planning and Environmental Desktop Review, Opus, May 2016

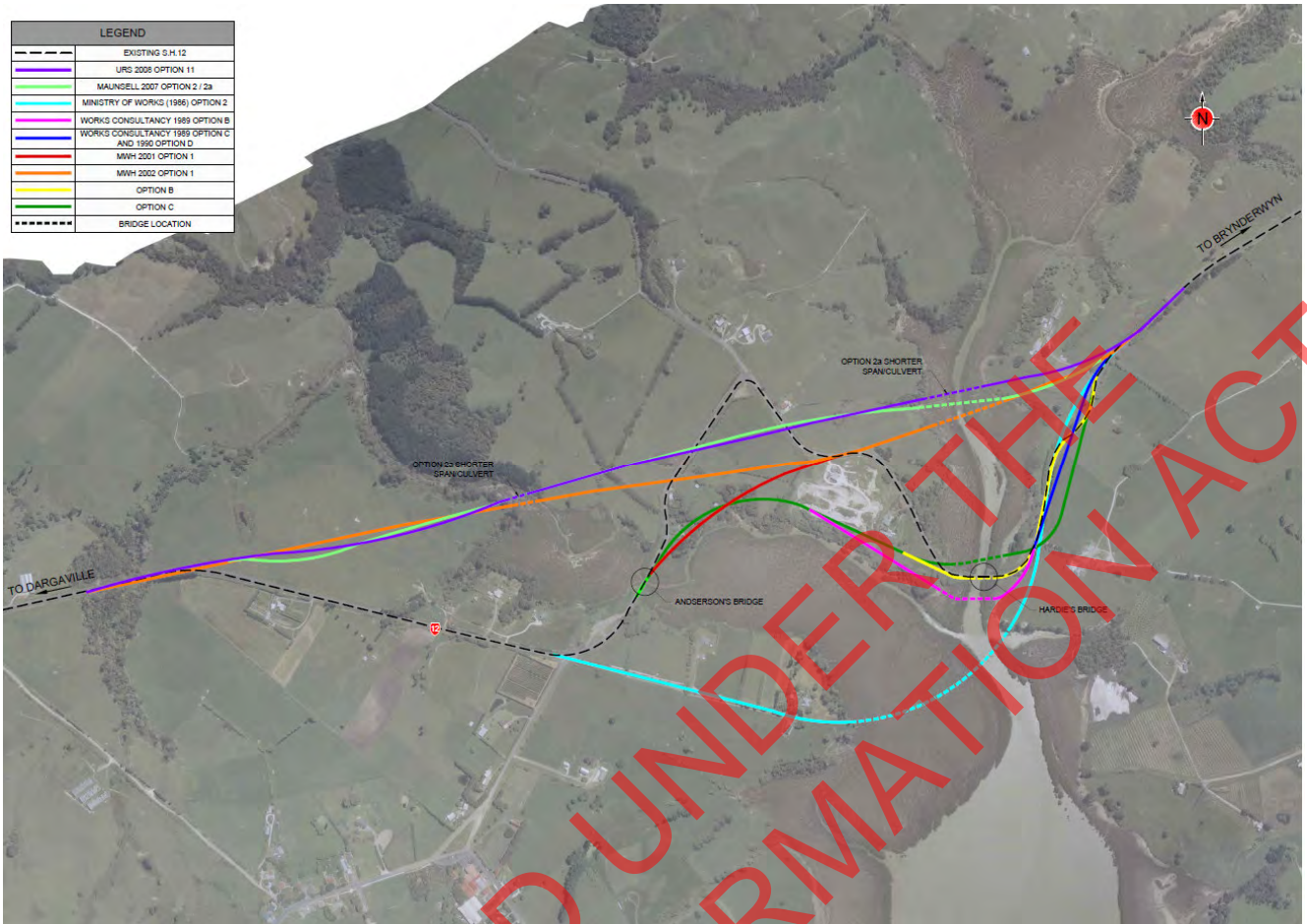


Figure 9: Long List Options

A summary of these options is provided below.

Table 1: Long List Options

| STUDY | OPTION | DESCRIPTION | DISCUSSION |
|--|-------------|--|-------------------------------|
| Ministry of Works and Development (1986) | Option 1 | Replace single lane bridges with new two lane structures but on an improved existing alignment. | |
| | Options 2-5 | Completely new alignment from RP185/11.89 to Barlow Lane, crossing the Matakohe estuary via a new 120m two lane bridge (with a substantial embankment), joining the existing alignment to the east of Hardies. All options follow same alignment but with different construction methods. | Option 4 was preferred option |
| Works Consultancy Services (1989) | Option A | Same alignment as Option 2 MWD (1986). | |
| | Option B | Replace Andersons Bridge with a new two-lane bridge. New alignment in a south-easterly direction along the eastern side of the river, crossing the Matakohe estuary via a new two lane bridge south of Hardies Bridge, joining the existing alignment to the east of Hardies Bridge | Option B was preferred option |
| | Option C | Same alignment as Option B but crossing the Matakohe estuary via Hardies Bridge, which is | |

| STUDY | OPTION | DESCRIPTION | DISCUSSION |
|--|-----------------|---|--|
| | | upgraded to two lanes. Realigned "S"-bend at the eastern end of the study area (approximately RP185/14). | |
| Works Consultancy Services (1990) | Option A | Same as Option A WCS (1989) | Option A was preferred |
| | Option B and B1 | Same as Option B WCS (1989) | |
| | Option C | Removed | |
| | Option D | Extension of Option A with realignment of the S curves to the east of Hardies bridge | |
| Works Consultancy Services (1994 and 1996) | | | Further works were undertaken to update the cost, economic and accident data from the 1990 study. |
| MWH Ltd (2001) | Option 1 | New alignment using 100 km/h curves on the most direct route. Replace single lane Andersons bridge with a new two-lane bridge on the a similar alignment and a new two lane bridge over the Matakohe River on the new alignment | |
| MWH Ltd (2002) | Option B1 | Same as Option B1 WCS (1990) | PFR was completed including all of the main previous options. |
| | Option C | Same as Option C WCS (1990) | |
| | Option D | Same as Option D WCS (1990) | |
| | Option 1 | Same as Option 1 MWH (2001) | Both Option 1 and 2 require the construction of an embankment over the native river mangrove. Option 1 requires high approach fills (12m), to cross the Matakohe river and has unsatisfactory "K" value for the crest curve near the lime quarry in the middle of the new alignment. |
| | Option 2 | Similar to Option 1 but runs from the curve east of Horniblow Road (RP185/11.0) and bypasses Anderson Bridge to the north, where it meet with Option 1. | Option 2 addresses the low speed curve at the western end of the site and crash mitigation concerns relating to Option 1. Option 2 is preferred option but recommended further investigation into Options 1 and D. |
| MWH Ltd (2003) | | | Further works were undertaken to update the cost, economic and accident data from the 2002 PFR. |

| STUDY | OPTION | DESCRIPTION | DISCUSSION |
|---------------------|--------------------|---|--|
| Maunsell Ltd (2007) | Option 2 (revised) | <p>Similar to Option 2 MWH (2002) but slightly moved northward to minimise the length of the new bridge. The horizontal alignment starts (eastbound) with a 750m radius curve from the end of the existing straight. The curve turns left into a general straight which lines the highway up with the first bridge.</p> <p>After crossing the bridge, the highway turns right following a large 2000m radius curve followed by a small straight. This small straight leads onto the second bridge. Coming off the bridge is a 600m left hand curve that joins onto the existing straight at the eastern end of the project.</p> <p>The option involves extending the two bridges across the full width of the mangrove swamps. The two bridges are 270m and 120m in length with typical 18m spans. Embankment and piling works and temporary access required within the mangrove swamp.</p> | <p>Revised PFR to identify more cost effective options. Focus on constructability.</p> <p>Option 2 is recommended option</p> |
| | Option 2a | <p>Same as Option 2 but allows for an earth causeway to be built at embankment of each bridge. This gives a lesser length to both bridges (72m and 54m) compared to Option 2. The bridges are located over the waterway area to allow for tidal flows with 18m spans.</p> | |
| URS (2008) | Option 10 | Same as MWH (2002) Option D | |
| | Option 11 | <p>Similar to Maunsell (2007) Option 2, but with some minor geometric refinements. "No. 2 Bridge" is straighter and shorter. It is also higher, removing the sag, improving sight distance, meaning lighting is not required.</p> <p>Options 11A, B and C considered different options for a staged approach to construction.</p> | <p>Addendum to Maunsell (2007) PFR.</p> <p>Option 11A is recommended option.</p> |
| | Option 12 | Same as MWH (2002) Option 1. | |

For ease of reference, these options have been grouped into three general alignments (Option 10 – Southern Alignments, Option 11 – Northern Alignments and Option 12 – Central Alignments), as shown in Figure 10 below. This grouping is as follows:

- Southern alignments (Option 10):
 - Ministry of Works, 1986, Options 2-5
 - Works Consultancy, 1989, Option A
 - Works Consultancy, 1990, Option A
 - MWH, 2002, Option D
 - URS, 2008, Option 10
- Northern alignments (Option 11):
 - MWH, 2002, Option 2
 - Maunsell, 2007, Option 2
 - Maunsell, 2007, Option 2A

- URS, 2008, Option 11
- Central alignments (Option 12):
 - Works Consultancy, 1989, Option B
 - Works Consultancy, 1989, Option C
 - Works Consultancy, 1990, Option B
 - Works Consultancy, 1990, Option C
 - Works Consultancy, 1990, Option D
 - MWH, 2001, Option 1
 - MWH, 2002, Option B1
 - MWH, 2002, Option C
 - MWH, 2002, Option 1
 - URS, 2008, Option 12



Figure 10: General Alignments

5.3 Option Evaluation Process

The methodology adopted for the option evaluation process was:

- Collate options into three general groups
- Review technical reporting to confirm adequate information is available
- Prepare assessment criteria
- Assess and rank options using input from technical reports
- Endorse criteria and assessment outcomes

The long list of options was assessed at a high level against the following criteria:

- Investment objectives
- Ability to be implemented
 - Feasibility
 - Affordability
 - Public / Stakeholder considerations
- Assessment of Effects and Opportunities
 - Cultural Heritage, Social and Environmental
 - Economy
 - Safety

This assessment allowed the long-list options to be ranked. That process then informed the short-listing of options for further and more detailed assessment. Appendix B outlines the evaluation criteria developed by the project team and endorsed by the stakeholder team.

5.4 Long List Option Assessment

A qualitative assessment was undertaken against each criterion described above. A seven point assessment criteria was used. This is a coarse assessment given the higher-level nature of the long list. More detailed assessment will be undertaken for all short listed options.

The following key conclusions that can be drawn from the application of these criteria to the previously outlined considerations are summarised in the following sections.

5.4.1 Investment Objective Assessment

Investment Objective 1 - Tourist Journey Experience

- Options considered to provide a more legible, consistent tourist journey experience were ranked higher.
- No options scored negatively because all options provide two-way bridges to replace single-lane bridges, providing a better tourist journey experience.
- Northern alignments score the highest (+++) as these provide the longest and straightest section of new route. The new section will be designed to meet all new design standards and will have appropriate width shoulders and consistent curve radii.
- Southern alignments score the next highest (++) as these straighten the alignment but still provide one large curve.
- Central alignments score (+) as these provide two new two-way bridges but still provide two relatively small radii curves and do not straighten the alignment as much as other options.
- The remaining two options, which only improve one bridge and do not improve the alignment, score zero.

Investment Objective 2 – Reduce Deaths and Serious Injuries

- Options were evaluated with respect to the scale and likely effect of the safety improvement.
- No options scored negatively because all options improve the road environment, reducing the likely number and severity of head-on, loss of control and rear-end crashes.
- Northern alignments score the highest (+++) as these provide the longest and straightest section of new route. The new section will be designed to meet all new design standards and will have appropriate width shoulders and consistent curve radii.

| | |
|--|---|
| | requirements have scored the next lowest (-). Options requiring significant disturbance in the CMA have also scored poorly. All options are likely to require new designations for road purposes. |
| What is the extent of whole of life operation / maintenance costs? | New alignment of good standard has scored the highest. Options that provide two new bridges are beneficial. Replacing just one bridge still requires high maintenance of other bridge so scores lower. |
| AFFORDABILITY | |
| What are the funding risks of the alternative/option? | The most expensive options carry most funding risk. These may not be entirely funded traditionally. Alternative funding mechanisms may be required. |
| Can the alternative be funded traditionally? (economic efficiency) | The project is expected to deliver a BCR of 1.3, which is considered economically efficient. It will therefore meet requirements for NLTF funding. |
| Are alternative funding mechanisms required? | The project is expected to be economically efficient and therefore fundable through the NLTF. |
| Are there cashflow risks that could affect the delivery programme? | Cashflow risks are expected to be low. |
| Are there ongoing operating cost risks? | No ongoing operating cost risks likely. All options have scored zero. |
| Are operating subsidies required? How will these be funded? | No operating subsidies are required. All options have scored zero. |
| PUBLIC / STAKEHOLDERS | |
| Has the alternative been made public? | All options have scored zero, as options have not yet been made public. |
| Are there real or anticipated objections? | Options that provide the longest, straightest new alignment and improve both bridges are likely to be most publicly acceptable and have been scored accordingly. The southern alignment has scored poorly due to likely visual effects. |

Table 4 shows that northern alignments are likely to have some property and consenting risks but better whole of life maintenance costs. These options perform well in terms of affordability because they generate significant travel time and accident cost savings and also best in terms of public/stakeholder acceptance.

Central alignments have very high expected costs and relatively few benefits, meaning these options are not likely to be economically efficient. Southern alignments are expected to be marginal in terms of economic efficiency. These options may be able to achieve a BCR greater than 1 if costs at the lower end of the expected range are achieved.

It also indicates that the do minimum and options that only improve one of the one-lane bridges do not perform well against the majority of implementability considerations. This suggests that these options should not continue to the option short list.

| Matakohe Bridges SSBC | DoMin | Two-lane Andersons Bridge only | | Two-lane Hardies Bridge only | | 10 | 10 | 12 | 12 | 10 | 12 | 12 | 10 | 12 | 12 | 10 | 12 | 11 | 11 | 11 | |
|---|-------|--------------------------------|--|------------------------------|--|--------------------------|----|------------|-----------|----|----|----|-----------------|----|----|----|----|----|----|----|--|
| | | Ministry of Works (1986) | | Works Consultancy (1989) | | Works Consultancy (1990) | | MwH (2001) | MwH(2002) | | | | Maunsell (2007) | | | | | | | | |
| Option 1: Replace single lane bridges with new two lane structures on an improved existing alignment | | | | | | | | | | | | | | | | | | | | | |
| Option 2.5: New alignment from RP165/11.89 to Barlow Lane (east of Hardies bridge) crossing Matakoho Estuary via a new 120m two lane bridge | | | | | | | | | | | | | | | | | | | | | |
| Option A: Same alignment as Option 2 (1989 MwC) | | | | | | | | | | | | | | | | | | | | | |
| Option B: Replace Andersons Bridge with new two lane bridge. New alignment SE direction east of the river, crosses Matakoho estuary via a new two lane bridge | | | | | | | | | | | | | | | | | | | | | |
| Option C: Same alignment as Option B (WCS 1990) but crossing Matakoho estuary via Hardies Bridge, upgraded to two lanes. "S" bend realigned to the | | | | | | | | | | | | | | | | | | | | | |
| Option A: Same as Option A (WCS 1989) | | | | | | | | | | | | | | | | | | | | | |
| Option B & B1: Same as Option B (WCS 1990) | | | | | | | | | | | | | | | | | | | | | |
| Option C: was removed | | | | | | | | | | | | | | | | | | | | | |
| Option D: Extension of Option A with realignment of the S curve east of Hardies bridge | | | | | | | | | | | | | | | | | | | | | |
| Option 1: New alignment using 100 kmh curves on the most direct route. Replace Andersons bridge with new two lane bridge on similar alignment and | | | | | | | | | | | | | | | | | | | | | |
| Option B1: Same as Option B1 (WCS 1990) | | | | | | | | | | | | | | | | | | | | | |
| Option C: same as Option C (WCS 1990) | | | | | | | | | | | | | | | | | | | | | |
| Option D: same as Option D (WCS 1990) | | | | | | | | | | | | | | | | | | | | | |
| Option 1: same as Option 1 (MwH 2001) | | | | | | | | | | | | | | | | | | | | | |
| Option 2: similar to Option 1 but runs from the curve east of Hornblow Road (RP165/11.0) bypasses Andersons Bridge to the north, where it meet with | | | | | | | | | | | | | | | | | | | | | |
| Option 2 (revised): Similar to Option 2 (MwH 2002) but moved slightly north to minimise the length of the new bridge. The horizontal alignment starts | | | | | | | | | | | | | | | | | | | | | |
| Option 2a: Earth causeway to be built at each embankment of each bridge. This gives a lesser length to both bridges (72m and 54m) compared to | | | | | | | | | | | | | | | | | | | | | |

Table 4: Ability to be Implemented Summary

5.4.3 Assessment of Effects and Opportunities

Each of the options has been assessed with respect to cultural, social and environmental effects and opportunities, safety and economic performance. Table 5 summarises the evaluation against these criteria.

Table 5: Assessment of Effects and Opportunities

| CULTURAL, SOCIAL AND ENVIRONMENTAL EFFECTS | |
|--|---|
| Significant Maori sites | The coastal shore areas around the Kaipara Harbour are noted as Areas of Significance to Maori; the northern potential alignments avoid this area. Alignments that are closer to the coast (e.g. southern) score the lowest (---). Northern alignments have the least effect but still have the potential to disturb previously undiscovered sites, therefore score (-). |
| Historic heritage places | There are no known recorded areas / sites / items of specific heritage significance in the vicinity of the bridges |
| Outstanding natural landscapes | No outstanding natural landscape features are noted in the vicinity of the bridges. Consideration should be given to landscape and visual effects and the way that options integrate with the local context. |
| Ecological areas (habitat, flora, fauna) | The site supports tidal flows and a large estuarine habitat. The habitat supports a large mangrove ecosystem. Options should be designed to minimise disturbance, e.g. minimise the number of piles required in the waterway, avoid culverts, dredging etc. Options should aim to avoid vegetation clearance, specifically realignment / widening at the very western end of the site should be avoided. A large volume of fill may be required to support some vertical alignments. Options with the least requirement for cut and fill are desirable. Alignments that are closer to the coast (e.g. southern) score the lowest (---) as these are more likely to affect ecological areas including mangroves. Northern alignments have the least effect but still have the potential to disturb sites, therefore score (-) |

| | |
|---|---|
| Coastal marine area, wetlands, lakes, rivers | <p>The bridges are located within the Coastal Marine Area (CMA) with the classification Marine 2 (Conservation) Management Area. Amenity, visual and intrinsic values are important when considering resource consents in this area. Options should aim to avoid and minimise passage over the CMA.</p> <p>Southern alignments are expected to require the deepest piles based on the expected depth of marine muds in this location. Geotechnical treatment is likely and preloading is likely to be required for any causeway options. These options therefore score (---). Northern alignments mostly avoid the CMA, although still require bridging, therefore scoring (-).</p> |
| Contaminated land | No contaminated land is noted in the vicinity of the bridges |
| Community adjacency (noise, air quality, vibration) | <p>All options that provide new alignments have been scored negatively. Alignments that maintain some distance between structures on properties are favourable as are options that avoid splitting owners land into unusable segments.</p> <p>Northern alignments are generally closer to structures and dwellings, scoring (---), while southern alignments score (-).</p> |
| Risk of natural hazards (flooding, fault lines, sea level rise) | None of the proposed alignments are susceptible to flooding. Options that leave existing bridges in place are most susceptible to flooding. |
| Best use of existing networks and infrastructure | All options have been scored positively as they provide an improvement to the existing network. Options that replace both bridges score the highest. Options that improve only one bridge score less well as it is considered necessary to replace both bridges. Options with the longest section of new alignment score the least well as they use the least existing infrastructure. |
| Community cohesion, connectivity and access | All options have been designed to maintain access to communities. Options that provide a new faster better quality connection to Dargaville (++), others (+), retaining single lane bridge score zero. |
| Access to public transport, walking and cycling facilities | The options that provide longer new alignments will reduce traffic on a longer section of local road, making it available for cycling and walking. These have been scored the highest. Options with a shorter section of new alignment have scored less well. Retaining single lane bridge is considered to have no benefit and has been scored zero. |
| Land take, severance; negative and positive opportunities | All options outside of existing footprint have scored negatively as the Transport Agency will be required to purchase property. Options with larger footprints have scored less well than options with smaller footprints. |
| SAFETY | |
| Will safety be enhanced for different types of transport users? | Options that provide the longest and straightest section of new route enable most gain for light and heavy vehicle traffic (+++). Intersections and property accesses will be designed to enhance safety. Central and southern alignments score relatively lower against this criterion. |
| Will it involve gainers and losers in terms of safety? | Options that provide the longest and straightest section of new route enable gains for light and heavy vehicle traffic. Intersections and property accesses will be designed for safety such that there are no losers. |
| Are there impacts on personal safety / security? | The new section will be designed to meet all new design standards and will have appropriate width shoulders and consistent curve radii, therefore offering improved personal safety. Personal security is not specifically affected. Options with a longer section of new alignment are likely to improve safety more than those that retain the existing alignment. |

| | |
|---|--|
| What is the impact on fatal / serious injuries? | <p>The options that provide the longest and straightest section of new route are likely to reduce DSIs the most. These have been scored highest. Shorter sections of new route have scored the next highest.</p> <p>Central alignment options currently have two smaller radii curves, which provide a lower level of expected safety improvement than other options.</p> <p>Replacing the one-lane bridges scores the next highest. The options that only improve one bridge and do not improve the alignment, score zero</p> |
| ECONOMY | |
| How will the alternative/option affect traffic volumes? | <p>All options are considered to provide a more legible, consistent tourist journey experience and are considered likely to attract more visitors to the area.</p> <p>All options have scored (++) for this criterion.</p> |
| Does the option reduce vehicular travel time? | <p>Longer section of new, straight, shorter alignment will improve travel time the most. All options are positive, as removal of one-lane bridges will reduce travel time.</p> <p>Central alignment options currently have two smaller radii curves, which provide less travel time savings than other options.</p> |
| Does the option improve journey time reliability? | All options that replace the bridges improve reliability to a similar extent through the removal of single-lane bridges. |
| Are there gainers and losers (modes / regions)? | Options that provide the longest and straightest section of new route enable gains for light and heavy vehicle traffic. Intersections and property accesses will be designed such that there are no losers. |
| More efficient freight supply chains | Options with longer sections of straighter alignment will improve freight supply chains the most. |
| Integration with planned land use | <p>All options are considered to provide a more legible, consistent tourist journey experience and are considered likely to attract more visitors to the area.</p> <p>All options will be well-signposted to ensure visitors are directed appropriately.</p> |
| Enhance the development potential of adjacent land / jobs | Options that provide the longest, straightest new alignment will best provide access to Dargaville and the surrounding area. These have scored best for access to employment. |
| Preserve function of Primary Collector route | <p>Primary Collector routes are locally important roads that provide a primary distributor/collector function, linking significant local economic areas or areas of population.</p> <p>All options maintain a good standard of connection, i.e. longer sections of new, safer, more resilient alignment score better than shorter sections.</p> |
| Route security, resilience and flexibility | <p>Options that provide the longest section of new alignment enable the longest section of viable alternative route, if diversion routes are required.</p> <p>Options that provide the longest section of new alignment, designed to provide adequate shoulders and curves are likely to be closed less often as a result of crashes, increasing resilience. The new alignment can best be designed to address any localised flooding or slippage issues in comparison with the existing route, improving resilience.</p> |

5.5 Short List Option

Based on the above summary, the northern alignment, **OPTION 11**, has been identified as the short-listed option. This option is shown in Figure 11.



Figure 11: Short Listed Option

The key reasons for this being the short-listed option include:

- Delivers the best outcomes against the Investment Objectives
- Best delivers against the economic assessment criteria
- Provides a relatively straight alignment, 950m shorter than the existing, with horizontal and vertical alignments achieving 100 km/h design speed
- Proposed bridges are further upstream, away from environmentally sensitive areas and therefore has the smallest impact on hydrology and CMA
- Is able to be constructed in two stages, almost entirely offline.
- Carries less consenting risk than other options
- Access to Matakohe East Road and Ararua Road and all existing properties can be maintained

To investigate the recommended short list option – *Option 11* - in more detail, three sub-options were considered as follows:

- Option 11: full length bridges;
- Option 11N: shortened bridges; and
- Option 11C: arches.

More detailed technical investigation and reporting has been developed to support these sub-options. This information is provided in the following report:

- Matakohe Options Comparison Report, Opus, May 2016
- Northland One Lane Bridges, Planning and Environmental Desktop Review, Opus, May 2016
- Matakohe Options and Geometrics Report, Opus, June 2016

5.6 Short List Option Assessment

The technical assessments developed to support each sub-option provide additional detail with respect to the benefits and dis-benefits of each option. The following key parameters were considered:

- Best fit horizontal and vertical alignments
- Intersection layouts to maximise access and safety
- Maintenance of adequate clearances for the tidal waterway and for marine use
- Long term environmental effects of new structures, including embankments and their overall visual effect in a rural environment
- Super-structure construction that provides adequate longitudinal restraint at abutments

The following information provides a summary of the key aspects of those investigations relevant to the evaluation of each option:

Intersection Design

Intersection design and property access will be similar for the three short listed options. This is summarised below.

Following discussions with Kaipara District Council, it is most likely that the existing bridges will both be closed to vehicular traffic. This is particularly important when it comes to the design of the intersections.

Without the bridges, intersections on the new alignment will be required to join Matakohe East Road and Ararua Road only. Access to properties will be maintained and safely managed.

It is proposed to provide a new intersection with Matakohe East Road, close to the western tie-in. Based on the expected traffic volumes and distribution, a basic right and left turn treatment is proposed. Currently six properties gain access from this section. Access will be maintained.

The existing Ararua Road intersection will be relocated slightly west, utilising the existing State Highway to join the new alignment. Traffic volumes are expected to remain the same. A basic right and left turn treatment will be provided.

Property Access

Between Anderson's Bridge and Hardie's Bridge there are ten existing crossing places to the south of the new alignment. Some of these will be directly affected by the works and will be rationalised in consultation with landowners.

Access will be maintained to the quarry and to the dwelling to the east of the quarry, joining the new alignment near the proposed Ararua Road intersection.

Between Hardie's Bridge and the eastern tie-in, there are two further authorised crossing places, which will also be maintained.

If the existing bridges are to remain and potentially become part of a walking and cycling route, it may be necessary to provide vehicular access up to the bridges, with provision for parking. This could be made possible from any of the three access to the south of the new alignment discussed above.

Option 11: Full Length Bridges

The following key parameters have been adopted for the full length bridge options:

- Preliminary geotechnical reporting indicates rock slump at the western abutment of the west crossing. Moving the alignment at this location is not likely to be easily achievable
- Vertical alignment of the west crossing has been lowered, with 130m length retained
- For the east (Matakohe River) crossing, the bridge is approximately 13m above the existing estuary bed level.
- The eastern bridge is required to be 280m to ensure that bridge abutments do not encroach on the estuary reach,
- Elevation is constrained by minimum radius vertical curves required at the western end of the alignment.
- Estimated cost = \$28M

Option 11N: Shortened Bridges

The following key parameters have been adopted for the shortened bridge options:

- Preliminary geotechnical reporting indicates that causeway construction does not require extensive geotechnical provision - extent of marine sediment is limited in this location.
- Cut to fill material is expected to be good quality, allowing causeway construction at minimal cost.
- The hydrology is not expected to govern design considerations at either crossing. It is expected that full bridge lengths could be reduced substantially without significant effect on hydrology.
- The west crossing could potentially require only a 55m bridge with some causeway construction in the upper extents of the estuary. This would allow a clear waterway area of 40m width.
- The east crossing could potentially require only a 130m bridge with some causeway construction within the estuary reach. This would allow a clear waterway area of 60m width.
- Estimated cost = \$18M.

Option 11C: Culverts / Precast Arches

- Pre-cast concrete arches (single and multiple span, 10-15m span) are being considered for this option as they leave the river bed open for fish passage and may be more acceptable than other culvert options with respect to consent.
- Preliminary geotechnical reporting indicates that the existing channel beds and adjacent ground is sound and will support culvert / arch structures without geotechnical engineering.
- There are limited depths of marine sediment over rock meaning that causeway construction is viable from a geotechnical perspective.
- Cut to fill material is expected to be good quality, allowing causeway construction at minimal cost.

- From a hydrological perspective, the catchment areas are small above both crossings. The waterway area at each crossing is therefore not substantial and may be governed by tidal flows. Sizing of culverts/arches would need to be addressed as a key part of the consenting process.
- At the west crossing, culverts / arches might be advantageous due to the presence of multiple and dry channels. There is limited mangrove growth above the new alignment and therefore minimal disturbance to it is expected.

Summary Considerations:

- All options are considered to deliver similarly against the Investment Objectives.
- Reducing bridge lengths reduces construction costs by approximately \$10M (64% of the cost of full length bridges).
- Cut volume of 285,000m³ is expected. Option 11 would require 263,000m³ cut to waste. Option 11C would require approximately 170,000m³ cut to waste. If disposal on site cannot be achieved, this waste would need to be removed off-site at an additional cost of approximately \$2.5M for Option 11. Using this material as fill for a culvert / arch option would save approximately \$1M.
- However, consenting considerations may limit the length of embankment permitted into the estuary reaches. The west crossing has lower embankment height, narrower footprint and is closer to the upper end of the estuary reach and therefore increased embankment is likely to be more acceptable than for the east crossing.
- For consenting reasons, culverts / arches may not be acceptable. If full width embankments were not permissible, a culvert / arch option would not be viable.
- Option 11 is considered to have lower risks than Option 11N and Option 11C but is significantly more expensive.

On this basis, it is recommended that **Option 11N** is progressed to the pre-implementation phase as the preferred option. During the pre-implementation phase, more detailed investigation will be undertaken with respect to design and consenting requirements, such that a consentable option with minimal construction cost is developed.

5.7 Recommended Option

The recommended option comprises two new two lane structures, following the alignment identified as Option 11N.

The new bridges will be wider than the existing structures and will follow a significantly straighter alignment, to provide a consistent journey experience for tourists, with increased resilience and improved safety.

Providing new two lane bridges removes the give way priority on the existing bridges, which can be confusing for tourists. The recommended option will better provide for cyclists than the existing situation, with 1.5m wide sealed shoulders.

The recommended option will provide better network resilience, aiming to ensure that journeys on the State Highway are less likely to be interrupted by storm events or crashes. The new bridges will be constructed to enable use by High Productivity Motor Vehicles (HPMV). Currently they are only capable of use by 50MAX heavy vehicles. This will significantly improve the functionality of SH12 for freight traffic.

The new bridges will be designed to ensure current safety standards are met, including appropriately designed barriers on both sides of the carriageway. A significantly straighter alignment, compliant traffic lane widths and dedicated space for cyclists will also act to improve safety.

Reducing the length of bridge structures provided with this option will significantly reduce the cost (by approximately \$10M), however the consequent increase in embankment or provision of culverts / arches also carries some environmental and consenting risk, specifically with respect to extended causeways within the estuary reaches. It is noted that further consideration in developed design could address these risks.

Therefore, it is recommended that both Options 11 and 11C are considered further during the pre-implementation phase to develop a design that delivers value for money without adversely affecting the adjacent environment.

Table 8 summarises the key benefits of the recommended option with respect to the Investment Objectives and agreed evaluation criteria. Plans of the recommended option are provided in **Appendix D**.

Table 8: Recommended Option

| CRITERIA | DESCRIPTION |
|------------------------------------|--|
| Investment Objective 1 | This option offers an improvement against the Do Minimum through reduced travel time and increased resilience for SH12. It also offers increased legibility of the SH12 route for tourists. |
| Investment Objective 2 | The option performs well from a safety perspective with two two-lane bridges on a much straighter alignment providing greater clarity of movement and priority. This removes delays and confusion associated with a single lane bridge and also clarifies intersection priorities and visibility. |
| Feasibility | The option is considered feasible to implement and is relatively straightforward to construct. Although some private land will be required with this option, property risks are relatively low. There is some risk associated with consenting in a coastal environment. However this is considered to be relatively minor and manageable, in comparison with other options. |
| Affordability | This option is considered the most economically efficient of the options identified. It generates the greatest travel time and accident savings relative to its cost. It is expected to achieve a BCR > 1. |
| Stakeholders | The options have not been made public however, feedback from Iwi and KDC indicates that there will be a largely positive reaction to this option from stakeholders. This is based on the view that this option will best address the problems at this location. |
| Cultural, Social and Environmental | This option best balances the effects on the environment of a new bridge with the least impact on the social and cultural constraints in the area. It is considered that this option will have the least effect on sites of significance to Māori, and minimises works required in the CMA. |

| CRITERIA | DESCRIPTION |
|----------|---|
| | <p>Some land take and impact on adjacent land uses is likely, but to a lesser degree than other options.</p> <p>An improvement to connectivity and accessibility is expected, as well as improved resilience.</p> |
| Economy | This option provides the most direct route, resulting in the greatest positive impact economically. |
| Safety | This option performs well from a safety perspective. |

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6. Economic Case

Fortnightly workshops have been held with attendees from the project team and NZ Transport Agency. The purpose of these workshops was to develop options and endorse a recommended option through consideration of the evidence base and stakeholder involvement.

Option 11N is recommended as the preferred option.

Table 9 summarises the economic evaluation undertaken for the preferred option. Full economic evaluation is provided in Appendix E.

Table 9: Preferred Option – Economic Evaluation Summary

| TIMING | |
|--|--------------|
| Earliest implementation start date | 2018 |
| Expected duration of implementation | 24 months |
| ECONOMIC EFFICIENCY | |
| Time Zero | July 2015 |
| Base date for costs and benefits | July 2016 |
| Present value of Total Project Cost (do minimum) | \$2,797,596 |
| Present value Net Total Project Cost (recommended option) | \$25,319,050 |
| Present value Total Project Cost (recommended less do minimum) | \$22,521,454 |
| Present value Net Benefit (recommended option excluding WEBs) | \$32,247,522 |
| Present value Net Benefit WEBs (recommended option) | \$32,251,326 |
| BCR (excluding WEBs) | 1.43 |
| BCR (including WEBs) | 1.43 |

Table 10: Preferred Option – P50 Costs and Benefits

| P50 COSTS | DO MIN | PREFERRED |
|-------------------------------|--------|--------------|
| Property | \$0 | \$1,280,000 |
| Project Development | \$0 | \$0 |
| Pre-Implementation | \$0 | \$193,850 |
| Construction / Implementation | \$0 | \$22,173,557 |
| External impact mitigation | \$0 | |

| P50 COSTS | DO MIN | PREFERRED |
|----------------------------------|--------|---------------------|
| Other capital (e.g. insurances) | \$0 | |
| Capital risk management | \$0 | |
| TOTAL IMPLEMENTATION COST | | \$23,647,407 |
| Maintenance | | |
| Renewal | | |
| Operating | | |
| Other ongoing costs | | |
| Post project evaluation | | |
| ONGOING COSTS | | |
| Project Contingency | | \$2,999,741 |
| TOTAL P50 PROJECT COSTS | | \$26,647,147 |
| BENEFITS (PRESENT VALUE) | | |
| Travel time savings | \$0 | \$9,368,912 |
| Vehicle operating cost savings | \$0 | \$3,510,340 |
| Accident cost savings | \$0 | \$14,066,184 |
| Network resilience | \$0 | \$5,126,570 |
| WEBs (reduced closures) | \$0 | \$3,804 |
| Vehicle emissions reductions | | \$175,517 |
| Reduced driver frustration | | |
| Walking and cycling (EEM) | | |
| Travel behaviour change | | |
| PV TOTAL NET BENEFITS | | \$32,251,326 |

6.1 Outcomes Table

Option 11N has been selected as the recommended option, to be progressed to the pre-implementation phase. Table 11 summarises the outcomes that this option delivers in comparison with other options and indicates the relative differences in benefits and costs.

It indicates that the Options 10 and 12 deliver significantly less benefit at more cost.

Table 11: Outcomes Table

| OPTION | TRAVEL TIME SAVINGS | | ACCIDENT SAVINGS | | COST (P50) |
|-------------------|---------------------|-------------------|----------------------|-------------|---------------------|
| | NPV\$ | SECONDS / VEHICLE | NPV\$ | DSI / ANNUM | |
| Option 11N | \$9,369,000 | 93 | \$14,066,000 | 0.6 | \$26,647,000 |
| Option 11 | \$9,369,000 (0%) | 93 | \$14,066,000 (0%) | 0.6 | \$37,225,000 (40%) |
| Option 11C | \$9,369,000 (0%) | 93 | \$14,066,000 (0%) | 0.6 | \$20,529,000 (-23%) |
| Option 10 | \$5,943,000 (-37%) | 59 | \$14,031,000 (-0.2%) | 0.6 | \$58,940,000 (121%) |
| Option 12 | \$6,622,000 (-29%) | 66 | \$12,916,000 (-8%) | 0.5 | \$30,318,000 (14%) |

Table 11 presents rough orders of cost for all options other than the preferred option 11N. The bridging costs have been based on a nominal per square metre rate which has been varied to make allowance for the order of additional costs and risk considered to be associated with some options.

Options 10 and 12 have been priced without geotechnical and survey data, and alignment has not been developed in detail for these options. Therefore significant variations in scheme cost might arise due to, but not limited to, variations in temporary works and construction access, construction works at height, working in the tidal waterway, complexity of causeway construction, provisions for the bridge abutments and piers, geotechnical information and treatments.

The property valuations for the options, other than the preferred option 11N, have been estimated based on the properties affected and the absence of any building structures on these properties. The legal costs have been based on experience on similar projects.

7. Assessment Profile

The investment profile has been determined using the Transport Agency's Investment Assessment Framework, as described below.

The indicative investment profile overall for the Matakohē Bridges has been assessed as **HML**.

Strategic Fit = High

The site has a **high** crash risk based on the calculations from Figure 4-1 and 4-2, NZ Transport Agency, High Risk Rural Intersections Guide. Safety improvements are therefore required. In addition.

The project will improve journeys for freight and tourism and will also improve the resilience of the route. The alternative route is 2 ¼ hours (160 km) should SH12 be closed at this location.

The project is consistent with the Tai Tokerau Regional Economic Development Action Plan and improvements to regional connectivity are necessary for economic growth and productivity.

Overall, the corridor has been given a **high** strategic fit as the problems and benefits supported by the currently available evidence "*provide a safe, secure and resilient transport network to ensure national and regional connectivity for economic growth and productivity*".

This business case confirms that the key problems relate to safety and resilience, particularly for freight, and that these are significant from a regional perspective.

Effectiveness = Medium

Overall, the corridor has been given a **medium** effectiveness rating. This is based on the intent and potential scope of the preferred option to deliver against the range of effectiveness criteria set out in the current Investment Assessment Framework and summarised below.

- Provides a long-term solution with enduring benefits appropriate to the scale of the solution.
- Based on the problems identified there is sufficient scope to identify appropriate alternatives that would make a significant contribution to achieving the multiple impacts of the GPS
- The agreed problems and benefits are integrated, and therefore there is scope to make a significant contribution to multiple outcomes including:
 - Improving journey time reliability
 - More efficient and productive freight supply chains
 - Improving the resilience and route security.
 - Improving route safety.

Efficiency = Low

The benefit cost ratio calculated using EEM criteria for the preferred option is **1.43**.

Combined with strategic fit and effectiveness ratings of **HM**, the project's priority order is **Priority 6**.

This priority ranking, based on the evidence provided in this business case, indicates that the project would provide a beneficial investment.

8. Financial Case

8.1 Project Delivery Costs

The key assumptions for the preferred option are set out in the Economic Case. Cost estimates for each option are provided in Appendix F.

8.2 Pre-Implementation Costs

| ITEM | DISCUSSION |
|--------------------|---|
| Timing assumptions | All construction costs incurred in Year 1 of economic analysis. |

8.3 Implementation Costs

| ITEM | DISCUSSION |
|--------------------|--|
| Property purchase | Negligible costs associated with property acquisition for the preferred option. Option able to be contained within existing road reserve. |
| Design costs | Design costs have been calculated and included in the estimate. |
| Construction costs | Costs are based on a concept design. Appropriate contingency sums are included in the estimate to allow for uncertainties associated with this early stage in the design process. |

8.4 Post-Implementation Costs

| ITEM | DISCUSSION |
|-------------------|--|
| Operating costs | There are no operating costs associated with the project. |
| Maintenance costs | Compared with the do-minimum there are likely to be lower maintenance costs as a result of the provision of a new bridge structure. The existing structures are nearing the end of their useful life and require significant investment in maintenance, in comparison with a new structure. The section of the existing state highway network (including existing bridges) replaced by the project, will require ongoing maintenance and ultimately it is expected that its state highway classification would be revoked and the asset returned to Kaipara District Council management. |
| Other costs | No additional costs identified. |

| ITEM | DISCUSSION |
|-------------------------------|---|
| Post-project evaluation costs | Post-construction crash data will be analysed to assess the effectiveness of the project in reducing DSI's and to identify any other benefits or dis-benefits |

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9. Commercial Case

9.1 Procurement

The proposed construction procurement basis will be Competitive Early Contractor Involvement (ECI).

The strategy has been developed using the NZ Transport Agency's standard procurement approach, with contractors tendering for a Competitive ECI contract. ECI tenders are evaluated on a quality basis and as such engagement of an independent parallel estimate peer review is recommended.

A market briefing was held in March 2016. Six consortia have lodged Statements of Interest and Ability (SIA) to undertake this programme of work. These consortia will be short-listed to two in June 2016, to competitively tender for work.

9.2 Funding

It is anticipated that this project will be funded from the National Land Transport Fund (NLTF) as the expected BCR indicates that the project is likely to be economically efficient and is above the minimum threshold for investment.

9.3 Risk Management

Risk will be allocated in accordance with the ECI procurement model and will be transferred in accordance with relevant standard conditions of contract (CCCS and NZS3910:2013).

Risk associated with Safety in Design will be developed using a formal process to inform design outcomes.

Formal Risk Assessment in accordance with Z/44 will be undertaken to identify the most appropriate entity / person to manage each 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.

10. Management Case

10.1 Project Management Planning

An independent Road Safety Audit will be carried out on the detailed design of this project in accordance with the Agency's Road Safety Audit Procedures for Projects – Guidelines (Interim Release May 2013).

A detailed pre-implementation report will be developed, including any departures to be applied for. Approvals at the appropriate level will be sought when required.

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

Table 12: Pre-Implementation and Implementation Deliverables

| PHASE | DELIVERABLE | APPROVAL PROCESS | PERSON RESPONSIBLE |
|-----------------|-------------|--|--------------------|
| Detailed Design | 2016 | Auckland / Northland State Highway Manager | Jacque Bell |
| Tender Phase | 2016 | Auckland / Northland State Highway Manager | Jacque Bell |

10.2 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 key risks identified to date are:

- Management of stakeholder expectations. This will be managed and addressed through focused stakeholder engagement during the pre-implementation stage.
- Departures. A Road Safety Audit will be undertaken to identify any departure requirements.
- Archaeological artefacts. There is a risk that archaeological sites may be found within the project extents. It is anticipated that this risk is small, however, as initial investigations have identified some potential sites in the adjacent area, the construction team will be made aware of the necessary actions to implement if artefacts are discovered. Within the existing carriageway, land has already been disturbed.
- Role / function of existing road network. The project will replace a section of existing state highway. The existing network, including existing bridges, will require ongoing maintenance. It is expected that this asset would be returned to Kaipara District Council for ongoing management.
- Property risks. The project requires acquisition of private property. There are risks associated with the acquisition of this property. Landowner expectations and property acquisition negotiations will require management during the pre-implementation stage.

10.3 Post-Project Evaluation Planning

The outcome of the project will be measured on the number of deaths and serious injuries that are saved across this project extent.

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

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APPENDIX A. SUMMARY OF IWI ENGAGEMENT

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APPENDIX B. ASSESSMENT CRITERIA

| OBJECTIVES | CONSIDERATIONS | MEASURES |
|--|---|--|
| Investment Objective 1 | We will facilitate Tai Tokerau growth by providing a simple, legible journey experience for tourists that provides greater resilience for the Far North by 2018 | Qualitative assessment based on tourist journey experience |
| Investment Objective 2 | We will improve safety at the Matakohe bridges so there are no loss of control, head-on or rear end crashes by 2018. | Number and severity of crashes by 2018 |
| IMPLEMENTABILITY APPRAISAL | | |
| Feasibility | How straightforward is it to implement this alternative / option? | Level of complexity. I.e. tunnelling, community consultation, challenging ground condition |
| | Are innovative technologies involved? | Level of innovation |
| | Are there significant hazards that may pose a health, safety in design risk? | Level of hazards |
| | Are there significant effects on property? | Impact of project on property |
| | Are other infrastructure providers affected? | Other organisations beside NZTA |
| | Are there consenting risks that could affect delivery or cost risk? | Level of consenting risk for option |
| | Are there factors likely to affect the ability to operate / maintain the option over its projected life without major additional costs? | Maintenance and operation costs |
| Affordability | What are the funding risks of the alternative/option? | Included in the RLTP to no funding allocation |
| | Can the alternative be funded traditionally? (economic efficiency) | Estimated economic efficiency of project |
| | Are alternative funding mechanisms required? | yes / no |
| | Are there cashflow risks that might affect the delivery programme? | yes / no |
| | Are there ongoing operating cost risks? | Level of operating costs |
| | Are operating subsidies required? How will these be funded? | Tolling / PQP procurement |
| Public / Stakeholders | Has the alternative been made public? | Yes / no |
| | How acceptable is the alternative? | Level of anticipated acceptance |
| | Are there real or anticipated objections from the community or stakeholders? | Level of anticipated acceptance by stakeholders |
| ASSESSMENT OF EFFECTS | | |
| Cultural heritage, environmental, social and community wellbeing | Are there any sites or features (including their setting) of significance to Maori (archaeological or existent) affected? | |
| | Are there any historic heritage places (including their setting) (e.g. archaeological or buildings, sites, remnants) affected? | |

| OBJECTIVES | CONSIDERATIONS | MEASURES |
|------------|--|---|
| | Are any (first tier) outstanding landscapes or natural features, or (second tier) significant/special landscape or natural features affected? | Environmental mapping |
| | Are there any ecological areas, or areas with habitat value (including large areas of native vegetation) affected? | |
| | Are there any coastal marine areas, wetlands, lakes, rivers, streams or their margins affected? | Environmental mapping |
| | Are there any areas of contaminated land affected? | |
| | Are there community facilities (park/schools/hospitals etc), or residential or other sensitive land uses in the area that could be affected by adjacency effects (eg noise, disruption, vibration, air quality etc)? | Assessment of proximity to settlements |
| | Are there potential effects from hazards or risks (including from future climate change) from erosion, flooding, fault lines, sea level rise | |
| | Extent to which the option integrates transport and land use to make best use of existing networks and infrastructure. | Extent of integration with land use aspirations |
| | Are there any communities affected by reduced cohesion, connectivity or accessibility? | Qualitative assessment of access to the road network |
| | Are there opportunities to enhance the active travel modes - cycling and walking and/or linkages to other national or regional recreational cycle networks for longer distance cyclists? | Qualitative assessment of access to alternative modes |
| | Extent and significance of land take, severance; negative and positive opportunities | Severance / connectivity |
| Economy | How will the alternative/option affect traffic volumes? | Level of growth catered for? |
| | Does the option provide an opportunity to reduce vehicular travel time on SH1 between the Auckland and Northland regions? | Qualitative evaluation |
| | Does the option improve journey time reliability? | Qualitative evaluation |
| | Are there gainers and losers (modes / regions)? What is the overall effect? | Qualitative assessment of overall benefits to surrounding communities |
| | Does the option provide for more efficient freight supply chains between the Auckland and Northland regions | Route quality |
| | How well does the option integrate with land use with reference to regional growth strategies | Consistency with regional growth strategies |
| | How well does the option enhance the development potential of adjacent land / attract new jobs / help existing businesses? | Qualitative assessment of access to land use |
| | How well does the option preserve the function of SH12 as a collector route, consistent with ONRC | Qualitative evaluation |
| | How well does the option address route security, resilience and flexibility | Extent to which the option improves route resilience |
| Safety | How will the alternative enhance safety for different types of transport users? | Alternative mode safety |

| OBJECTIVES | CONSIDERATIONS | MEASURES |
|------------|--|---|
| | Will it involve gainers and losers in terms of safety? | Adverse safety effects from the option |
| | Are there impacts on personal safety / security? | Assessment of the reduction in crash risk |
| | What is the impact on fatal / serious injuries? | Assessment of reduction in DSI |

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APPENDIX C. OPTION ASSESSMENT

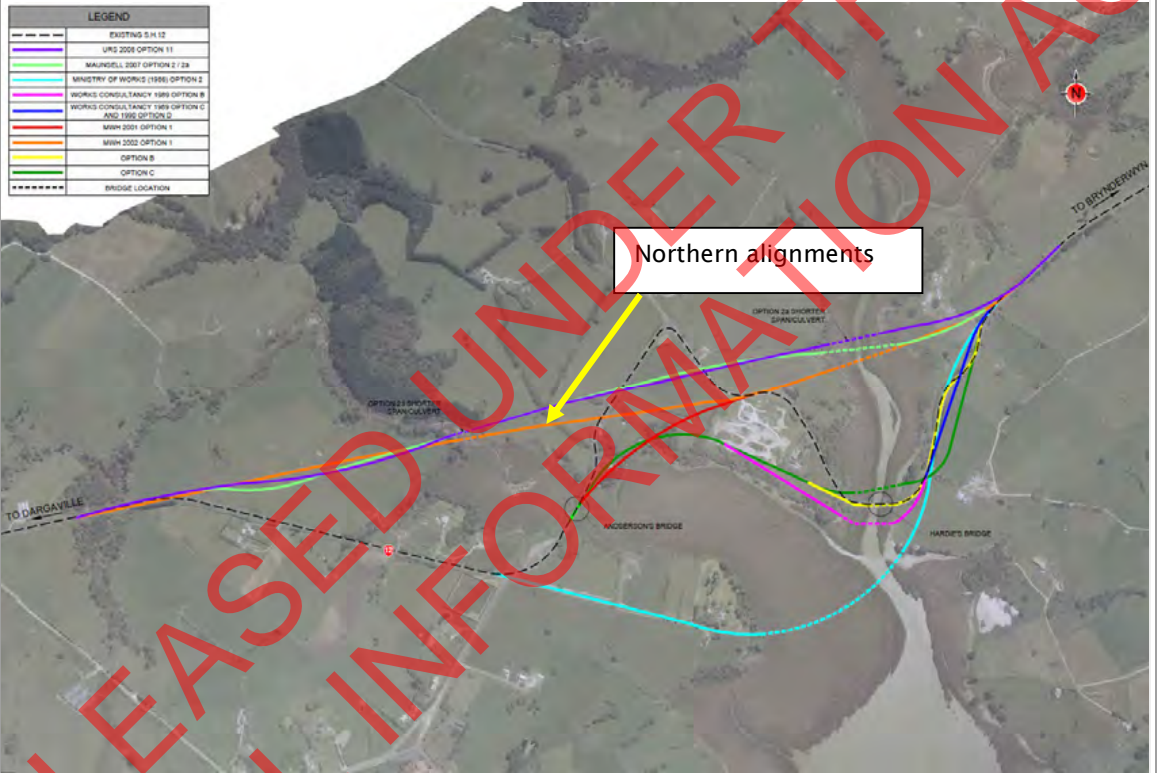
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ASSESSMENT SUMMARY TABLE – NORTHERN ALIGNMENT

| | | | |
|-------------------------------|---|--|---------------------------------------|
| Business case name: | SH10 Matakohe Bridges | Name of Project Manager & Region: | Vivianne Tadros, Auckland / Northland |
| Business case purpose: | To upgrade the Matakohe Bridges to improve the safety, resilience and economic performance of the Northland region. | | |

Option description: This group of options recommends removing the two existing tight radii curves and providing a relatively straight offline alignment to the north of the existing alignment. Several alignments have been grouped together for this long list evaluation stage as they comprise relatively similar characteristics. These options are shown below.

Dependencies : None



| | | | |
|--|--|-----------------------------|--------------------------|
| Estimated total public sector funding requirement : | | Lower | Upper |
| | Capital cost (\$m): | | |
| | Net property cost (\$m): | | |
| | Opex (\$m/30yr): | | |
| | Maintenance (\$m/30yr): | | |
| | Present value of cost to govt. (\$m): | | |
| Estimated BCR range: | | | |
| Timing of need: | Optimal programme: | | Likely: |
| IAF profile: | Strategic fit: H/M/L | Effectiveness: H/M/L | Efficiency: H/M/L |

| MULTI CRITERIA ASSESSMENT – NORTHERN ALIGNMENT | | |
|--|-------|---|
| Criterion | Score | Discussion |
| Objective 1: Economic Growth and Resilience | +++ | This option offers a significant improvement against the Do Minimum. It reduces travel time and increases the resilience of SH12 and the wider Northland region. It improves the legibility of the SH12 route for tourists. This results in a +++ rating. |
| Objective 2: Safety | +++ | The option performs well from a safety perspective with a two lane bridge along a straight alignment providing greater clarity of movement and priority. It removes the confusion associated with single lane bridges, giving a strong +++ score. It also provides shoulders for cycling. |
| Feasibility: | 0 | This option scored 0 overall with respect to feasibility. There are some risks associated with property and consenting but the construction method is considered straightforward and whole of life costs were relatively low, compared with other options. |
| Affordability: | + | This option scored + overall for affordability. Although it is more expensive, this option delivers better benefits than other options, and achieves a BCR of 1.3, which meets NLTP funding criteria. |
| Public/Stakeholders: | + | The options have not been made public. However, a positive reaction is likely, based on the provision of a significantly improved new structure along a straighter, safer alignment. |
| Environmental and social: | 0 | Work within the CMA and land take is required. No heritage or culturally significant sites are affected. Most land along this alignment is pre-disturbed and effects are limited in comparison with other options (particularly the southern alignment). |
| Safety: | +++ | The option performs well from a safety perspective with a two lane bridge along a straight alignment providing greater clarity of movement and priority. It removes the confusion associated with single lane bridges, giving a strong +++ score. It also provides shoulders for cycling. |
| Economy: | ++ | Journey times for freight and tourism will be reduced and travel time reliability will improve as a result of the option. All options are expected to deliver similar benefits for economy. These benefits are in part offset by an increase in travel time to Matakohe township. |
| Environmental opportunities | | The northern alignment impacts on the environment to a lesser degree than other options. |
| Social opportunities | | This option deviates the road away from Matakohe township. To ensure people continue to visit the township and particularly the Kauri Museum, clear signage is recommended and appropriate intersection design to ensure safe access is maintained. |
| Rationale for selection or rejection of alternative: | | This option ranked 1st of those assessed as it best meets the Investment Objectives sought for this project. The option enhances resilience and economic opportunities in the area, increases the legibility of the travel route and improves its safety. It has a minimal effect on the adjacent environment in comparison with other options. Although it has a higher cost than other options it achieves a positive BCR, meeting NLTP funding requirements. |

ASSESSMENT SUMMARY TABLE - CENTRAL ALIGNMENT

| | | | |
|-------------------------------|---|--|---------------------------------------|
| Business case name: | SH10 Matakohe Bridges | Name of Project Manager & Region: | Vivianne Tadros, Auckland / Northland |
| Business case purpose: | To upgrade the Matakohe Bridges to improve the safety, resilience and economic performance of the Northland region. | | |

Option description: This group of options recommends realigning the two existing tight radii curves and slightly increasing their radii. Several alignments have been grouped together for this long list evaluation stage as they comprise relatively similar characteristics. These options are shown below.
Dependencies: None



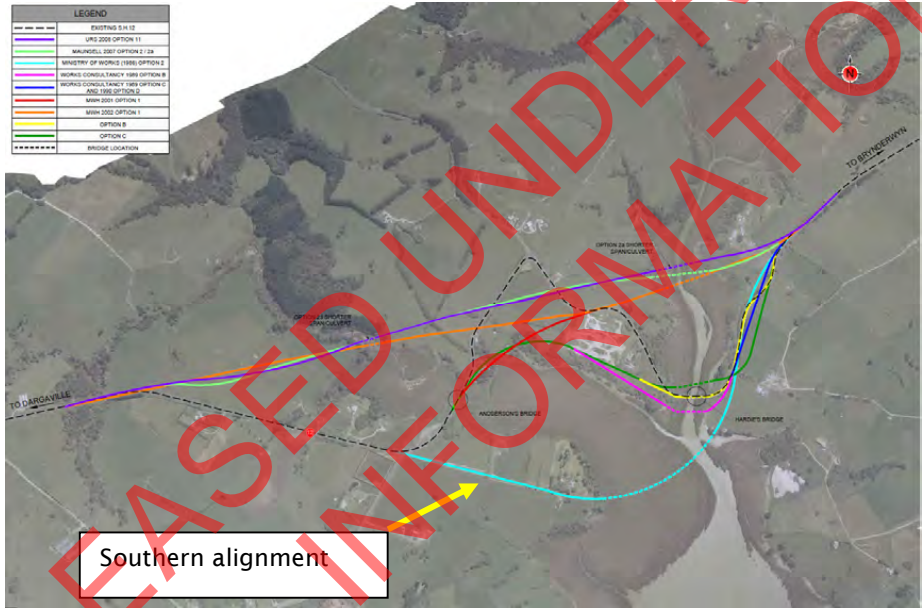
| | Lower | Upper |
|---|-------|-------|
| Estimated total public sector funding requirement: | | |
| Capital cost (\$m): | | |
| Net property cost (\$m): | | |
| Opex (\$m/30yr): | | |
| Maintenance (\$m/30yr): | | |
| Present value of cost to govt. (\$m): | | |

Estimated BCR range:

| | | | |
|------------------------|-----------------------------|-----------------------------|--------------------------|
| Timing of need: | <i>Optimal programme:</i> | <i>Likely:</i> | |
| IAF profile: | <i>Strategic fit:</i> H/M/L | <i>Effectiveness:</i> H/M/L | <i>Efficiency:</i> H/M/L |

| MULTI CRITERIA ASSESSMENT – CENTRAL ALIGNMENT | | |
|--|-------|---|
| Criterion | Score | Discussion |
| Objective 1: Economic Growth and Resilience | + | This option offers some improvement against the Do Minimum. It reduces travel time and slightly increases the resilience of SH12 and the wider Northland region. It improves the legibility of the SH12 route for tourists. This results in a + rating. |
| Objective 2: Safety | + | The option performs better than the Do-Minimum from a safety perspective with two new two lane bridges along a straighter alignment, providing greater clarity of movement and priority, giving a + score. It also provides shoulders for cycling. |
| Feasibility: | 0 | This option scored 0 overall with respect to feasibility. There are some risks associated with property and consenting but the construction method is considered straightforward and whole of life costs were relatively low, compared with other options. |
| Affordability: | - | This option scored - overall for affordability. Although it delivers benefits, it is also expensive and is not as economically efficient as other options. |
| Public/Stakeholders: | 0 | The options have not been made public. However, a moderately positive reaction is likely, based on the provision of improved new two-way structures with larger radii curves. Other options are likely to generate a more positive reaction from the public and stakeholders. |
| Environmental and social: | 0 | No significant sites for local iwi have been identified along this corridor. No outstanding natural landscapes are identified and this option is likely to have minimal impact on the environment in comparison with other options. This option follows the existing alignment close to the Matakohe township, maintaining access to that community. |
| Safety: | + | The option performs better than the Do-Minimum from a safety perspective with two new two lane bridges along a straighter alignment, providing greater clarity of movement and priority, giving a + score. It also provides shoulders for cycling. |
| Economy: | ++ | Journey times for freight and tourism will be slightly reduced and travel time reliability slightly improved as a result of the option. |
| Environmental opportunities | | This option disturbs the CMA to a lesser degree than other options, minimising environmental effects, although it is located closer to sensitive environments than the northern alignment. |
| Social opportunities | | This option continues the road in its existing location adjacent to Matakohe township. Clear signage is recommended and appropriate intersection design to ensure safe access to the township is maintained. |
| Rationale for selection or rejection of alternative: | | This option ranked 3 rd of those assessed. Although it delivers some benefits, it meets the described Investment Objectives the least well of the options considered. It somewhat enhances resilience and economic opportunities in the area and slightly improves the legibility of the travel route. It is relatively expensive in relation to the benefits it delivers. |

ASSESSMENT SUMMARY TABLE – SOUTHERN ALIGNMENT

| | | | | | |
|---|---|--|---------------------------------------|--------------------|-------|
| Business case name: | SH10 Matakohe Bridges | Name of Project Manager & Region: | Vivianne Tadros, Auckland / Northland | | |
| Business case purpose: | To upgrade the Matakohe Bridges to improve the safety, resilience and economic performance of the Northland region. | | | | |
| Option description: | <p>This group of options recommends removing the two existing tight radii curves and replacing them with a single curve with a much larger radius. Several alignments have been grouped together for this long list evaluation stage as they comprise relatively similar characteristics. These options are shown in the covering picture to this note.</p> <p>Dependencies : None</p>  <p>LEGEND</p> <ul style="list-style-type: none"> EXISTING S/L 10 URS 2008 OPTION 11 MANUREWA DEP OPTION 2 (2) MINISTRY OF WORKS 1988 OPTION 1 BECAVE CONSULTANCY 1989 OPTION 8 BECAVE CONSULTANCY 1989 OPTION 17 AND USE SECTION 4 MANUREWA DEP OPTION 1 MANUREWA DEP OPTION 2 OPTION 3 OPTION 4 OPTION 5 OPTION 6 OPTION 7 OPTION 8 OPTION 9 OPTION 10 BRIDGE LOCATION <p>Southern alignment</p> | | | | |
| Estimated total public sector funding requirement: | Capital cost (\$m): Net property cost (\$m): Opex (\$m/30yr): Maintenance (\$m/30yr): Present value of cost to govt. (\$m): | Lower | Upper | | |
| Estimated BCR range: | | | | | |
| Timing of need: | Optimal programme: | | Likely: | | |
| IAF profile: | Strategic fit: | H/M/L | Effectiveness: H/M/L | Efficiency: | H/M/L |

| MULTI CRITERIA ASSESSMENT –SOUTHERN ALIGNMENT | | |
|---|--|--|
| Criterion | Score | Discussion |
| Objective 1: Economic Growth and Resilience | ++ | This option offers an improvement against the Do Minimum. It reduces travel time and increases the resilience of SH12 and the wider Northland region. It improves the legibility of the SH12 route for tourists. However, it does not reduce travel times as much as the northern alignment. This results in a ++ rating. |
| Objective 2: Safety | ++ | The option performs well from a safety perspective with a two lane bridge along a straighter alignment with a single larger radius curve providing greater clarity of movement. It removes the confusion associated with single lane bridges, giving a ++ score. It also provides shoulders for cycling. |
| Feasibility: | 0 | This option scored 0 overall with respect to feasibility. Whole of life costs were relatively low, compared with other options. The overall design is considered straightforward, however there are risks associated with consenting in the coastal marine area. Construction will need to minimise disturbance in the CMA and minimise potential sedimentation of the harbour. |
| Affordability: | 0 | This option scored 0 overall for affordability. Although it delivers fewer benefits than other options, but is also less expensive. |
| Public/Stakeholders: | + | The options have not been made public. However, a slightly positive reaction is likely as it significantly improves the existing alignment. However, the structure is expected to encroach into the harbour in comparison with the existing alignment. Iwi may not view this option favourably. |
| Environmental and social: | - | A large amount of disturbance is required in the coastal marine area during construction and operation of this option. A significant volume of mangroves and marine mud will need to be disturbed during construction, causing sediment runoff issues that can be hard to manage. For this option to be preferred, alternatives that require minimal coastal marine disturbance should be investigated and discounted. During operation, the new and more numerous piles will alter water flushing into the harbour. This is likely to encourage further deposition of sediment, further blocking the harbour. For this option to be preferred, detailed hydrological and ecological expert evidence that the bridge would not increase sedimentation would be required. |
| Safety: | ++ | The option performs well from a safety perspective with a two lane bridge along a straighter alignment with a single larger radius curve providing greater clarity of movement. It removes the confusion associated with single lane bridges, giving a ++ score. It also provides shoulders for cycling. |
| Economy: | ++ | Journey times for freight and tourism will be reduced (although to a lesser extent than the northern alignment) and travel time reliability will improve as a result of the option. |
| Environmental opportunities | This option is likely to dis-benefit the environment due to the extent of coastal marine disturbance and deposition of sediment expected. | |
| Social opportunities | This option continues the road in its existing location adjacent to Matakohē township. Clear signage is recommended and appropriate intersection design to ensure safe access to the township is maintained. | |

Rationale for selection or rejection of alternative:

This option ranked **2nd** of those assessed. It meets the described Investment Objectives relatively well by enhancing resilience and economic opportunities in the area and increasing the legibility of the travel route. It also has a relatively low cost in comparison with other options.

However, this option is considered to have the greatest impact on the adjacent environment, with the greatest visual effects, greatest coastal marine disturbance and likelihood of increased sedimentation.

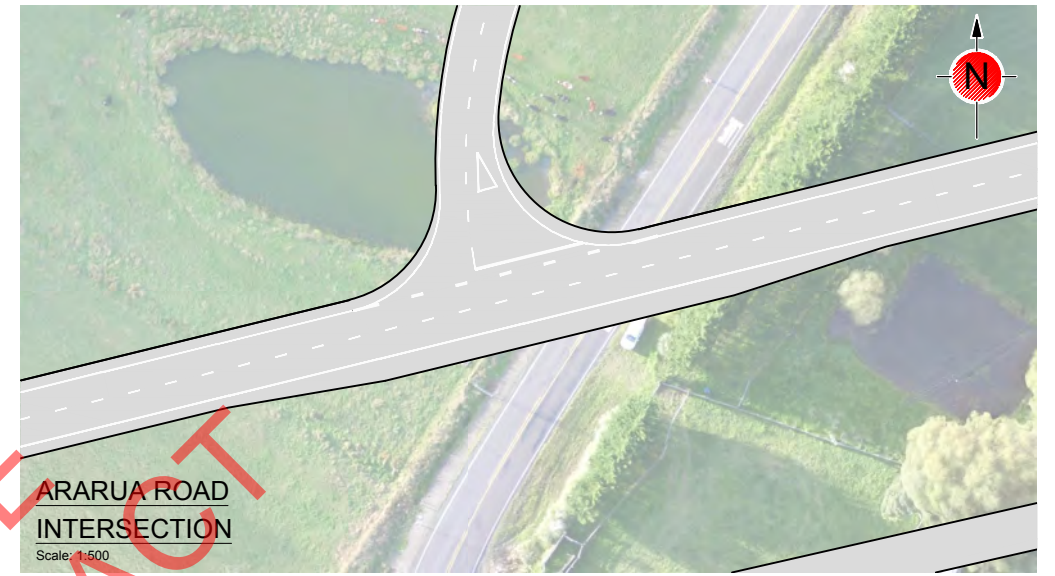
RELEASED UNDER THE
OFFICIAL INFORMATION ACT

APPENDIX D. RECOMMENDED OPTION DRAWINGS

RELEASED UNDER THE
OFFICIAL INFORMATION ACT

| | |
|---------|---|
| Survey | - |
| Design | - |
| Checked | - |
| Date | - |

300 mm



200

100

50

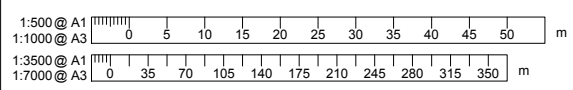
10 mm

0



OFFICIAL INFORMATION ACT

FOR INFORMATION



| Revision | Amendment | Approved | Revision Date |
|----------|------------------------|----------|---------------|
| A | ISSUED FOR INFORMATION | CJP | 2016-06-08 |
| | | | |
| | | | |
| | | | |
| | | | |



OPUS
Whangarei Office
+64 9 430 1700

125A Bank Street
PO Box 553
Whangarei 0110

| | | |
|-------------|---------------------|---------------|
| Designed | Approved | Approved Date |
| C. PARKER | - | - |
| Drawn | Scales | |
| C. HOULTHAM | 1:500, 1:3500 AT A1 | |

| | |
|---|-----------------------|
| Project | |
| NZ Transport Agency MATAKOHE ONE LANE BRIDGE; S.H.12 ONE LANE BRIDGES | R.P.185/10.95 - 14.30 |
| Sheet | |
| GENERAL ARRANGEMENT PLAN | |
| Project No. | Sheet No. / Revision |
| 1-11717.03 | C11 / A |

APPENDIX E. ECONOMIC EVALUATION

RELEASED UNDER THE
OFFICIAL INFORMATION ACT

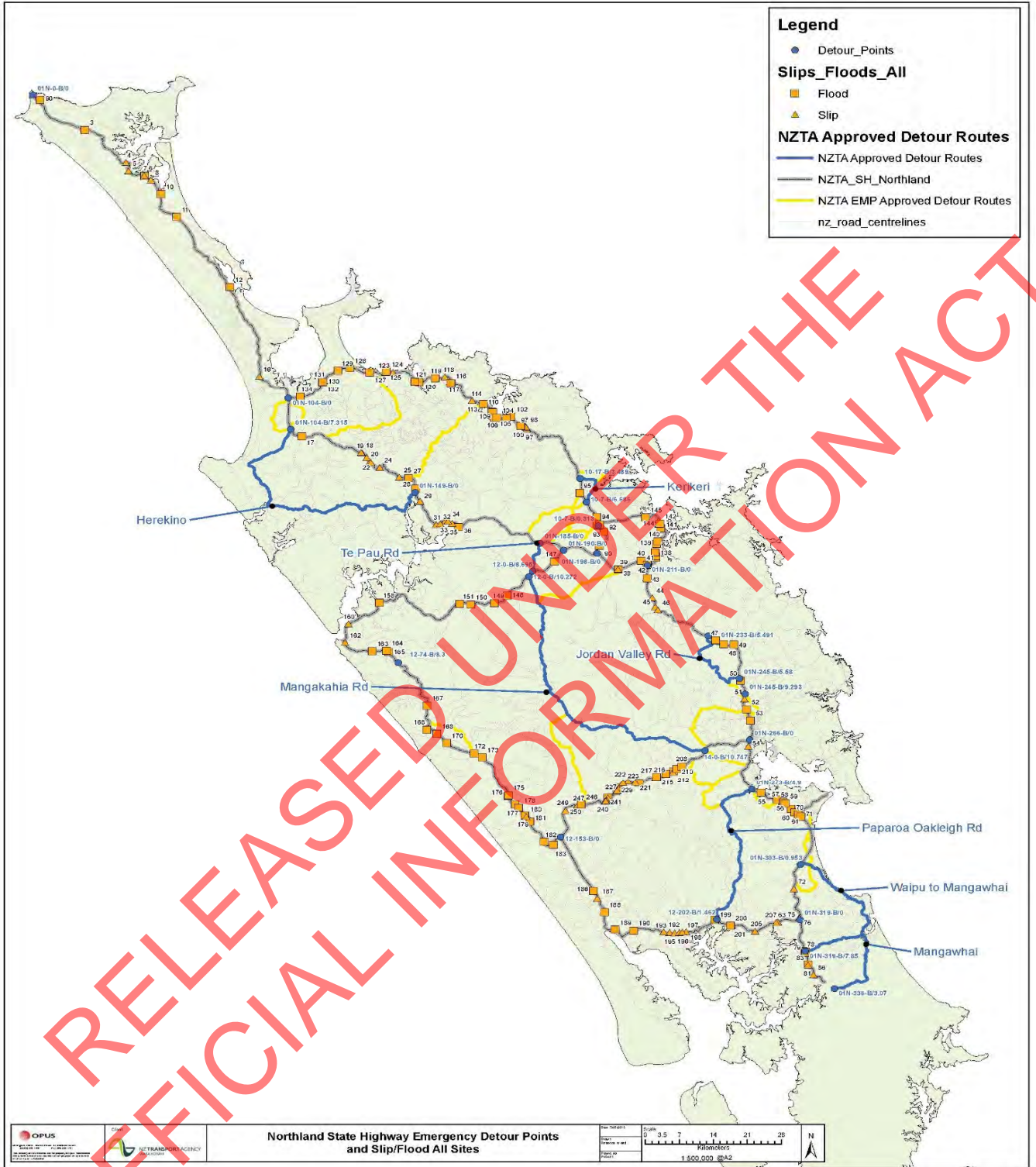
Matakohe, Replacement of One Lane Bridges Economic Summary

| NPV Benefits | NPV \$ | Comment |
|--|----------------------|--|
| Travel Time Costs - Delays at Bridge | \$ 543,630 | Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988) |
| Travel Time Costs - Detours for Closures | \$ 117,639 | Detours as per Fig.13 NZTA Approved Detours |
| Travel Time Costs - New Alignment | \$ 8,707,643 | As per EEM |
| Vehicle Operating Costs - Delays at Bridge | \$ 26,087 | Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988) |
| Vehicle Operating Costs - Detours for Closures | \$ 82,173 | Detours as per Fig.13 NZTA Approved Detours |
| Vehicle Operating Costs - New Alignment | \$ 3,402,080 | As per EEM |
| Crash Costs 1-Lane vs 2-Lane | \$ 8,828,651 | As per EEM |
| Crash Costs - Detours for Closures | \$ 38,291 | Additional Traffic on network |
| Crash Costs - New Alignment | \$ 5,199,242 | As per EEM |
| Emissions | \$ 175,517 | 5% of VOC as per EEM A9.6 |
| Network Resilience | \$ 5,126,570 | HPMV Waiting time during SH1 Closures |
| Wider Economic Benefits of reduced closures | \$ 3,804 | Used Results from 2013 Network resilience case |
| Total Benefits | \$ 32,251,326 | |
| NPV Costs | | |
| Do-Min - New Bridges in Year 20 | \$ 2,769,392 | Assumed 20 year life in existing bridge |
| Do-Min - Additional Maintenance Costs | \$ 28,204 | |
| Subtotal: NPV Do-Min Costs | \$ 2,797,596 | |
| Option - New Bridges in Year 0 | \$ 11,899,403 | |
| Option - New Alignment | \$ 13,419,647 | |
| Subtotal: NPV Option Costs | \$ 25,319,050 | |
| Net Costs | \$ 22,521,454 | |
| Indicative BCR | 1.43 | |

Matakohe Bridges + Realignment - Site Location, SH12 RP 185/10.87 to 14.31



NZTA Approved Detours



| Matakohe Bridges - SH1 HPMV closures | | | | | | | |
|--------------------------------------|---------------|------------------|------------------|----------------------|-------------|---|------------------------|
| # | State Highway | Start Location | End Location | Impact | Description | Event Comments | Event Duration (hh.mm) |
| 70 | 1N | 01N-0261/02.43-D | 01N-0261/02.43-D | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 3.05 |
| 30 | 1N | 01N-0261/02.43-I | 01N-0261/02.43-I | Road Closed | Crash | Crash On St Hwy 1 In Whangarei At Intersection With Manse Street. Southbound Lane Is Closed At Manse Street Intersection. Diversions In Place On Northbound Lane On St Hwy 1 Which Is Open To Two-way Traffic. | 4.04 |
| 61 | 1N | 01N-0261/03.89 | 01N-0261/03.89 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. | 5.53 |
| 65 | 1N | 01N-0261/04.25 | 01N-0261/04.25 | Road Closed | Other | Utilities Disruption | 0.12 |
| 97 | 1N | 01N-0266/00.18 | 01N-0266/00.18 | Road Closed | Other | Otaika Road (sh1) Is Closed Between Maunu Road And Tarewa Road Due To A Gas Leak. | 0.2 |
| 35 | 1N | 01N-0266/00.34 | 01N-0266/00.34 | Road Closed | Flooding | State Highway01 At The Otaika Road Intersection With Matipo Place In Whangarei Flooding | 13.45 |
| 71 | 1N | 01N-0266/00.88 | 01N-0266/00.88 | Road Closed | Crash | Police Advise Of A Motor Vehicle Accident In The Area Near Raumanga Valley Road. Caution Is Advised, Take Extra Care, Expect Some Delays. | 3.24 |
| 104 | 1N | 01N-0266/02.09 | 01N-0266/02.09 | Road Closed | Crash | Road Has Been Reopened | 1.23 |
| 106 | 1N | 01N-0266/02.29 | 01N-0266/02.29 | Road Closed | Crash | Due To A Serious Incident In This Area The Road Is Closed Southbound. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route. | 1.11 |
| 46 | 1N | 01N-0266/03.53 | 01N-0266/03.53 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 0.18 |
| 64 | 1N | 01N-0266/05.20 | 01N-0266/05.20 | Road Closed | Crash | Due To A Crash Sh1 Is Closed At Otaika In Both Directions. Avoid This Area Or Delay Your Trip | 1.26 |
| 95 | 1N | 01N-0266/05.73 | 01N-0266/05.73 | Road Closed | Crash | Road Is Now Open. | 2.38 |
| 66 | 1N | 01N-0266/06.37 | 01N-0266/06.37 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 5.04 |
| 60 | 1N | 01N-0266/06.47 | 01N-0266/06.47 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 0.49 |
| 109 | 1N | 01N-0273/03.68 | 01N-0273/03.68 | Road Closed | Crash | Due To A Serious Incident In This Area The Road Is Closed. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route. | 3.15 |
| 2 | 1N | 01N-0273/04.57 | 01N-0273/04.57 | Road Closed | Crash | Sh1 Fatal Vehicle Accident Diversions In Place | 1.56 |
| 117 | 1N | 01N-0273/07.94 | 01N-0273/09.06 | Vehicle Restrictions | Road Works | Call Came Through From Police Asking If The 50km/h Speed Restriction Signs Can Be Removed, As The Roadworks Has Been Completed And Road Has Been Swept. Cones Have Been Pushed To The Side Of The Road. | 0.33 |
| 103 | 1N | 01N-0292/01.24 | 01N-0292/01.24 | Road Closed | Crash | Due To A Serious Crash This Section Of Highway Is Closed. Expect Delays Or Avoid The Area If Possible. | 2.36 |
| 73 | 1N | 01N-0292/01.96 | 01N-0292/01.96 | Road Closed | Crash | Due To An Incident, This Section Of The Highway Is Closed. Avoid This Area Or Delay Your Trip If Possible. | 6.02 |
| 10 | 1N | 01N-0292/10.10 | 01N-0292/10.10 | Road Closed | Crash | Vehicle Accident. | 3.44 |
| 98 | 1N | 01N-0303/00.00 | 01N-0303/00.00 | Road Closed | Crash | Incident Cleared | 3.39 |
| 12 | 1N | 01N-0303/00.20 | 01N-0303/00.20 | Road Closed | Crash | Fatal Car Accident - Diversions Needed. Northern Diversion : Waipu Gorge Road. Southern Diversion: Sh12. Needed Asap. | 0.37 |
| 5 | 1N | 01N-0303/00.29 | 01N-0303/15.63 | Road Closed | Other | Emergency Maintenance Work On Tuesday 21st October From 6.30am To 7.30pm. | 13 |
| 51 | 1N | 01N-0303/10.13 | 01N-0303/10.13 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 3.39 |
| 88 | 1N | 01N-0303/12.82 | 01N-0303/12.82 | Road Closed | Resurfacing | Due To Road Surface Improvement Works, On The Southern Side Of The Brynderwyns, Allow An Extra 30-45min Driving Time For The Detours During Overnight Closures. Sh1 Will Be Closed From 6.45pm - 5am Each Night From April 6 To The Morning Of April 10 | 250.15 |
| 89 | 1N | 01N-0303/12.82 | 01N-0303/12.82 | Road Closed | Resurfacing | Sh1, At The Brynderwyn Hills, Will Close Overnight For Surface Improvement Road Works. The Road Will Be Closed Between 6:45pm Tonight And 5am Tomorrow. A Signposted Detour Will Be In Place. For More Info Plus Maps, Visit www.highwayinfo.govt.nz | 10.15 |

| Matakohe Bridges - SH1 HPMV closures | | | | | | | |
|--------------------------------------|---------------|----------------|----------------|-------------|------------------|---|------------------------|
| # | State Highway | Start Location | End Location | Impact | Description | Event Comments | Event Duration (hh.mm) |
| 63 | 1N | 01N-0303/12.94 | 01N-0303/12.94 | Road Closed | Crash | Due To A Crash This Portion Of Sh1 Is Closed. Expect Delays. Avoid This Area Or Delay Trip If Possible | 5.28 |
| 115 | 1N | 01N-0303/13.46 | 01N-0303/13.46 | Road Closed | Maintenance | Due To Road Works In This Area This Section Of Highway Will Be Closed. A Detour Will Be In Place. Follow Instructions From Traffic Management On Scene. Allow An Extra 30 To 45 Minutes To Your Journey. | 11 |
| 84 | 1N | 01N-0303/14.88 | 01N-0303/14.88 | Road Closed | Crash | Due To An Incident On The Southern Side Of The Brynderwyns The Road Is Now Closed. Expect Delays. Avoid This Area Or Delay Trip If Possible. | 3.37 |
| 94 | 1N | 01N-0303/15.03 | 01N-0303/15.03 | Road Closed | Crash | The Road Is Now Open. | 5.11 |
| 17 | 1N | 01N-0303/15.05 | 01N-0303/15.05 | Road Closed | Pavement Repairs | Night Time Closures For A 3 Week Period. Week 1 Road Will Be Closed From Monday To Thursday. Last 2 Weeks Road Will Be Closed From Tuesday To Thursday. Closures Start 9th Nov At 8pm | 10 |
| 91 | 1N | 01N-0303/15.08 | 01N-0303/15.08 | Road Closed | Crash | Road Now Fully Open. | 4.5 |
| 26 | 1N | 01N-0303/15.09 | 01N-0303/15.09 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 86 | 1N | 01N-0303/15.15 | 01N-0303/15.15 | Road Closed | Crash | A Two Vehicle Crash Involving Serious Injury Has Required The Highway To Be Closed. | 1.08 |
| 24 | 1N | 01N-0303/15.16 | 01N-0303/15.16 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 16 | 1N | 01N-0303/15.24 | 01N-0303/15.24 | Road Closed | Pavement Repairs | Night Time Closures For A 3 Week Period. Tuesday To Thursday Starting 9th November. | 10 |
| 25 | 1N | 01N-0303/15.24 | 01N-0303/15.24 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 23 | 1N | 01N-0303/15.29 | 01N-0303/15.29 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 27 | 1N | 01N-0303/15.33 | 01N-0303/15.33 | Road Closed | Resurfacing | Night Time Closures. Road Will Be Closed From Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 21 | 1N | 01N-0303/15.38 | 01N-0303/15.38 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am. | 10 |
| 20 | 1N | 01N-0303/15.40 | 01N-0303/15.40 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am. | 10 |
| 19 | 1N | 01N-0303/15.42 | 01N-0303/15.42 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period. Week 1 Road Will Be Closed From Monday To Thursday. Last 2 Weeks Road Will Be Closed From Tuesday To Thursday. Closures Start 9th Nov At 8pm And Reopening At 6am. | 10 |
| 39 | 1N | 01N-0303/15.70 | 01N-0303/15.70 | Road Closed | Slip | Landslip On Southbound Lane. North Of Wellsford. Hole In The Road, Was Coned Off But Cones Have Been Moved By Members Of The Public. | 21.04 |
| 22 | 1N | 01N-0303/15.79 | 01N-0303/15.79 | Road Closed | Pavement Repairs | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am. | 10 |

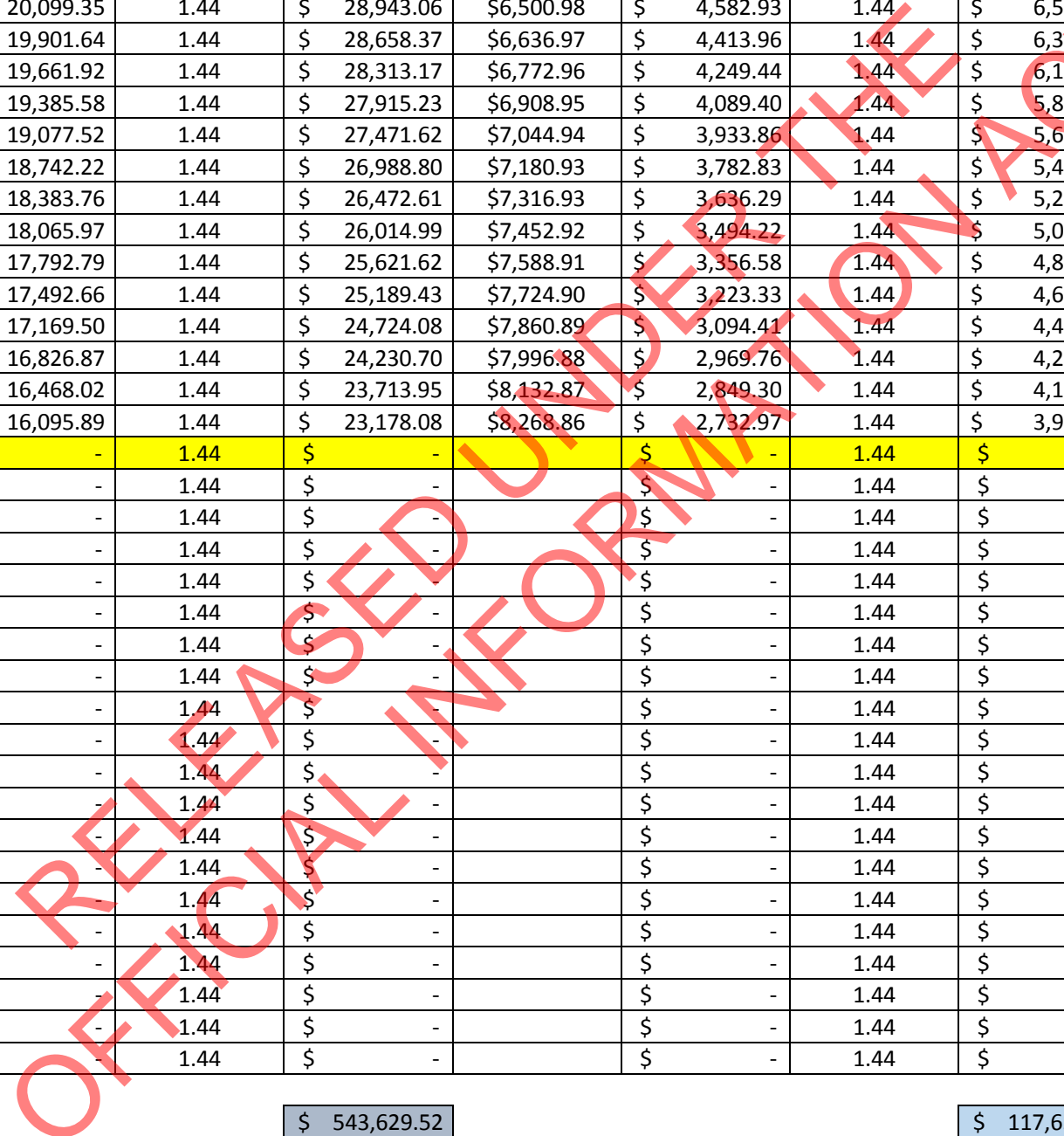
Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM TTC (Delays) | | | | DM TTC (Detours) | | | | DM TTC (HPMV Detours) | | | |
|------|------|-------------|------|-----------------|--------------|---------------|--------------|------------------|-------------|---------------|-------------|-----------------------|---------------|---------------|---------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL |
| 2016 | 0 | 1 | 1923 | \$ 20,596.23 | \$ 20,596.23 | 1.44 | \$ 29,658.57 | \$5,685.03 | \$ 5,685.03 | 1.44 | \$ 8,186.44 | \$ 238,421.35 | \$ 238,421.35 | 1.44 | \$ 343,326.75 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 21,671.89 | \$ 20,445.18 | 1.44 | \$ 29,441.06 | \$5,821.02 | \$ 5,491.53 | 1.44 | \$ 7,907.80 | \$ 245,573.99 | \$ 231,673.58 | 1.44 | \$ 333,609.95 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 22,857.69 | \$ 20,343.26 | 1.44 | \$ 29,294.30 | \$5,957.01 | \$ 5,301.72 | 1.44 | \$ 7,634.48 | \$ 252,726.63 | \$ 224,925.80 | 1.44 | \$ 323,893.16 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 24,271.09 | \$ 20,378.48 | 1.44 | \$ 29,345.01 | \$6,093.00 | \$ 5,115.80 | 1.44 | \$ 7,366.76 | \$ 259,879.27 | \$ 218,199.65 | 1.44 | \$ 314,207.50 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 25,684.50 | \$ 20,344.53 | 1.44 | \$ 29,296.12 | \$6,228.99 | \$ 4,933.95 | 1.44 | \$ 7,104.88 | \$ 267,031.92 | \$ 211,514.29 | 1.44 | \$ 304,580.57 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 27,097.90 | \$ 20,249.13 | 1.44 | \$ 29,158.75 | \$6,364.99 | \$ 4,756.29 | 1.44 | \$ 6,849.05 | \$ 274,184.56 | \$ 204,886.65 | 1.44 | \$ 295,036.78 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 28,511.31 | \$ 20,099.35 | 1.44 | \$ 28,943.06 | \$6,500.98 | \$ 4,582.93 | 1.44 | \$ 6,599.42 | \$ 281,337.20 | \$ 198,331.62 | 1.44 | \$ 285,597.54 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 29,924.71 | \$ 19,901.64 | 1.44 | \$ 28,658.37 | \$6,636.97 | \$ 4,413.96 | 1.44 | \$ 6,356.11 | \$ 288,489.84 | \$ 191,862.22 | 1.44 | \$ 276,281.59 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 31,338.12 | \$ 19,661.92 | 1.44 | \$ 28,313.17 | \$6,772.96 | \$ 4,249.44 | 1.44 | \$ 6,119.19 | \$ 295,642.48 | \$ 185,489.75 | 1.44 | \$ 267,105.24 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 32,751.52 | \$ 19,385.58 | 1.44 | \$ 27,915.23 | \$6,908.95 | \$ 4,089.40 | 1.44 | \$ 5,888.73 | \$ 302,795.12 | \$ 179,223.97 | 1.44 | \$ 258,082.51 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 34,164.93 | \$ 19,077.52 | 1.44 | \$ 27,471.62 | \$7,044.94 | \$ 3,933.86 | 1.44 | \$ 5,664.76 | \$ 309,947.76 | \$ 173,073.21 | 1.44 | \$ 249,225.42 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 35,578.33 | \$ 18,742.22 | 1.44 | \$ 26,988.80 | \$7,180.93 | \$ 3,782.83 | 1.44 | \$ 5,447.27 | \$ 317,100.40 | \$ 167,044.53 | 1.44 | \$ 240,544.13 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 36,991.74 | \$ 18,383.76 | 1.44 | \$ 26,472.61 | \$7,316.93 | \$ 3,636.29 | 1.44 | \$ 5,236.25 | \$ 324,253.04 | \$ 161,143.83 | 1.44 | \$ 232,047.11 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 38,533.41 | \$ 18,065.97 | 1.44 | \$ 26,014.99 | \$7,452.92 | \$ 3,494.22 | 1.44 | \$ 5,031.67 | \$ 331,405.68 | \$ 155,375.92 | 1.44 | \$ 223,741.32 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 40,227.79 | \$ 17,792.79 | 1.44 | \$ 25,621.62 | \$7,588.91 | \$ 3,356.58 | 1.44 | \$ 4,833.48 | \$ 338,558.32 | \$ 149,744.67 | 1.44 | \$ 215,632.33 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 41,922.18 | \$ 17,492.66 | 1.44 | \$ 25,189.43 | \$7,724.90 | \$ 3,223.33 | 1.44 | \$ 4,641.60 | \$ 345,710.96 | \$ 144,253.11 | 1.44 | \$ 207,724.47 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 43,616.56 | \$ 17,169.50 | 1.44 | \$ 24,724.08 | \$7,860.89 | \$ 3,094.41 | 1.44 | \$ 4,455.95 | \$ 352,863.60 | \$ 138,903.45 | 1.44 | \$ 200,020.96 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 45,310.94 | \$ 16,826.87 | 1.44 | \$ 24,230.70 | \$7,996.88 | \$ 2,969.76 | 1.44 | \$ 4,276.45 | \$ 360,016.24 | \$ 133,697.22 | 1.44 | \$ 192,524.00 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 47,005.33 | \$ 16,468.02 | 1.44 | \$ 23,713.95 | \$8,132.87 | \$ 2,849.30 | 1.44 | \$ 4,102.99 | \$ 367,168.88 | \$ 128,635.34 | 1.44 | \$ 185,234.89 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 48,699.71 | \$ 16,095.89 | 1.44 | \$ 23,178.08 | \$8,268.86 | \$ 2,732.97 | 1.44 | \$ 3,935.47 | \$ 374,321.52 | \$ 123,718.13 | 1.44 | \$ 178,154.11 |
| 2036 | 20 | 0.311804727 | 2843 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2037 | 21 | 0.294155403 | 2889 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |

\$ 543,629.52

\$ 117,638.76

\$ 5,126,570.33



Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM TTC (Alignment) | | | | OPT TTC (Alignment) | | | | DM VOC (Delays) | | | |
|------|------|-------------|------|--------------------|---------------|---------------|---------------|---------------------|---------------|---------------|---------------|-----------------|-------------|---------------|-------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL |
| 2016 | 0 | 1 | 1923 | \$ 586,694.99 | \$ 586,694.99 | 1.44 | \$ 844,840.79 | \$ 294,285.53 | \$ 294,285.53 | 1.44 | \$ 423,771.16 | \$ 1,495.49 | \$ 1,495.49 | 1 | \$ 1,495.49 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 600,775.67 | \$ 566,769.50 | 1.44 | \$ 816,148.08 | \$ 301,348.38 | \$ 284,290.92 | 1.44 | \$ 409,378.93 | \$ 1,563.55 | \$ 1,475.04 | 1 | \$ 1,475.04 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 614,856.35 | \$ 547,219.96 | 1.44 | \$ 787,996.75 | \$ 308,411.23 | \$ 274,484.90 | 1.44 | \$ 395,258.25 | \$ 1,637.94 | \$ 1,457.76 | 1 | \$ 1,457.76 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 628,937.03 | \$ 528,067.66 | 1.44 | \$ 760,417.43 | \$ 315,474.08 | \$ 264,878.12 | 1.44 | \$ 381,424.50 | \$ 1,725.45 | \$ 1,448.72 | 1 | \$ 1,448.72 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 643,017.71 | \$ 509,330.26 | 1.44 | \$ 733,435.57 | \$ 322,536.94 | \$ 255,479.46 | 1.44 | \$ 367,890.43 | \$ 1,812.96 | \$ 1,436.03 | 1 | \$ 1,436.03 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 657,098.39 | \$ 491,022.14 | 1.44 | \$ 707,071.89 | \$ 329,599.79 | \$ 246,296.14 | 1.44 | \$ 354,666.44 | \$ 1,900.46 | \$ 1,420.14 | 1 | \$ 1,420.14 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 671,179.07 | \$ 473,154.76 | 1.44 | \$ 681,342.86 | \$ 336,662.64 | \$ 237,333.88 | 1.44 | \$ 341,760.78 | \$ 1,987.97 | \$ 1,401.44 | 1 | \$ 1,401.44 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 685,259.75 | \$ 455,736.87 | 1.44 | \$ 656,261.10 | \$ 343,725.49 | \$ 228,597.09 | 1.44 | \$ 329,179.80 | \$ 2,075.47 | \$ 1,380.31 | 1 | \$ 1,380.31 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 699,340.43 | \$ 438,774.84 | 1.44 | \$ 631,835.77 | \$ 350,788.35 | \$ 220,088.95 | 1.44 | \$ 316,928.09 | \$ 2,162.98 | \$ 1,357.08 | 1 | \$ 1,357.08 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 713,421.11 | \$ 422,272.86 | 1.44 | \$ 608,072.92 | \$ 357,851.20 | \$ 211,811.58 | 1.44 | \$ 305,008.67 | \$ 2,250.49 | \$ 1,332.06 | 1 | \$ 1,332.06 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 727,501.79 | \$ 406,233.20 | 1.44 | \$ 584,975.81 | \$ 364,914.05 | \$ 203,766.10 | 1.44 | \$ 293,423.19 | \$ 2,337.99 | \$ 1,305.52 | 1 | \$ 1,305.52 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 741,582.47 | \$ 390,656.39 | 1.44 | \$ 562,545.21 | \$ 371,976.91 | \$ 195,952.79 | 1.44 | \$ 282,172.02 | \$ 2,425.50 | \$ 1,277.72 | 1 | \$ 1,277.72 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 755,663.15 | \$ 375,541.44 | 1.44 | \$ 540,779.67 | \$ 379,039.76 | \$ 188,371.15 | 1.44 | \$ 271,254.45 | \$ 2,513.00 | \$ 1,248.89 | 1 | \$ 1,248.89 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 769,743.83 | \$ 360,885.94 | 1.44 | \$ 519,675.76 | \$ 386,102.61 | \$ 181,019.97 | 1.44 | \$ 260,668.76 | \$ 2,608.91 | \$ 1,223.16 | 1 | \$ 1,223.16 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 783,824.51 | \$ 346,686.34 | 1.44 | \$ 499,228.33 | \$ 393,165.46 | \$ 173,897.46 | 1.44 | \$ 250,412.35 | \$ 2,714.80 | \$ 1,200.76 | 1 | \$ 1,200.76 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 797,905.19 | \$ 332,937.96 | 1.44 | \$ 479,430.66 | \$ 400,228.32 | \$ 167,001.29 | 1.44 | \$ 240,481.86 | \$ 2,820.70 | \$ 1,176.98 | 1 | \$ 1,176.98 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 811,985.87 | \$ 319,635.22 | 1.44 | \$ 460,274.72 | \$ 407,291.17 | \$ 160,328.65 | 1.44 | \$ 230,873.26 | \$ 2,926.60 | \$ 1,152.05 | 1 | \$ 1,152.05 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 826,066.55 | \$ 306,771.72 | 1.44 | \$ 441,751.28 | \$ 414,354.02 | \$ 153,876.34 | 1.44 | \$ 221,581.93 | \$ 3,032.50 | \$ 1,126.16 | 1 | \$ 1,126.16 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 840,147.23 | \$ 294,340.37 | 1.44 | \$ 423,850.13 | \$ 421,416.87 | \$ 147,640.79 | 1.44 | \$ 212,602.73 | \$ 3,138.40 | \$ 1,099.52 | 1 | \$ 1,099.52 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 854,227.91 | \$ 282,333.44 | 1.44 | \$ 406,560.15 | \$ 428,479.73 | \$ 141,618.12 | 1.44 | \$ 203,930.10 | \$ 3,244.29 | \$ 1,072.28 | 1 | \$ 1,072.28 |
| 2036 | 20 | 0.311804727 | 2843 | \$ 868,308.59 | \$ 270,742.72 | 1.44 | \$ 389,869.52 | \$ 435,542.58 | \$ 135,804.23 | 1.44 | \$ 195,558.10 | \$ - | \$ - | 1 | \$ - |
| 2037 | 21 | 0.294155403 | 2889 | \$ 882,389.27 | \$ 259,559.57 | 1.44 | \$ 373,765.78 | \$ 442,605.43 | \$ 130,194.78 | 1.44 | \$ 187,480.48 | \$ - | \$ - | 1 | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ 896,469.95 | \$ 248,774.98 | 1.44 | \$ 358,235.97 | \$ 449,668.28 | \$ 124,785.24 | 1.44 | \$ 179,690.75 | \$ - | \$ - | 1 | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ 910,550.63 | \$ 238,379.66 | 1.44 | \$ 343,266.71 | \$ 456,731.14 | \$ 119,570.96 | 1.44 | \$ 172,182.18 | \$ - | \$ - | 1 | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ 924,631.31 | \$ 228,364.10 | 1.44 | \$ 328,844.30 | \$ 463,793.99 | \$ 114,547.17 | 1.44 | \$ 164,947.92 | \$ - | \$ - | 1 | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ 938,711.99 | \$ 218,718.61 | 1.44 | \$ 314,954.80 | \$ 470,856.84 | \$ 109,709.00 | 1.44 | \$ 157,980.96 | \$ - | \$ - | 1 | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ 952,792.67 | \$ 209,433.38 | 1.44 | \$ 301,584.07 | \$ 477,919.69 | \$ 105,051.54 | 1.44 | \$ 151,274.22 | \$ - | \$ - | 1 | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ 966,873.35 | \$ 200,498.55 | 1.44 | \$ 288,717.91 | \$ 484,982.55 | \$ 100,569.84 | 1.44 | \$ 144,820.57 | \$ - | \$ - | 1 | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ 980,954.03 | \$ 191,904.18 | 1.44 | \$ 276,342.01 | \$ 492,045.40 | \$ 96,258.91 | 1.44 | \$ 138,612.83 | \$ - | \$ - | 1 | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ 995,034.71 | \$ 183,640.36 | 1.44 | \$ 264,442.12 | \$ 499,108.25 | \$ 92,113.79 | 1.44 | \$ 132,643.86 | \$ - | \$ - | 1 | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ 1,009,115.39 | \$ 175,697.21 | 1.44 | \$ 253,003.99 | \$ 506,171.11 | \$ 88,129.52 | 1.44 | \$ 126,906.51 | \$ - | \$ - | 1 | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ 1,023,196.07 | \$ 168,064.91 | 1.44 | \$ 242,013.47 | \$ 513,233.96 | \$ 84,301.16 | 1.44 | \$ 121,393.67 | \$ - | \$ - | 1 | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ 1,037,276.75 | \$ 160,733.70 | 1.44 | \$ 231,456.53 | \$ 520,296.81 | \$ 80,623.84 | 1.44 | \$ 116,098.33 | \$ - | \$ - | 1 | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ 1,051,357.43 | \$ 153,693.97 | 1.44 | \$ 221,319.32 | \$ 527,359.66 | \$ 77,092.72 | 1.44 | \$ 111,013.51 | \$ - | \$ - | 1 | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ 1,065,438.11 | \$ 146,936.20 | 1.44 | \$ 211,588.13 | \$ 534,422.52 | \$ 73,703.03 | 1.44 | \$ 106,132.36 | \$ - | \$ - | 1 | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ 1,079,518.79 | \$ 140,451.03 | 1.44 | \$ 202,249.48 | \$ 541,485.37 | \$ 70,450.07 | 1.44 | \$ 101,448.10 | \$ - | \$ - | 1 | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ 1,093,599.47 | \$ 134,229.24 | 1.44 | \$ 193,290.11 | \$ 548,548.22 | \$ 67,329.23 | 1.44 | \$ 96,954.09 | \$ - | \$ - | 1 | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ 1,107,680.15 | \$ 128,261.81 | 1.44 | \$ 184,697.00 | \$ 555,611.07 | \$ 64,335.97 | 1.44 | \$ 92,643.80 | \$ - | \$ - | 1 | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ 1,121,760.83 | \$ 122,539.86 | 1.44 | \$ 176,457.40 | \$ 562,673.93 | \$ 61,465.85 | 1.44 | \$ 88,510.83 | \$ - | \$ - | 1 | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ 1,135,841.51 | \$ 117,054.74 | 1.44 | \$ 168,558.82 | \$ 569,736.78 | \$ 58,714.52 | 1.44 | \$ 84,548.91 | \$ - | \$ - | 1 | \$ - |
| | | | | \$ 17,471,152.3 | | | | \$ 8,763,509.7 | | | | \$ 26,087.11 | | | |

Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM VOC (Detours) | | | | DM VOC (Alignment) | | | | OPT VOC (Alignment) | | | |
|------|------|-------------|------|------------------|-------------|---------------|-------------|--------------------|---------------|---------------|---------------|---------------------|---------------|---------------|---------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL |
| 2016 | 0 | 1 | 1923 | \$ 5,718.41 | \$ 5,718.41 | 1 | \$ 5,718.41 | \$ 582,481.16 | \$ 582,481.16 | 1 | \$ 582,481.16 | \$ 417,969.06 | \$ 417,969.06 | 1 | \$ 417,969.06 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 5,855.20 | \$ 5,523.77 | 1 | \$ 5,523.77 | \$ 596,460.71 | \$ 562,698.78 | 1 | \$ 562,698.78 | \$ 428,000.32 | \$ 403,773.89 | 1 | \$ 403,773.89 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 5,991.99 | \$ 5,332.85 | 1 | \$ 5,332.85 | \$ 610,440.26 | \$ 543,289.66 | 1 | \$ 543,289.66 | \$ 438,031.58 | \$ 389,846.55 | 1 | \$ 389,846.55 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 6,128.78 | \$ 5,145.84 | 1 | \$ 5,145.84 | \$ 624,419.80 | \$ 524,274.91 | 1 | \$ 524,274.91 | \$ 448,062.84 | \$ 376,202.20 | 1 | \$ 376,202.20 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 6,265.56 | \$ 4,962.91 | 1 | \$ 4,962.91 | \$ 638,399.35 | \$ 505,672.08 | 1 | \$ 505,672.08 | \$ 458,094.09 | \$ 362,853.43 | 1 | \$ 362,853.43 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 6,402.35 | \$ 4,784.21 | 1 | \$ 4,784.21 | \$ 652,378.90 | \$ 487,495.47 | 1 | \$ 487,495.47 | \$ 468,125.35 | \$ 349,810.50 | 1 | \$ 349,810.50 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 6,539.14 | \$ 4,609.84 | 1 | \$ 4,609.84 | \$ 666,358.45 | \$ 469,756.41 | 1 | \$ 469,756.41 | \$ 478,156.61 | \$ 337,081.54 | 1 | \$ 337,081.54 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 6,675.93 | \$ 4,439.88 | 1 | \$ 4,439.88 | \$ 680,338.00 | \$ 452,463.62 | 1 | \$ 452,463.62 | \$ 488,187.87 | \$ 324,672.81 | 1 | \$ 324,672.81 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 6,812.72 | \$ 4,274.39 | 1 | \$ 4,274.39 | \$ 694,317.54 | \$ 435,623.42 | 1 | \$ 435,623.42 | \$ 498,219.12 | \$ 312,588.84 | 1 | \$ 312,588.84 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 6,949.51 | \$ 4,113.41 | 1 | \$ 4,113.41 | \$ 708,297.09 | \$ 419,239.96 | 1 | \$ 419,239.96 | \$ 508,250.38 | \$ 300,832.62 | 1 | \$ 300,832.62 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 7,086.30 | \$ 3,956.95 | 1 | \$ 3,956.95 | \$ 722,276.64 | \$ 403,315.50 | 1 | \$ 403,315.50 | \$ 518,281.64 | \$ 289,405.76 | 1 | \$ 289,405.76 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 7,223.09 | \$ 3,805.04 | 1 | \$ 3,805.04 | \$ 736,256.19 | \$ 387,850.58 | 1 | \$ 387,850.58 | \$ 528,312.90 | \$ 278,308.64 | 1 | \$ 278,308.64 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 7,359.88 | \$ 3,657.64 | 1 | \$ 3,657.64 | \$ 750,235.74 | \$ 372,844.18 | 1 | \$ 372,844.18 | \$ 538,344.15 | \$ 267,540.55 | 1 | \$ 267,540.55 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 7,496.67 | \$ 3,514.73 | 1 | \$ 3,514.73 | \$ 764,215.28 | \$ 358,293.95 | 1 | \$ 358,293.95 | \$ 548,375.41 | \$ 257,099.79 | 1 | \$ 257,099.79 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 7,633.46 | \$ 3,376.29 | 1 | \$ 3,376.29 | \$ 778,194.83 | \$ 344,196.32 | 1 | \$ 344,196.32 | \$ 558,406.67 | \$ 246,983.81 | 1 | \$ 246,983.81 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 7,770.25 | \$ 3,242.25 | 1 | \$ 3,242.25 | \$ 792,174.38 | \$ 330,546.69 | 1 | \$ 330,546.69 | \$ 568,437.93 | \$ 237,189.29 | 1 | \$ 237,189.29 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 7,907.04 | \$ 3,112.58 | 1 | \$ 3,112.58 | \$ 806,153.93 | \$ 317,339.50 | 1 | \$ 317,339.50 | \$ 578,469.18 | \$ 227,712.24 | 1 | \$ 227,712.24 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 8,043.83 | \$ 2,987.19 | 1 | \$ 2,987.19 | \$ 820,133.48 | \$ 304,568.39 | 1 | \$ 304,568.39 | \$ 588,500.44 | \$ 218,548.12 | 1 | \$ 218,548.12 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 8,180.62 | \$ 2,866.03 | 1 | \$ 2,866.03 | \$ 834,113.02 | \$ 292,226.32 | 1 | \$ 292,226.32 | \$ 598,531.70 | \$ 209,691.86 | 1 | \$ 209,691.86 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 8,317.41 | \$ 2,749.01 | 1 | \$ 2,749.01 | \$ 848,092.57 | \$ 280,305.63 | 1 | \$ 280,305.63 | \$ 608,562.96 | \$ 201,137.98 | 1 | \$ 201,137.98 |
| 2036 | 20 | 0.311804727 | 2843 | \$ - | \$ - | 1 | \$ - | \$ 862,072.12 | \$ 268,798.16 | 1 | \$ 268,798.16 | \$ 618,594.22 | \$ 192,880.60 | 1 | \$ 192,880.60 |
| 2037 | 21 | 0.294155403 | 2889 | \$ - | \$ - | 1 | \$ - | \$ 876,051.67 | \$ 257,695.33 | 1 | \$ 257,695.33 | \$ 628,625.47 | \$ 184,913.58 | 1 | \$ 184,913.58 |
| 2038 | 22 | 0.277505097 | 2935 | \$ - | \$ - | 1 | \$ - | \$ 890,031.21 | \$ 246,988.20 | 1 | \$ 246,988.20 | \$ 638,656.73 | \$ 177,230.50 | 1 | \$ 177,230.50 |
| 2039 | 23 | 0.261797261 | 2981 | \$ - | \$ - | 1 | \$ - | \$ 904,010.76 | \$ 236,667.54 | 1 | \$ 236,667.54 | \$ 648,687.99 | \$ 169,824.74 | 1 | \$ 169,824.74 |
| 2040 | 24 | 0.246978548 | 3027 | \$ - | \$ - | 1 | \$ - | \$ 917,990.31 | \$ 226,723.91 | 1 | \$ 226,723.91 | \$ 658,719.25 | \$ 162,689.52 | 1 | \$ 162,689.52 |
| 2041 | 25 | 0.232998631 | 3073 | \$ - | \$ - | 1 | \$ - | \$ 931,969.86 | \$ 217,147.70 | 1 | \$ 217,147.70 | \$ 668,750.50 | \$ 155,817.95 | 1 | \$ 155,817.95 |
| 2042 | 26 | 0.219810029 | 3119 | \$ - | \$ - | 1 | \$ - | \$ 945,949.41 | \$ 207,929.17 | 1 | \$ 207,929.17 | \$ 678,781.76 | \$ 149,203.04 | 1 | \$ 149,203.04 |
| 2043 | 27 | 0.207367952 | 3165 | \$ - | \$ - | 1 | \$ - | \$ 959,928.95 | \$ 199,058.50 | 1 | \$ 199,058.50 | \$ 688,813.02 | \$ 142,837.74 | 1 | \$ 142,837.74 |
| 2044 | 28 | 0.195630143 | 3211 | \$ - | \$ - | 1 | \$ - | \$ 973,908.50 | \$ 190,525.86 | 1 | \$ 190,525.86 | \$ 698,844.28 | \$ 136,715.01 | 1 | \$ 136,715.01 |
| 2045 | 29 | 0.184556739 | 3257 | \$ - | \$ - | 1 | \$ - | \$ 987,888.05 | \$ 182,321.40 | 1 | \$ 182,321.40 | \$ 708,875.53 | \$ 130,827.76 | 1 | \$ 130,827.76 |
| 2046 | 30 | 0.174110131 | 3303 | \$ - | \$ - | 1 | \$ - | \$ 1,001,867.60 | \$ 174,435.30 | 1 | \$ 174,435.30 | \$ 718,906.79 | \$ 125,168.96 | 1 | \$ 125,168.96 |
| 2047 | 31 | 0.16425484 | 3349 | \$ - | \$ - | 1 | \$ - | \$ 1,015,847.15 | \$ 166,857.81 | 1 | \$ 166,857.81 | \$ 728,938.05 | \$ 119,731.60 | 1 | \$ 119,731.60 |
| 2048 | 32 | 0.154957397 | 3395 | \$ - | \$ - | 1 | \$ - | \$ 1,029,826.69 | \$ 159,579.26 | 1 | \$ 159,579.26 | \$ 738,969.31 | \$ 114,508.76 | 1 | \$ 114,508.76 |
| 2049 | 33 | 0.146186223 | 3441 | \$ - | \$ - | 1 | \$ - | \$ 1,043,806.24 | \$ 152,590.09 | 1 | \$ 152,590.09 | \$ 749,000.56 | \$ 109,493.56 | 1 | \$ 109,493.56 |
| 2050 | 34 | 0.137911531 | 3487 | \$ - | \$ - | 1 | \$ - | \$ 1,057,785.79 | \$ 145,880.86 | 1 | \$ 145,880.86 | \$ 759,031.82 | \$ 104,679.24 | 1 | \$ 104,679.24 |
| 2051 | 35 | 0.130105218 | 3533 | \$ - | \$ - | 1 | \$ - | \$ 1,071,765.34 | \$ 139,442.26 | 1 | \$ 139,442.26 | \$ 769,063.08 | \$ 100,059.12 | 1 | \$ 100,059.12 |
| 2052 | 36 | 0.122740772 | 3579 | \$ - | \$ - | 1 | \$ - | \$ 1,085,744.88 | \$ 133,265.17 | 1 | \$ 133,265.17 | \$ 779,094.34 | \$ 95,626.64 | 1 | \$ 95,626.64 |
| 2053 | 37 | 0.115793181 | 3625 | \$ - | \$ - | 1 | \$ - | \$ 1,099,724.43 | \$ 127,340.59 | 1 | \$ 127,340.59 | \$ 789,125.59 | \$ 91,375.36 | 1 | \$ 91,375.36 |
| 2054 | 38 | 0.10923885 | 3671 | \$ - | \$ - | 1 | \$ - | \$ 1,113,703.98 | \$ 121,659.74 | 1 | \$ 121,659.74 | \$ 799,156.85 | \$ 87,298.98 | 1 | \$ 87,298.98 |
| 2055 | 39 | 0.103055519 | 3717 | \$ - | \$ - | 1 | \$ - | \$ 1,127,683.53 | \$ 116,214.01 | 1 | \$ 116,214.01 | \$ 809,188.11 | \$ 83,391.30 | 1 | \$ 83,391.30 |

\$ 82,173.21

\$ 12,045,603.4

\$ 8,643,523.45



Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM CO2 | | | | OPT CO2 | | | | DM ACC (Bridges) | | |
|------|------|-------------|------|--------------|--------------|---------------|--------------|--------------|--------------|---------------|--------------|------------------|----------------|---------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST (Andersons) | Cost (Hardies) | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 29,484.75 | \$ 29,484.75 | 1 | \$ 29,484.75 | \$ 20,898.45 | \$ 20,898.45 | 1 | \$ 20,898.45 | \$ 245,467.70 | \$ 30,429.88 | \$ 275,897.58 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 30,193.97 | \$ 28,484.88 | 1 | \$ 28,484.88 | \$ 21,400.02 | \$ 20,188.69 | 1 | \$ 20,188.69 | \$ 246,449.57 | \$ 30,551.60 | \$ 261,321.86 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 30,903.51 | \$ 27,504.01 | 1 | \$ 27,504.01 | \$ 21,901.58 | \$ 19,492.33 | 1 | \$ 19,492.33 | \$ 247,431.45 | \$ 30,673.32 | \$ 247,512.25 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 31,613.70 | \$ 26,543.47 | 1 | \$ 26,543.47 | \$ 22,403.14 | \$ 18,810.11 | 1 | \$ 18,810.11 | \$ 248,413.32 | \$ 30,795.04 | \$ 234,428.72 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 32,323.89 | \$ 25,603.55 | 1 | \$ 25,603.55 | \$ 22,904.70 | \$ 18,142.67 | 1 | \$ 18,142.67 | \$ 249,395.19 | \$ 30,916.76 | \$ 222,033.32 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 33,034.09 | \$ 24,684.99 | 1 | \$ 24,684.99 | \$ 23,406.27 | \$ 17,490.52 | 1 | \$ 17,490.52 | \$ 250,377.06 | \$ 31,038.48 | \$ 210,290.06 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 33,744.28 | \$ 23,788.38 | 1 | \$ 23,788.38 | \$ 23,907.83 | \$ 16,854.08 | 1 | \$ 16,854.08 | \$ 251,358.93 | \$ 31,160.20 | \$ 199,164.84 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 34,454.47 | \$ 22,914.19 | 1 | \$ 22,914.19 | \$ 24,409.39 | \$ 16,233.64 | 1 | \$ 16,233.64 | \$ 252,340.80 | \$ 31,281.92 | \$ 188,625.31 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 35,164.66 | \$ 22,062.74 | 1 | \$ 22,062.74 | \$ 24,910.96 | \$ 15,629.44 | 1 | \$ 15,629.44 | \$ 253,322.67 | \$ 31,403.64 | \$ 178,640.81 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 35,874.85 | \$ 21,234.27 | 1 | \$ 21,234.27 | \$ 25,412.52 | \$ 15,041.63 | 1 | \$ 15,041.63 | \$ 254,304.54 | \$ 31,525.36 | \$ 169,182.28 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 36,585.05 | \$ 20,428.90 | 1 | \$ 20,428.90 | \$ 25,914.08 | \$ 14,470.29 | 1 | \$ 14,470.29 | \$ 255,286.41 | \$ 31,647.08 | \$ 160,222.16 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 37,295.24 | \$ 19,646.67 | 1 | \$ 19,646.67 | \$ 26,415.64 | \$ 13,915.43 | 1 | \$ 13,915.43 | \$ 256,268.28 | \$ 31,768.80 | \$ 151,734.34 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 38,005.43 | \$ 18,887.53 | 1 | \$ 18,887.53 | \$ 26,917.21 | \$ 13,377.03 | 1 | \$ 13,377.03 | \$ 257,250.15 | \$ 31,890.51 | \$ 143,694.05 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 38,716.04 | \$ 18,151.59 | 1 | \$ 18,151.59 | \$ 27,418.77 | \$ 12,854.99 | 1 | \$ 12,854.99 | \$ 258,232.02 | \$ 32,012.23 | \$ 136,077.83 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 39,427.15 | \$ 17,438.67 | 1 | \$ 17,438.67 | \$ 27,920.33 | \$ 12,349.19 | 1 | \$ 12,349.19 | \$ 259,213.90 | \$ 32,133.95 | \$ 128,863.43 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 40,138.27 | \$ 16,748.30 | 1 | \$ 16,748.30 | \$ 28,421.90 | \$ 11,859.46 | 1 | \$ 11,859.46 | \$ 260,195.77 | \$ 32,255.67 | \$ 122,029.77 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 40,849.38 | \$ 16,080.21 | 1 | \$ 16,080.21 | \$ 28,923.46 | \$ 11,385.61 | 1 | \$ 11,385.61 | \$ 261,177.64 | \$ 32,377.39 | \$ 115,556.85 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 41,560.49 | \$ 15,434.09 | 1 | \$ 15,434.09 | \$ 29,425.02 | \$ 10,927.41 | 1 | \$ 10,927.41 | \$ 262,159.51 | \$ 32,499.11 | \$ 109,425.73 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 42,271.60 | \$ 14,809.59 | 1 | \$ 14,809.59 | \$ 29,926.58 | \$ 10,484.59 | 1 | \$ 10,484.59 | \$ 263,141.38 | \$ 32,620.83 | \$ 103,618.45 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 42,982.71 | \$ 14,206.35 | 1 | \$ 14,206.35 | \$ 30,428.15 | \$ 10,056.90 | 1 | \$ 10,056.90 | \$ 264,123.25 | \$ 32,742.55 | \$ 98,118.01 |
| 2036 | 20 | 0.311804727 | 2843 | \$ 43,693.82 | \$ 13,629.50 | 1 | \$ 13,629.50 | \$ 30,929.71 | \$ 9,644.03 | 1 | \$ 9,644.03 | \$ 265,105.12 | \$ 32,864.27 | \$ 92,618.81 |
| 2037 | 21 | 0.294155403 | 2889 | \$ 44,404.93 | \$ 13,084.77 | 1 | \$ 13,084.77 | \$ 31,431.27 | \$ 9,245.68 | 1 | \$ 9,245.68 | \$ 266,086.99 | \$ 32,985.99 | \$ 87,129.61 |
| 2038 | 22 | 0.277505097 | 2935 | \$ 45,116.04 | \$ 12,574.41 | 1 | \$ 12,574.41 | \$ 31,932.84 | \$ 8,861.52 | 1 | \$ 8,861.52 | \$ 267,068.86 | \$ 33,107.71 | \$ 81,640.41 |
| 2039 | 23 | 0.261797261 | 2981 | \$ 45,827.15 | \$ 12,099.38 | 1 | \$ 12,099.38 | \$ 32,434.40 | \$ 8,491.24 | 1 | \$ 8,491.24 | \$ 268,050.73 | \$ 33,229.43 | \$ 76,151.21 |
| 2040 | 24 | 0.246978548 | 3027 | \$ 46,538.26 | \$ 11,659.20 | 1 | \$ 11,659.20 | \$ 32,935.96 | \$ 8,134.48 | 1 | \$ 8,134.48 | \$ 269,032.60 | \$ 33,351.15 | \$ 70,662.01 |
| 2041 | 25 | 0.232998631 | 3073 | \$ 47,249.37 | \$ 11,259.39 | 1 | \$ 11,259.39 | \$ 33,437.53 | \$ 7,790.90 | 1 | \$ 7,790.90 | \$ 270,014.47 | \$ 33,472.87 | \$ 65,172.81 |
| 2042 | 26 | 0.219810029 | 3119 | \$ 47,960.48 | \$ 10,894.46 | 1 | \$ 10,894.46 | \$ 33,939.09 | \$ 7,460.15 | 1 | \$ 7,460.15 | \$ 271,000.34 | \$ 33,594.59 | \$ 59,683.61 |
| 2043 | 27 | 0.207367952 | 3165 | \$ 48,671.59 | \$ 10,569.93 | 1 | \$ 10,569.93 | \$ 34,440.65 | \$ 7,141.89 | 1 | \$ 7,141.89 | \$ 272,000.21 | \$ 33,716.31 | \$ 54,194.41 |
| 2044 | 28 | 0.195630143 | 3211 | \$ 49,382.70 | \$ 10,281.29 | 1 | \$ 10,281.29 | \$ 34,942.21 | \$ 6,835.75 | 1 | \$ 6,835.75 | \$ 273,000.08 | \$ 33,838.03 | \$ 48,705.21 |
| 2045 | 29 | 0.184556739 | 3257 | \$ 50,093.81 | \$ 10,024.07 | 1 | \$ 10,024.07 | \$ 35,443.78 | \$ 6,541.39 | 1 | \$ 6,541.39 | \$ 274,000.00 | \$ 33,959.75 | \$ 43,216.01 |
| 2046 | 30 | 0.174110131 | 3303 | \$ 50,804.92 | \$ 9,792.76 | 1 | \$ 9,792.76 | \$ 35,945.34 | \$ 6,258.45 | 1 | \$ 6,258.45 | \$ 275,000.00 | \$ 34,081.47 | \$ 37,726.81 |
| 2047 | 31 | 0.16425484 | 3349 | \$ 51,516.03 | \$ 9,581.89 | 1 | \$ 9,581.89 | \$ 36,446.90 | \$ 5,986.58 | 1 | \$ 5,986.58 | \$ 276,000.00 | \$ 34,203.23 | \$ 32,237.61 |
| 2048 | 32 | 0.154957397 | 3395 | \$ 52,227.14 | \$ 9,396.96 | 1 | \$ 9,396.96 | \$ 36,948.47 | \$ 5,725.44 | 1 | \$ 5,725.44 | \$ 277,000.00 | \$ 34,324.99 | \$ 26,748.41 |
| 2049 | 33 | 0.146186223 | 3441 | \$ 52,938.25 | \$ 9,232.50 | 1 | \$ 9,232.50 | \$ 37,450.03 | \$ 5,474.68 | 1 | \$ 5,474.68 | \$ 278,000.00 | \$ 34,446.75 | \$ 21,259.21 |
| 2050 | 34 | 0.137911531 | 3487 | \$ 53,649.36 | \$ 9,084.04 | 1 | \$ 9,084.04 | \$ 37,951.59 | \$ 5,233.96 | 1 | \$ 5,233.96 | \$ 279,000.00 | \$ 34,568.51 | \$ 15,770.01 |
| 2051 | 35 | 0.130105218 | 3533 | \$ 54,360.47 | \$ 8,947.11 | 1 | \$ 8,947.11 | \$ 38,453.15 | \$ 5,002.96 | 1 | \$ 5,002.96 | \$ 280,000.00 | \$ 34,690.27 | \$ 10,280.81 |
| 2052 | 36 | 0.122740772 | 3579 | \$ 55,071.58 | \$ 8,826.26 | 1 | \$ 8,826.26 | \$ 38,954.72 | \$ 4,781.33 | 1 | \$ 4,781.33 | \$ 281,000.00 | \$ 34,812.03 | \$ 4,791.61 |
| 2053 | 37 | 0.115793181 | 3625 | \$ 55,782.69 | \$ 8,716.03 | 1 | \$ 8,716.03 | \$ 39,456.28 | \$ 4,568.77 | 1 | \$ 4,568.77 | \$ 282,000.00 | \$ 34,933.79 | \$ 4,802.41 |
| 2054 | 38 | 0.10923885 | 3671 | \$ 56,493.80 | \$ 8,612.99 | 1 | \$ 8,612.99 | \$ 39,957.84 | \$ 4,364.95 | 1 | \$ 4,364.95 | \$ 283,000.00 | \$ 35,055.55 | \$ 4,813.21 |
| 2055 | 39 | 0.103055519 | 3717 | \$ 57,204.91 | \$ 8,514.70 | 1 | \$ 8,514.70 | \$ 40,459.41 | \$ 4,169.57 | 1 | \$ 4,169.57 | \$ 284,000.00 | \$ 35,177.31 | \$ 4,824.01 |

\$ 607,693.19

\$ 432,176.17

\$ 3,750,372.03

Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM ACC (Method A) | | DM ACC (Detours) | | DM ACC (Alignment) | | DM ACC (Method A) | | OPT ACC (Bridges) | | |
|------|------|-------------|------|-------------------|---------------|------------------|-------------|--------------------|---------------|-------------------|---------------|-------------------|----------------|--------------|
| | | SPPWF | AADT | COST | PV COST | COST | PV COST | COST | PV COST | COST | PV COST | COST (Andersons) | Cost (Hardies) | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 649,806.14 | \$ 925,703.72 | \$ 3,056.44 | \$ 3,056.44 | \$ 340,791.83 | \$ 340,791.83 | \$ 631,888.72 | \$ 631,888.72 | \$ 34,912.74 | \$ 34,912.74 | \$ 69,825.47 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 652,405.36 | \$ 862,006.81 | \$ 3,068.67 | \$ 2,894.97 | \$ 342,154.99 | \$ 322,787.73 | \$ 634,416.28 | \$ 598,505.92 | \$ 35,052.39 | \$ 35,052.39 | \$ 66,136.58 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 655,004.59 | \$ 803,236.77 | \$ 3,080.90 | \$ 2,741.99 | \$ 343,518.16 | \$ 305,729.94 | \$ 636,943.83 | \$ 566,877.74 | \$ 35,192.04 | \$ 35,192.04 | \$ 62,641.58 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 657,603.81 | \$ 748,967.71 | \$ 3,093.12 | \$ 2,597.04 | \$ 344,881.33 | \$ 289,569.01 | \$ 639,471.39 | \$ 536,912.51 | \$ 35,331.69 | \$ 35,331.69 | \$ 59,330.34 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 660,203.03 | \$ 698,813.82 | \$ 3,105.35 | \$ 2,459.73 | \$ 346,244.49 | \$ 274,258.07 | \$ 641,998.94 | \$ 508,523.29 | \$ 35,471.34 | \$ 35,471.34 | \$ 56,193.25 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 662,802.26 | \$ 652,425.37 | \$ 3,117.57 | \$ 2,329.63 | \$ 347,607.66 | \$ 259,752.67 | \$ 644,526.50 | \$ 481,627.69 | \$ 35,610.99 | \$ 35,610.99 | \$ 53,221.21 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 665,401.48 | \$ 609,485.14 | \$ 3,129.80 | \$ 2,206.38 | \$ 348,970.83 | \$ 246,010.66 | \$ 647,054.05 | \$ 456,147.57 | \$ 35,750.64 | \$ 35,750.64 | \$ 50,405.58 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 668,000.71 | \$ 569,705.22 | \$ 3,142.02 | \$ 2,089.63 | \$ 350,334.00 | \$ 232,992.12 | \$ 649,581.61 | \$ 432,008.87 | \$ 35,890.29 | \$ 35,890.29 | \$ 47,738.19 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 670,599.93 | \$ 532,824.15 | \$ 3,154.25 | \$ 1,979.02 | \$ 351,697.16 | \$ 220,659.15 | \$ 652,109.16 | \$ 409,141.36 | \$ 36,029.94 | \$ 36,029.94 | \$ 45,211.27 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 673,199.16 | \$ 498,604.28 | \$ 3,166.48 | \$ 1,874.23 | \$ 353,060.33 | \$ 208,975.87 | \$ 654,636.72 | \$ 387,478.47 | \$ 36,169.60 | \$ 36,169.60 | \$ 42,817.46 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 675,798.38 | \$ 466,829.50 | \$ 3,178.70 | \$ 1,774.97 | \$ 354,423.50 | \$ 197,908.23 | \$ 657,164.27 | \$ 366,957.10 | \$ 36,309.25 | \$ 36,309.25 | \$ 40,549.79 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 678,397.61 | \$ 437,303.15 | \$ 3,190.93 | \$ 1,680.94 | \$ 355,786.67 | \$ 187,423.98 | \$ 659,691.83 | \$ 347,517.43 | \$ 36,448.90 | \$ 36,448.90 | \$ 38,401.65 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 680,996.83 | \$ 409,846.10 | \$ 3,203.15 | \$ 1,591.87 | \$ 357,149.83 | \$ 177,492.53 | \$ 662,219.38 | \$ 329,102.74 | \$ 36,588.55 | \$ 36,588.55 | \$ 36,366.78 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 683,596.06 | \$ 384,295.10 | \$ 3,215.38 | \$ 1,507.50 | \$ 358,513.00 | \$ 168,084.88 | \$ 664,746.94 | \$ 311,659.30 | \$ 36,728.20 | \$ 36,728.20 | \$ 34,439.23 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 686,195.28 | \$ 360,501.26 | \$ 3,227.60 | \$ 1,427.57 | \$ 359,876.17 | \$ 159,173.58 | \$ 667,274.49 | \$ 295,136.15 | \$ 36,867.85 | \$ 36,867.85 | \$ 32,613.37 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 688,794.50 | \$ 338,328.64 | \$ 3,239.83 | \$ 1,351.87 | \$ 361,239.33 | \$ 150,732.55 | \$ 669,802.05 | \$ 279,484.99 | \$ 37,007.50 | \$ 37,007.50 | \$ 30,883.87 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 691,393.73 | \$ 317,653.10 | \$ 3,252.06 | \$ 1,280.16 | \$ 362,602.50 | \$ 142,737.13 | \$ 672,329.60 | \$ 264,660.05 | \$ 37,147.15 | \$ 37,147.15 | \$ 29,245.68 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 693,992.95 | \$ 298,361.11 | \$ 3,264.28 | \$ 1,212.24 | \$ 363,965.67 | \$ 135,163.90 | \$ 674,857.16 | \$ 250,617.94 | \$ 37,286.80 | \$ 37,286.80 | \$ 27,693.98 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 696,592.18 | \$ 280,348.83 | \$ 3,276.51 | \$ 1,147.90 | \$ 365,328.84 | \$ 127,990.69 | \$ 677,384.71 | \$ 237,317.53 | \$ 37,426.45 | \$ 37,426.45 | \$ 26,224.25 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 699,191.40 | \$ 263,521.13 | \$ 3,288.73 | \$ 1,086.97 | \$ 366,692.00 | \$ 121,196.48 | \$ 679,912.27 | \$ 224,719.85 | \$ 37,566.10 | \$ 37,566.10 | \$ 24,832.17 |
| 2036 | 20 | 0.311804727 | 2843 | \$ 145,828.11 | \$ 52,801.56 | \$ - | \$ - | \$ 368,055.17 | \$ 114,761.34 | \$ 682,439.82 | \$ 212,787.96 | \$ 37,705.76 | \$ 37,705.76 | \$ 23,513.67 |
| 2037 | 21 | 0.294155403 | 2889 | \$ 146,368.21 | \$ 49,604.33 | \$ - | \$ - | \$ 369,418.34 | \$ 108,666.40 | \$ 684,967.38 | \$ 201,486.85 | \$ 37,845.41 | \$ 37,845.41 | \$ 22,264.86 |
| 2038 | 22 | 0.277505097 | 2935 | \$ 146,908.31 | \$ 46,618.19 | \$ - | \$ - | \$ 370,781.51 | \$ 102,893.76 | \$ 687,494.93 | \$ 190,783.35 | \$ 37,985.06 | \$ 37,985.06 | \$ 21,082.09 |
| 2039 | 23 | 0.261797261 | 2981 | \$ 147,448.42 | \$ 43,827.56 | \$ - | \$ - | \$ 372,144.67 | \$ 97,426.46 | \$ 690,022.49 | \$ 180,646.00 | \$ 38,124.71 | \$ 38,124.71 | \$ 19,961.89 |
| 2040 | 24 | 0.246978548 | 3027 | \$ 147,988.52 | \$ 41,218.12 | \$ - | \$ - | \$ 373,507.84 | \$ 92,248.42 | \$ 692,550.04 | \$ 171,045.00 | \$ 38,264.36 | \$ 38,264.36 | \$ 18,900.95 |
| 2041 | 25 | 0.232998631 | 3073 | \$ 148,528.63 | \$ 38,776.75 | \$ - | \$ - | \$ 374,871.01 | \$ 87,344.43 | \$ 695,077.60 | \$ 161,952.13 | \$ 38,404.01 | \$ 38,404.01 | \$ 17,896.16 |
| 2042 | 26 | 0.219810029 | 3119 | \$ 149,068.73 | \$ 36,491.39 | \$ - | \$ - | \$ 376,234.18 | \$ 82,700.04 | \$ 697,605.15 | \$ 153,340.61 | \$ 38,543.66 | \$ 38,543.66 | \$ 16,944.57 |
| 2043 | 27 | 0.207367952 | 3165 | \$ 149,608.83 | \$ 34,350.96 | \$ - | \$ - | \$ 377,597.34 | \$ 78,301.59 | \$ 700,132.71 | \$ 145,185.09 | \$ 38,683.31 | \$ 38,683.31 | \$ 16,043.36 |
| 2044 | 28 | 0.195630143 | 3211 | \$ 150,148.94 | \$ 32,345.26 | \$ - | \$ - | \$ 378,960.51 | \$ 74,136.10 | \$ 702,660.26 | \$ 137,461.53 | \$ 38,822.96 | \$ 38,822.96 | \$ 15,189.88 |
| 2045 | 29 | 0.184556739 | 3257 | \$ 150,689.04 | \$ 30,464.90 | \$ - | \$ - | \$ 380,323.68 | \$ 70,191.30 | \$ 705,187.82 | \$ 130,147.16 | \$ 38,962.61 | \$ 38,962.61 | \$ 14,381.63 |
| 2046 | 30 | 0.174110131 | 3303 | \$ 151,229.15 | \$ 28,701.25 | \$ - | \$ - | \$ 381,686.84 | \$ 66,455.55 | \$ 707,715.37 | \$ 123,220.42 | \$ 39,102.27 | \$ 39,102.27 | \$ 13,616.20 |
| 2047 | 31 | 0.16425484 | 3349 | \$ 151,769.25 | \$ 27,046.30 | \$ - | \$ - | \$ 383,050.01 | \$ 62,917.82 | \$ 710,242.92 | \$ 116,660.84 | \$ 39,241.92 | \$ 39,241.92 | \$ 12,891.35 |
| 2048 | 32 | 0.154957397 | 3395 | \$ 152,309.36 | \$ 25,492.71 | \$ - | \$ - | \$ 384,413.18 | \$ 59,567.67 | \$ 712,770.48 | \$ 110,449.06 | \$ 39,381.57 | \$ 39,381.57 | \$ 12,204.93 |
| 2049 | 33 | 0.146186223 | 3441 | \$ 152,849.46 | \$ 24,033.65 | \$ - | \$ - | \$ 385,776.35 | \$ 56,395.19 | \$ 715,298.03 | \$ 104,566.72 | \$ 39,521.22 | \$ 39,521.22 | \$ 11,554.92 |
| 2050 | 34 | 0.137911531 | 3487 | \$ 153,389.56 | \$ 22,662.86 | \$ - | \$ - | \$ 387,139.51 | \$ 53,391.00 | \$ 717,825.59 | \$ 98,996.43 | \$ 39,660.87 | \$ 39,660.87 | \$ 10,939.38 |
| 2051 | 35 | 0.130105218 | 3533 | \$ 153,929.67 | \$ 21,374.49 | \$ - | \$ - | \$ 388,502.68 | \$ 50,546.23 | \$ 720,353.14 | \$ 93,721.70 | \$ 39,800.52 | \$ 39,800.52 | \$ 10,356.51 |
| 2052 | 36 | 0.122740772 | 3579 | \$ 154,469.77 | \$ 20,163.16 | \$ - | \$ - | \$ 389,865.85 | \$ 47,852.44 | \$ 722,880.70 | \$ 88,726.94 | \$ 39,940.17 | \$ 39,940.17 | \$ 9,804.57 |
| 2053 | 37 | 0.115793181 | 3625 | \$ 155,009.88 | \$ 19,023.87 | \$ - | \$ - | \$ 391,229.02 | \$ 45,301.65 | \$ 725,408.25 | \$ 83,997.33 | \$ 40,079.82 | \$ 40,079.82 | \$ 9,281.94 |
| 2054 | 38 | 0.10923885 | 3671 | \$ 155,549.98 | \$ 17,951.99 | \$ - | \$ - | \$ 392,592.18 | \$ 42,886.32 | \$ 727,935.81 | \$ 79,518.87 | \$ 40,219.47 | \$ 40,219.47 | \$ 8,787.06 |
| 2055 | 39 | 0.103055519 | 3717 | \$ 156,090.08 | \$ 16,943.21 | \$ - | \$ - | \$ 393,955.35 | \$ 40,599.27 | \$ 730,463.36 | \$ 75,278.28 | \$ 40,359.12 | \$ 40,359.12 | \$ 8,318.46 |

\$ 11,088,653.4

\$ 38,291.05

\$ 5,704,013.95

NOT USED

\$ 10,576,257.5

\$ 1,168,706.07

NOT USED

Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | OPT ACC (Method A) | | OPT ACC (Detours) | | OPT ACC (Alignment) | | OPT ACC (Method A) | | DM BRIDGE CONSTRUCTION | |
|------|------|-------------|------|--------------------|---------------|-------------------|---------|---------------------|--------------|--------------------|---------------|------------------------|------------------|
| | | SPPWF | AADT | COST | PV COST | COST | PV COST | COST | PV COST | COST | PV COST | COST | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 135,026.02 | \$ 135,026.02 | \$ - | \$ - | \$ 98,982.68 | \$ 98,982.68 | \$ 321,255.00 | \$ 321,255.00 | \$ - | \$ - |
| 2017 | 1 | 0.943396226 | 1969 | \$ 135,566.13 | \$ 127,892.57 | \$ - | \$ - | \$ 99,378.61 | \$ 93,753.40 | \$ 322,540.02 | \$ 304,283.04 | \$ - | \$ - |
| 2018 | 2 | 0.88999644 | 2015 | \$ 136,106.23 | \$ 121,134.06 | \$ - | \$ - | \$ 99,774.54 | \$ 88,798.98 | \$ 323,825.04 | \$ 288,203.13 | \$ - | \$ - |
| 2019 | 3 | 0.839619283 | 2061 | \$ 136,646.34 | \$ 114,730.90 | \$ - | \$ - | \$ 100,170.47 | \$ 84,105.06 | \$ 325,110.06 | \$ 272,968.68 | \$ - | \$ - |
| 2020 | 4 | 0.792093663 | 2107 | \$ 137,186.44 | \$ 108,664.51 | \$ - | \$ - | \$ 100,566.40 | \$ 79,658.01 | \$ 326,395.08 | \$ 258,535.48 | \$ - | \$ - |
| 2021 | 5 | 0.747258173 | 2153 | \$ 137,726.54 | \$ 102,917.29 | \$ - | \$ - | \$ 100,962.33 | \$ 75,444.93 | \$ 327,680.10 | \$ 244,861.63 | \$ - | \$ - |
| 2022 | 6 | 0.70496054 | 2199 | \$ 138,266.65 | \$ 97,472.53 | \$ - | \$ - | \$ 101,358.26 | \$ 71,453.58 | \$ 328,965.12 | \$ 231,907.43 | \$ - | \$ - |
| 2023 | 7 | 0.665057114 | 2245 | \$ 138,806.75 | \$ 92,314.42 | \$ - | \$ - | \$ 101,754.19 | \$ 67,672.35 | \$ 330,250.14 | \$ 219,635.21 | \$ - | \$ - |
| 2024 | 8 | 0.627412371 | 2291 | \$ 139,346.86 | \$ 87,427.94 | \$ - | \$ - | \$ 102,150.12 | \$ 64,090.25 | \$ 331,535.16 | \$ 208,009.26 | \$ - | \$ - |
| 2025 | 9 | 0.591898464 | 2337 | \$ 139,886.96 | \$ 82,798.88 | \$ - | \$ - | \$ 102,546.05 | \$ 60,696.85 | \$ 332,820.18 | \$ 196,995.75 | \$ - | \$ - |
| 2026 | 10 | 0.558394777 | 2383 | \$ 140,427.06 | \$ 78,413.74 | \$ - | \$ - | \$ 102,941.98 | \$ 57,482.27 | \$ 334,105.20 | \$ 186,562.60 | \$ - | \$ - |
| 2027 | 11 | 0.526787525 | 2429 | \$ 140,967.17 | \$ 74,259.75 | \$ - | \$ - | \$ 103,337.92 | \$ 54,437.12 | \$ 335,390.22 | \$ 176,679.38 | \$ - | \$ - |
| 2028 | 12 | 0.496969364 | 2475 | \$ 141,507.27 | \$ 70,324.78 | \$ - | \$ - | \$ 103,733.85 | \$ 51,552.54 | \$ 336,675.24 | \$ 167,317.28 | \$ - | \$ - |
| 2029 | 13 | 0.468839022 | 2521 | \$ 142,047.38 | \$ 66,597.35 | \$ - | \$ - | \$ 104,129.78 | \$ 48,820.10 | \$ 337,960.26 | \$ 158,448.96 | \$ - | \$ - |
| 2030 | 14 | 0.442300964 | 2567 | \$ 142,587.48 | \$ 63,066.58 | \$ - | \$ - | \$ 104,525.71 | \$ 46,231.82 | \$ 339,245.28 | \$ 150,048.52 | \$ - | \$ - |
| 2031 | 15 | 0.417265061 | 2613 | \$ 143,127.59 | \$ 59,722.14 | \$ - | \$ - | \$ 104,921.64 | \$ 43,780.13 | \$ 340,530.30 | \$ 142,091.40 | \$ - | \$ - |
| 2032 | 16 | 0.393646284 | 2659 | \$ 143,667.69 | \$ 56,554.25 | \$ - | \$ - | \$ 105,317.57 | \$ 41,457.87 | \$ 341,815.32 | \$ 134,554.33 | \$ - | \$ - |
| 2033 | 17 | 0.371364419 | 2705 | \$ 144,207.79 | \$ 53,553.64 | \$ - | \$ - | \$ 105,713.50 | \$ 39,258.23 | \$ 343,100.34 | \$ 127,415.26 | \$ - | \$ - |
| 2034 | 18 | 0.350343791 | 2751 | \$ 144,747.90 | \$ 50,711.53 | \$ - | \$ - | \$ 106,109.43 | \$ 37,174.78 | \$ 344,385.36 | \$ 120,653.27 | \$ - | \$ - |
| 2035 | 19 | 0.33051301 | 2797 | \$ 145,288.00 | \$ 48,019.57 | \$ - | \$ - | \$ 106,505.36 | \$ 35,201.41 | \$ 345,670.38 | \$ 114,248.56 | \$ - | \$ - |
| 2036 | 20 | 0.311804727 | 2843 | \$ 145,828.11 | \$ 45,469.89 | \$ - | \$ - | \$ 106,901.29 | \$ 33,332.33 | \$ 346,955.40 | \$ 108,182.33 | \$ 13,227,500.00 | \$ 4,124,397.02 |
| 2037 | 21 | 0.294155403 | 2889 | \$ 146,368.21 | \$ 43,055.00 | \$ - | \$ - | \$ 107,297.22 | \$ 31,562.06 | \$ 348,240.42 | \$ 102,436.80 | \$ - | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ 146,908.31 | \$ 40,767.81 | \$ - | \$ - | \$ 107,693.15 | \$ 29,885.40 | \$ 349,525.44 | \$ 96,995.09 | \$ - | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ 147,448.42 | \$ 38,601.59 | \$ - | \$ - | \$ 108,089.08 | \$ 28,297.43 | \$ 350,810.46 | \$ 91,841.22 | \$ - | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ 147,988.52 | \$ 36,549.99 | \$ - | \$ - | \$ 108,485.01 | \$ 26,793.47 | \$ 352,095.48 | \$ 86,960.03 | \$ - | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ 148,528.63 | \$ 34,606.97 | \$ - | \$ - | \$ 108,880.95 | \$ 25,369.11 | \$ 353,380.50 | \$ 82,337.17 | \$ - | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ 149,068.73 | \$ 32,766.80 | \$ - | \$ - | \$ 109,276.88 | \$ 24,020.15 | \$ 354,665.52 | \$ 77,959.04 | \$ - | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ 149,608.83 | \$ 31,024.08 | \$ - | \$ - | \$ 109,672.81 | \$ 22,742.63 | \$ 355,950.54 | \$ 73,812.73 | \$ - | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ 150,148.94 | \$ 29,373.66 | \$ - | \$ - | \$ 110,068.74 | \$ 21,532.76 | \$ 357,235.56 | \$ 69,886.04 | \$ - | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ 150,689.04 | \$ 27,810.68 | \$ - | \$ - | \$ 110,464.67 | \$ 20,387.00 | \$ 358,520.58 | \$ 66,167.39 | \$ - | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ 151,229.15 | \$ 26,330.53 | \$ - | \$ - | \$ 110,860.60 | \$ 19,301.95 | \$ 359,805.60 | \$ 62,645.80 | \$ - | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ 151,769.25 | \$ 24,928.83 | \$ - | \$ - | \$ 111,256.53 | \$ 18,274.42 | \$ 361,090.62 | \$ 59,310.88 | \$ - | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ 152,309.36 | \$ 23,601.46 | \$ - | \$ - | \$ 111,652.46 | \$ 17,301.37 | \$ 362,375.64 | \$ 56,152.79 | \$ - | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ 152,849.46 | \$ 22,344.49 | \$ - | \$ - | \$ 112,048.39 | \$ 16,379.93 | \$ 363,660.66 | \$ 53,162.18 | \$ - | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ 153,389.56 | \$ 21,154.19 | \$ - | \$ - | \$ 112,444.32 | \$ 15,507.37 | \$ 364,945.68 | \$ 50,330.22 | \$ - | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ 153,929.67 | \$ 20,027.05 | \$ - | \$ - | \$ 112,840.25 | \$ 14,681.11 | \$ 366,230.70 | \$ 47,648.53 | \$ - | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ 154,469.77 | \$ 18,959.74 | \$ - | \$ - | \$ 113,236.18 | \$ 13,898.70 | \$ 367,515.72 | \$ 45,109.16 | \$ - | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ 155,009.88 | \$ 17,949.09 | \$ - | \$ - | \$ 113,632.11 | \$ 13,157.82 | \$ 368,800.74 | \$ 42,704.61 | \$ - | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ 155,549.98 | \$ 16,992.10 | \$ - | \$ - | \$ 114,028.04 | \$ 12,456.29 | \$ 370,085.76 | \$ 40,427.74 | \$ - | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ 156,090.08 | \$ 16,085.94 | \$ - | \$ - | \$ 114,423.98 | \$ 11,792.02 | \$ 371,370.78 | \$ 38,271.81 | -\$ 13,148,299.73 | -\$ 1,355,004.85 |

\$ 2,260,002.35

\$ -

\$ 1,656,725.70

NOT USED

\$ 5,377,015.74

\$ 2,769,392.17

| Worksheet A1 - Discounting | | | | | | | | | |
|----------------------------|------|-------------|------|----------------------|-------------|-------------------------|------------------|---------------------|------------------|
| YEAR | TIME | Growth | 2.4% | DM Maintenance Costs | | OPT BRIDGE CONSTRUCTION | | OPT Alignment Costs | |
| | | SPPWF | AADT | COST | PV COST | COST | PV COST | COST | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 2,243.75 | \$ 2,243.75 | \$ 13,227,500.00 | \$ 13,227,500.00 | \$ 13,419,647.00 | \$ 13,419,647.00 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 2,243.75 | \$ 2,116.75 | \$ - | \$ - | \$ - | \$ - |
| 2018 | 2 | 0.88999644 | 2015 | \$ 2,243.75 | \$ 1,996.93 | \$ - | \$ - | \$ - | \$ - |
| 2019 | 3 | 0.839619283 | 2061 | \$ 2,243.75 | \$ 1,883.90 | \$ - | \$ - | \$ - | \$ - |
| 2020 | 4 | 0.792093663 | 2107 | \$ 2,243.75 | \$ 1,777.26 | \$ - | \$ - | \$ - | \$ - |
| 2021 | 5 | 0.747258173 | 2153 | \$ 2,243.75 | \$ 1,676.66 | \$ - | \$ - | \$ - | \$ - |
| 2022 | 6 | 0.70496054 | 2199 | \$ 2,243.75 | \$ 1,581.76 | \$ - | \$ - | \$ - | \$ - |
| 2023 | 7 | 0.665057114 | 2245 | \$ 2,243.75 | \$ 1,492.22 | \$ - | \$ - | \$ - | \$ - |
| 2024 | 8 | 0.627412371 | 2291 | \$ 2,243.75 | \$ 1,407.76 | \$ - | \$ - | \$ - | \$ - |
| 2025 | 9 | 0.591898464 | 2337 | \$ 2,243.75 | \$ 1,328.07 | \$ - | \$ - | \$ - | \$ - |
| 2026 | 10 | 0.558394777 | 2383 | \$ 2,243.75 | \$ 1,252.90 | \$ - | \$ - | \$ - | \$ - |
| 2027 | 11 | 0.526787525 | 2429 | \$ 2,243.75 | \$ 1,181.98 | \$ - | \$ - | \$ - | \$ - |
| 2028 | 12 | 0.496969364 | 2475 | \$ 2,243.75 | \$ 1,115.08 | \$ - | \$ - | \$ - | \$ - |
| 2029 | 13 | 0.468839022 | 2521 | \$ 2,243.75 | \$ 1,051.96 | \$ - | \$ - | \$ - | \$ - |
| 2030 | 14 | 0.442300964 | 2567 | \$ 2,243.75 | \$ 992.41 | \$ - | \$ - | \$ - | \$ - |
| 2031 | 15 | 0.417265061 | 2613 | \$ 2,243.75 | \$ 936.24 | \$ - | \$ - | \$ - | \$ - |
| 2032 | 16 | 0.393646284 | 2659 | \$ 2,243.75 | \$ 883.24 | \$ - | \$ - | \$ - | \$ - |
| 2033 | 17 | 0.371364419 | 2705 | \$ 2,243.75 | \$ 833.25 | \$ - | \$ - | \$ - | \$ - |
| 2034 | 18 | 0.350343791 | 2751 | \$ 2,243.75 | \$ 786.08 | \$ - | \$ - | \$ - | \$ - |
| 2035 | 19 | 0.33051301 | 2797 | \$ 2,243.75 | \$ 741.59 | \$ - | \$ - | \$ - | \$ - |
| 2036 | 20 | 0.311804727 | 2843 | \$ 243.75 | \$ 76.00 | \$ - | \$ - | \$ - | \$ - |
| 2037 | 21 | 0.294155403 | 2889 | \$ 243.75 | \$ 71.70 | \$ - | \$ - | \$ - | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ 243.75 | \$ 67.64 | \$ - | \$ - | \$ - | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ 243.75 | \$ 63.81 | \$ - | \$ - | \$ - | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ 243.75 | \$ 60.20 | \$ - | \$ - | \$ - | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ 243.75 | \$ 56.79 | \$ - | \$ - | \$ - | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ 243.75 | \$ 53.58 | \$ - | \$ - | \$ - | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ 243.75 | \$ 50.55 | \$ - | \$ - | \$ - | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ 243.75 | \$ 47.68 | \$ - | \$ - | \$ - | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ 243.75 | \$ 44.99 | \$ - | \$ - | \$ - | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ 243.75 | \$ 42.44 | \$ - | \$ - | \$ - | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ 243.75 | \$ 40.04 | \$ - | \$ - | \$ - | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ 243.75 | \$ 37.77 | \$ - | \$ - | \$ - | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ 243.75 | \$ 35.63 | \$ - | \$ - | \$ - | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ 243.75 | \$ 33.62 | \$ - | \$ - | \$ - | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ 243.75 | \$ 31.71 | \$ - | \$ - | \$ - | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ 243.75 | \$ 29.92 | \$ - | \$ - | \$ - | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ 243.75 | \$ 28.22 | \$ - | \$ - | \$ - | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ 243.75 | \$ 26.63 | \$ - | \$ - | \$ - | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ 243.75 | \$ 25.12 | -\$ 12,887,195.72 | -\$ 1,328,096.64 | \$ - | \$ - |
| | | | | \$ 28,203.82 | | \$ 11,899,403.36 | | \$ 13,419,647.00 | |

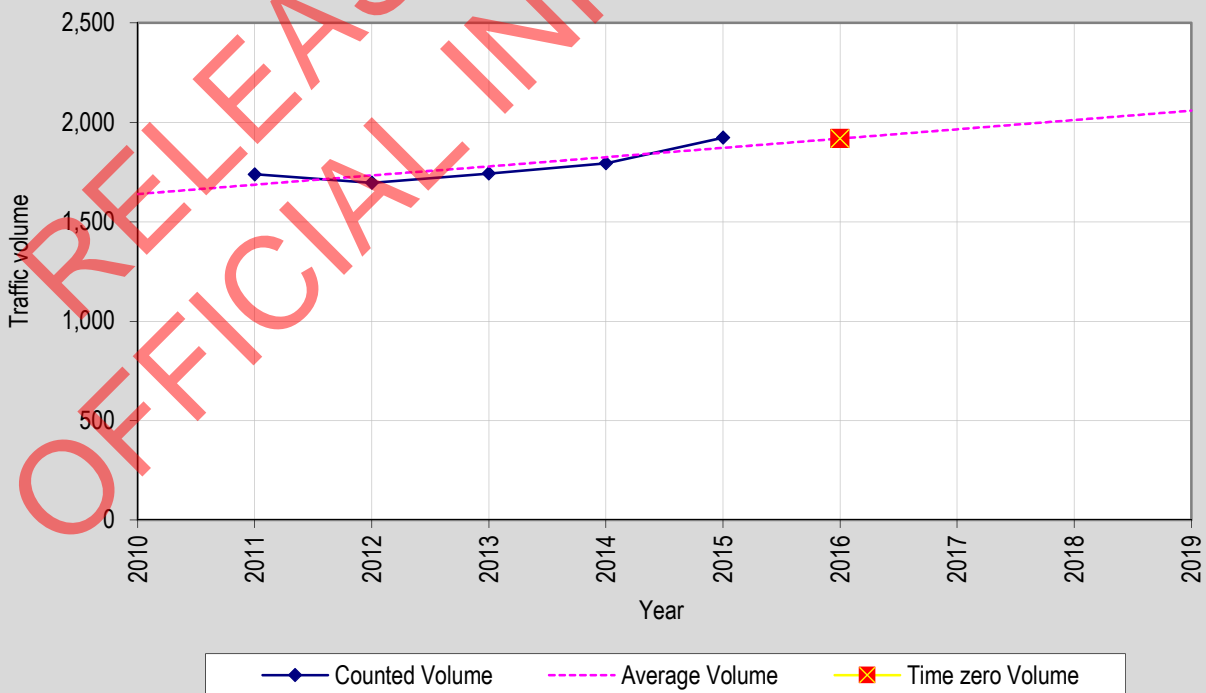
OFFICIAL INFORMATION ACT

Worksheets A2: Traffic Data

Worksheet A2.4 - Time zero traffic volume and growth rates

| | | |
|---|-----------------------|--|
| 1 | Activity option | Count Station 01200198 |
| 2 | Road/section/movement | SH12 RS 185 RP 14.2: About 1.5km east of Ararua Rd, 1km west of Petley Rd. |
| 3 | Time period | 2011-2015 Traffic Count Data |

| Year (4) | AADT or average volume (5) | Regression output | | |
|-------------|-------------------------------|-------------------|--------------------------|-------------|
| 2010 | | 6 | Constant | -92026.8 |
| 2011 | 1739 | 7 | X coefficient | 46.6 |
| 2012 | 1696 | 8 | R squared | 0.706290249 |
| 2013 | 1743 | 9 | Time zero | 2016 |
| 2014 | 1794 | 10 | Time zero traffic volume | 1,919 |
| 2015 | 1923 | 11 | Growth rate at time zero | 2.4% |



| Delays & Conflicts at One Lane Bridges | | | | | | Andersons | | | Hardies | | | | |
|--|-------|--------|--------|--------|--------|-----------|------|----------------------|---------------------|-------------|----------------------|---------------------|-------------|
| Andersons (25m) & Hardies (65m) Bridges | | | | | | Year | AADT | Delay (mins per day) | Wait (mins per day) | Total Stops | Delay (mins per day) | Wait (mins per day) | Total Stops |
| Table 3: Total Delay in minutes per day | | | | | | 2016 | 1923 | 45.919 | 4.961 | 65.303 | 120.9895 | 22.152 | 180.6595 |
| Interpolated figures for 25m & 65m Bridges | | | | | | 2017 | 1969 | 48.357 | 5.283 | 68.109 | 127.2685 | 23.256 | 188.7785 |
| AADT | 1500 | 2000 | 2500 | 3000 | 3500 | 2018 | 2015 | 51.035 | 5.62 | 71.155 | 134.2 | 24.525 | 197.61 |
| 20m | 18 | 39 | 65 | 93 | 123 | 2019 | 2061 | 54.209 | 5.988 | 74.697 | 142.48 | 26.135 | 207.914 |
| 30m | 29 | 61 | 104 | 153 | 220 | 2020 | 2107 | 57.383 | 6.356 | 78.239 | 150.76 | 27.745 | 218.218 |
| 60m | 59 | 123 | 208 | 313 | 440 | 2021 | 2153 | 60.557 | 6.724 | 81.781 | 159.04 | 29.355 | 228.522 |
| 80m | 76 | 157 | 262 | 390 | 542 | 2022 | 2199 | 63.731 | 7.092 | 85.323 | 167.32 | 30.965 | 238.826 |
| 25m | 23.5 | 50 | 84.5 | 123 | 171.5 | 2023 | 2245 | 66.905 | 7.46 | 88.865 | 175.6 | 32.575 | 249.13 |
| 65m | 63.25 | 131.5 | 221.5 | 332.25 | 465.5 | 2024 | 2291 | 70.079 | 7.828 | 92.407 | 183.88 | 34.185 | 259.434 |
| | | | | | | 2025 | 2337 | 73.253 | 8.196 | 95.949 | 192.16 | 35.795 | 269.738 |
| Table 4: Total waiting time in minutes per day | | | | | | 2026 | 2383 | 76.427 | 8.564 | 99.491 | 200.44 | 37.405 | 280.042 |
| AADT | 1500 | 2000 | 2500 | 3000 | 3500 | 2027 | 2429 | 79.601 | 8.932 | 103.033 | 208.72 | 39.015 | 290.346 |
| 20m | 1 | 4 | 6 | 8 | 11 | 2028 | 2475 | 82.775 | 9.3 | 106.575 | 217 | 40.625 | 300.65 |
| 30m | 3 | 7 | 13 | 19 | 26 | 2029 | 2521 | 86.117 | 9.668 | 110.201 | 226.1515 | 42.361 | 312.2875 |
| 60m | 11 | 22 | 38 | 57 | 77 | 2030 | 2567 | 89.659 | 10.036 | 113.927 | 236.3405 | 44.247 | 325.5125 |
| 80m | 15 | 30 | 52 | 77 | 105 | 2031 | 2613 | 93.201 | 10.404 | 117.653 | 246.5295 | 46.133 | 338.7375 |
| 25m | 2 | 5.5 | 9.5 | 13.5 | 18.5 | 2032 | 2659 | 96.743 | 10.772 | 121.379 | 256.7185 | 48.019 | 351.9625 |
| 65m | 12 | 24 | 41.5 | 62 | 84 | 2033 | 2705 | 100.285 | 11.14 | 125.105 | 266.9075 | 49.905 | 365.1875 |
| | | | | | | 2034 | 2751 | 103.827 | 11.508 | 128.831 | 277.0965 | 51.791 | 378.4125 |
| Table 5: Total number of stops per day | | | | | | 2035 | 2797 | 107.369 | 11.876 | 132.557 | 287.2855 | 53.677 | 391.6375 |
| AADT | 1500 | 2000 | 2500 | 3000 | 3500 | 2036 | 2843 | 110.911 | 12.244 | 136.283 | 297.4745 | 55.563 | 404.8625 |
| 20m | 32 | 55 | 83 | 110 | 133 | 2037 | 2889 | 114.453 | 12.612 | 140.009 | 307.6635 | 57.449 | 418.0875 |
| 30m | 47 | 85 | 134 | 188 | 247 | 2038 | 2935 | 117.995 | 12.98 | 143.735 | 317.8525 | 59.335 | 431.3125 |
| 60m | 98 | 181 | 287 | 424 | 589 | 2039 | 2981 | 121.537 | 13.348 | 147.461 | 328.0415 | 61.221 | 444.5375 |
| 80m | 130 | 234 | 364 | 528 | 726 | 2040 | 3027 | 125.619 | 13.77 | 151.214 | 339.4455 | 63.188 | 459.3555 |
| 25m | 39.5 | 70 | 108.5 | 149 | 190 | | | | | | | | |
| 65m | 106 | 194.25 | 306.25 | 450 | 623.25 | | | | | | | | |

Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

| Option (1) | Direction (2) | Period (3) | No./Year (4) | Road Category (5) | Period Volume (6) | TT (mins) (7) | TTC (\$/hr) (8) | Congest (\$/hr) (9) | Reliability (\$/hr) (10) | Annual Cost (\$) (11) |
|--------------------|------------------|---------------|-----------------|----------------------|----------------------|------------------|--------------------|------------------------|-----------------------------|--------------------------|
| DM - Bridge Delays | Both | 2016 | 245 | RS | 1,923 | 166.9085 | \$25.34 | \$4.88 | \$0.00 | \$20,596 |
| DM - Bridge Delays | Both | 2017 | 245 | RS | 1,969 | 175.6255 | \$25.34 | \$4.88 | \$0.00 | \$21,672 |
| DM - Bridge Delays | Both | 2018 | 245 | RS | 2,015 | 185.2350 | \$25.34 | \$4.88 | \$0.00 | \$22,858 |
| DM - Bridge Delays | Both | 2019 | 245 | RS | 2,061 | 196.6890 | \$25.34 | \$4.88 | \$0.00 | \$24,271 |
| DM - Bridge Delays | Both | 2020 | 245 | RS | 2,107 | 208.1430 | \$25.34 | \$4.88 | \$0.00 | \$25,684 |
| DM - Bridge Delays | Both | 2021 | 245 | RS | 2,153 | 219.5970 | \$25.34 | \$4.88 | \$0.00 | \$27,098 |
| DM - Bridge Delays | Both | 2022 | 245 | RS | 2,199 | 231.0510 | \$25.34 | \$4.88 | \$0.00 | \$28,511 |
| DM - Bridge Delays | Both | 2023 | 245 | RS | 2,245 | 242.5050 | \$25.34 | \$4.88 | \$0.00 | \$29,925 |
| DM - Bridge Delays | Both | 2024 | 245 | RS | 2,291 | 253.9590 | \$25.34 | \$4.88 | \$0.00 | \$31,338 |
| DM - Bridge Delays | Both | 2025 | 245 | RS | 2,337 | 265.4130 | \$25.34 | \$4.88 | \$0.00 | \$32,752 |
| DM - Bridge Delays | Both | 2026 | 245 | RS | 2,383 | 276.8670 | \$25.34 | \$4.88 | \$0.00 | \$34,165 |
| DM - Bridge Delays | Both | 2027 | 245 | RS | 2,429 | 288.3210 | \$25.34 | \$4.88 | \$0.00 | \$35,578 |
| DM - Bridge Delays | Both | 2028 | 245 | RS | 2,475 | 299.7750 | \$25.34 | \$4.88 | \$0.00 | \$36,992 |
| DM - Bridge Delays | Both | 2029 | 245 | RS | 2,521 | 312.2685 | \$25.34 | \$4.88 | \$0.00 | \$38,533 |
| DM - Bridge Delays | Both | 2030 | 245 | RS | 2,567 | 325.9995 | \$25.34 | \$4.88 | \$0.00 | \$40,228 |
| DM - Bridge Delays | Both | 2031 | 245 | RS | 2,613 | 339.7305 | \$25.34 | \$4.88 | \$0.00 | \$41,922 |
| DM - Bridge Delays | Both | 2032 | 245 | RS | 2,659 | 353.4615 | \$25.34 | \$4.88 | \$0.00 | \$43,617 |
| DM - Bridge Delays | Both | 2033 | 245 | RS | 2,705 | 367.1925 | \$25.34 | \$4.88 | \$0.00 | \$45,311 |
| DM - Bridge Delays | Both | 2034 | 245 | RS | 2,751 | 380.9235 | \$25.34 | \$4.88 | \$0.00 | \$47,005 |
| DM - Bridge Delays | Both | 2035 | 245 | RS | 2,797 | 394.6545 | \$25.34 | \$4.88 | \$0.00 | \$48,700 |
| DM - Bridge Delays | Both | 2036 | 245 | RS | 2,843 | 408.3855 | \$25.34 | \$4.88 | \$0.00 | \$50,394 |
| DM - Bridge Delays | Both | 2037 | 245 | RS | 2,889 | 422.1165 | \$25.34 | \$4.88 | \$0.00 | \$52,088 |
| DM - Bridge Delays | Both | 2038 | 245 | RS | 2,935 | 435.8475 | \$25.34 | \$4.88 | \$0.00 | \$53,783 |
| DM - Bridge Delays | Both | 2039 | 245 | RS | 2,981 | 449.5785 | \$25.34 | \$4.88 | \$0.00 | \$55,477 |
| DM - Bridge Delays | Both | 2040 | 245 | RS | 3,027 | 463.3095 | \$25.34 | \$4.88 | \$0.00 | \$57,171 |

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 Effective from 1 January 2016

Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

| Option (1) | Direction (2) | Period (3) | No./Year (4) | Road Category (5) | Period Volume (6) | TT (mins) (7) | TTC (\$/hr) (8) | Congest (\$/hr) (9) | Reliability (\$/hr) (10) | Annual Cost (\$) (11) |
|-----------------|------------------|---------------|-----------------|----------------------|----------------------|------------------|--------------------|------------------------|-----------------------------|--------------------------|
| DM - Diversions | Both | 2016 | - | RS | 1,923 | 13,461 | \$25.34 | \$0.00 | \$0.00 | \$5,685 |
| DM - Diversions | Both | 2017 | - | RS | 1,969 | 13,783 | \$25.34 | \$0.00 | \$0.00 | \$5,821 |
| DM - Diversions | Both | 2018 | - | RS | 2,015 | 14,105 | \$25.34 | \$0.00 | \$0.00 | \$5,957 |
| DM - Diversions | Both | 2019 | - | RS | 2,061 | 14,427 | \$25.34 | \$0.00 | \$0.00 | \$6,093 |
| DM - Diversions | Both | 2020 | - | RS | 2,107 | 14,749 | \$25.34 | \$0.00 | \$0.00 | \$6,229 |
| DM - Diversions | Both | 2021 | - | RS | 2,153 | 15,071 | \$25.34 | \$0.00 | \$0.00 | \$6,365 |
| DM - Diversions | Both | 2022 | - | RS | 2,199 | 15,393 | \$25.34 | \$0.00 | \$0.00 | \$6,501 |
| DM - Diversions | Both | 2023 | - | RS | 2,245 | 15,715 | \$25.34 | \$0.00 | \$0.00 | \$6,637 |
| DM - Diversions | Both | 2024 | - | RS | 2,291 | 16,037 | \$25.34 | \$0.00 | \$0.00 | \$6,773 |
| DM - Diversions | Both | 2025 | - | RS | 2,337 | 16,359 | \$25.34 | \$0.00 | \$0.00 | \$6,909 |
| DM - Diversions | Both | 2026 | - | RS | 2,383 | 16,681 | \$25.34 | \$0.00 | \$0.00 | \$7,045 |
| DM - Diversions | Both | 2027 | - | RS | 2,429 | 17,003 | \$25.34 | \$0.00 | \$0.00 | \$7,181 |
| DM - Diversions | Both | 2028 | - | RS | 2,475 | 17,325 | \$25.34 | \$0.00 | \$0.00 | \$7,317 |
| DM - Diversions | Both | 2029 | - | RS | 2,521 | 17,647 | \$25.34 | \$0.00 | \$0.00 | \$7,453 |
| DM - Diversions | Both | 2030 | - | RS | 2,567 | 17,969 | \$25.34 | \$0.00 | \$0.00 | \$7,589 |
| DM - Diversions | Both | 2031 | - | RS | 2,613 | 18,291 | \$25.34 | \$0.00 | \$0.00 | \$7,725 |
| DM - Diversions | Both | 2032 | - | RS | 2,659 | 18,613 | \$25.34 | \$0.00 | \$0.00 | \$7,861 |
| DM - Diversions | Both | 2033 | - | RS | 2,705 | 18,935 | \$25.34 | \$0.00 | \$0.00 | \$7,997 |
| DM - Diversions | Both | 2034 | - | RS | 2,751 | 19,257 | \$25.34 | \$0.00 | \$0.00 | \$8,133 |
| DM - Diversions | Both | 2035 | - | RS | 2,797 | 19,579 | \$25.34 | \$0.00 | \$0.00 | \$8,269 |
| DM - Diversions | Both | 2036 | - | RS | 2,843 | 19,901 | \$25.34 | \$0.00 | \$0.00 | \$8,405 |
| DM - Diversions | Both | 2037 | - | RS | 2,889 | 20,223 | \$25.34 | \$0.00 | \$0.00 | \$8,541 |
| DM - Diversions | Both | 2038 | - | RS | 2,935 | 20,545 | \$25.34 | \$0.00 | \$0.00 | \$8,677 |
| DM - Diversions | Both | 2039 | - | RS | 2,981 | 20,867 | \$25.34 | \$0.00 | \$0.00 | \$8,813 |
| DM - Diversions | Both | 2040 | - | RS | 3,027 | 21,189 | \$25.34 | \$0.00 | \$0.00 | \$8,949 |

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Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

| Option (1) | Direction (2) | Period (3) | No./Year (4) | Road Category (5) | Period Volume (6) | TT (mins) (7) | TTC (\$/hr) (8) | Congest (\$/hr) (9) | Reliability (\$/hr) (10) | Annual Cost (\$) (11) |
|------------------|------------------|---------------|-----------------|----------------------|----------------------|------------------|--------------------|------------------------|-----------------------------|--------------------------|
| DM - HPMV Delays | Both | 2016 | - | RS | 101.51 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$238,421 |
| DM - HPMV Delays | Both | 2017 | - | RS | 104.56 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$245,574 |
| DM - HPMV Delays | Both | 2018 | - | RS | 107.61 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$252,727 |
| DM - HPMV Delays | Both | 2019 | - | RS | 110.65 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$259,879 |
| DM - HPMV Delays | Both | 2020 | - | RS | 113.70 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$267,032 |
| DM - HPMV Delays | Both | 2021 | - | RS | 116.74 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$274,185 |
| DM - HPMV Delays | Both | 2022 | - | RS | 119.79 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$281,337 |
| DM - HPMV Delays | Both | 2023 | - | RS | 122.83 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$288,490 |
| DM - HPMV Delays | Both | 2024 | - | RS | 125.88 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$295,642 |
| DM - HPMV Delays | Both | 2025 | - | RS | 128.92 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$302,795 |
| DM - HPMV Delays | Both | 2026 | - | RS | 131.97 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$309,948 |
| DM - HPMV Delays | Both | 2027 | - | RS | 135.01 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$317,100 |
| DM - HPMV Delays | Both | 2028 | - | RS | 138.06 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$324,253 |
| DM - HPMV Delays | Both | 2029 | - | RS | 141.11 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$331,406 |
| DM - HPMV Delays | Both | 2030 | - | RS | 144.15 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$338,558 |
| DM - HPMV Delays | Both | 2031 | - | RS | 147.20 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$345,711 |
| DM - HPMV Delays | Both | 2032 | - | RS | 150.24 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$352,864 |
| DM - HPMV Delays | Both | 2033 | - | RS | 153.29 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$360,016 |
| DM - HPMV Delays | Both | 2034 | - | RS | 156.33 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$367,169 |
| DM - HPMV Delays | Both | 2035 | - | RS | 159.38 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$374,322 |
| DM - HPMV Delays | Both | 2036 | - | RS | 162.42 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$381,474 |
| DM - HPMV Delays | Both | 2037 | - | RS | 165.47 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$388,627 |
| DM - HPMV Delays | Both | 2038 | - | RS | 168.51 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$395,779 |
| DM - HPMV Delays | Both | 2039 | - | RS | 171.56 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$402,932 |
| DM - HPMV Delays | Both | 2040 | - | RS | 174.61 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$410,085 |

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Additional VOC due to delays

Assumptions

- Additional VOC due to stops (Cents per speed change cycle), Table A5.41 of EEM
- Additional VOC due to waiting time (Cents per min), Table A5.23 of EEM

| Year | Total vehicle stops per day | Additional VOC | Total waiting time (min per day) | Additional VOC (c/min) | Days per year | Annual Cost |
|------|-----------------------------|----------------|----------------------------------|------------------------|---------------|-------------|
| 2016 | 245.9625 | 2.151 | 27.113 | 3 | 245 | \$ 1,495.49 |
| 2017 | 256.8875 | 2.151 | 28.539 | 3 | 245 | \$ 1,563.55 |
| 2018 | 268.765 | 2.151 | 30.145 | 3 | 245 | \$ 1,637.94 |
| 2019 | 282.611 | 2.151 | 32.123 | 3 | 245 | \$ 1,725.45 |
| 2020 | 296.457 | 2.151 | 34.101 | 3 | 245 | \$ 1,812.96 |
| 2021 | 310.303 | 2.151 | 36.079 | 3 | 245 | \$ 1,900.46 |
| 2022 | 324.149 | 2.151 | 38.057 | 3 | 245 | \$ 1,987.97 |
| 2023 | 337.995 | 2.151 | 40.035 | 3 | 245 | \$ 2,075.47 |
| 2024 | 351.841 | 2.151 | 42.013 | 3 | 245 | \$ 2,162.98 |
| 2025 | 365.687 | 2.151 | 43.991 | 3 | 245 | \$ 2,250.49 |
| 2026 | 379.533 | 2.151 | 45.969 | 3 | 245 | \$ 2,337.99 |
| 2027 | 393.379 | 2.151 | 47.947 | 3 | 245 | \$ 2,425.50 |
| 2028 | 407.225 | 2.151 | 49.925 | 3 | 245 | \$ 2,513.00 |
| 2029 | 422.4885 | 2.151 | 52.029 | 3 | 245 | \$ 2,608.91 |
| 2030 | 439.4395 | 2.151 | 54.283 | 3 | 245 | \$ 2,714.80 |
| 2031 | 456.3905 | 2.151 | 56.537 | 3 | 245 | \$ 2,820.70 |
| 2032 | 473.3415 | 2.151 | 58.791 | 3 | 245 | \$ 2,926.60 |
| 2033 | 490.2925 | 2.151 | 61.045 | 3 | 245 | \$ 3,032.50 |
| 2034 | 507.2435 | 2.151 | 63.299 | 3 | 245 | \$ 3,138.40 |
| 2035 | 524.1945 | 2.151 | 65.553 | 3 | 245 | \$ 3,244.29 |
| 2036 | 541.1455 | 2.151 | 67.807 | 3 | 245 | \$ 3,350.19 |
| 2037 | 558.0965 | 2.151 | 70.061 | 3 | 245 | \$ 3,456.09 |
| 2038 | 575.0475 | 2.151 | 72.315 | 3 | 245 | \$ 3,561.99 |
| 2039 | 591.9985 | 2.151 | 74.569 | 3 | 245 | \$ 3,667.88 |
| 2040 | 610.5695 | 2.151 | 76.958 | 3 | 245 | \$ 3,783.31 |

Additional VOC due to Detours

Assumptions

- 3 Bridge closure in last 5 years = 60% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed average detour is 89.3km, 70 min (=77km/h)
- VOC cost Table A5.9, 75km/h, 2% grade

| Year (1) | AADT (2) | % AADT affected (3) | P (Diversion) (4) | Number of Veh Diverted (5) = (2)x(3)x(4) | Additional Journey Distance (6) | VOC Cost, cents per km (7) | Annual Cost |
|-------------|-------------|------------------------|----------------------|--|---------------------------------------|----------------------------------|-------------|
| 2016 | 1,923 | 16.67% | 0.6000 | 192.30 | 89.3 | 33.3 | \$ 5,718.41 |
| 2017 | 1,969 | 16.67% | 0.6000 | 196.90 | 89.3 | 33.3 | \$ 5,855.20 |
| 2018 | 2,015 | 16.67% | 0.6000 | 201.50 | 89.3 | 33.3 | \$ 5,991.99 |
| 2019 | 2,061 | 16.67% | 0.6000 | 206.10 | 89.3 | 33.3 | \$ 6,128.78 |
| 2020 | 2,107 | 16.67% | 0.6000 | 210.70 | 89.3 | 33.3 | \$ 6,265.56 |
| 2021 | 2,153 | 16.67% | 0.6000 | 215.30 | 89.3 | 33.3 | \$ 6,402.35 |
| 2022 | 2,199 | 16.67% | 0.6000 | 219.90 | 89.3 | 33.3 | \$ 6,539.14 |
| 2023 | 2,245 | 16.67% | 0.6000 | 224.50 | 89.3 | 33.3 | \$ 6,675.93 |
| 2024 | 2,291 | 16.67% | 0.6000 | 229.10 | 89.3 | 33.3 | \$ 6,812.72 |
| 2025 | 2,337 | 16.67% | 0.6000 | 233.70 | 89.3 | 33.3 | \$ 6,949.51 |
| 2026 | 2,383 | 16.67% | 0.6000 | 238.30 | 89.3 | 33.3 | \$ 7,086.30 |
| 2027 | 2,429 | 16.67% | 0.6000 | 242.90 | 89.3 | 33.3 | \$ 7,223.09 |
| 2028 | 2,475 | 16.67% | 0.6000 | 247.50 | 89.3 | 33.3 | \$ 7,359.88 |
| 2029 | 2,521 | 16.67% | 0.6000 | 252.10 | 89.3 | 33.3 | \$ 7,496.67 |
| 2030 | 2,567 | 16.67% | 0.6000 | 256.70 | 89.3 | 33.3 | \$ 7,633.46 |
| 2031 | 2,613 | 16.67% | 0.6000 | 261.30 | 89.3 | 33.3 | \$ 7,770.25 |
| 2032 | 2,659 | 16.67% | 0.6000 | 265.90 | 89.3 | 33.3 | \$ 7,907.04 |
| 2033 | 2,705 | 16.67% | 0.6000 | 270.50 | 89.3 | 33.3 | \$ 8,043.83 |
| 2034 | 2,751 | 16.67% | 0.6000 | 275.10 | 89.3 | 33.3 | \$ 8,180.62 |
| 2035 | 2,797 | 16.67% | 0.6000 | 279.70 | 89.3 | 33.3 | \$ 8,317.41 |
| 2036 | 2,843 | 16.67% | 0.6000 | 284.30 | 89.3 | 33.3 | \$ 8,454.20 |
| 2037 | 2,889 | 16.67% | 0.6000 | 288.90 | 89.3 | 33.3 | \$ 8,590.99 |
| 2038 | 2,935 | 16.67% | 0.6000 | 293.50 | 89.3 | 33.3 | \$ 8,727.78 |
| 2039 | 2,981 | 16.67% | 0.6000 | 298.10 | 89.3 | 33.3 | \$ 8,864.57 |
| 2040 | 3,027 | 16.67% | 0.6000 | 302.70 | 89.3 | 33.3 | \$ 9,001.36 |

Worksheets A6: Accident cost savings



Worksheet A6.1 - Summary of accident costs

| | | | | | | |
|----|---|---|--------------|--------|--------------------------------|-------------|
| 1 | Project name: | SH12 Matakoho Bridges RP185/10.87 to 14.31 | | | | |
| 2 | Historic accident period: | from | 2011 | to | 2015 | |
| 3 | Summary of accidents | | | | | |
| | Movement category | Number of injury accidents | | | Number of non-injury accidents | |
| | | Fatal | Serious | Minor | | |
| | Head on | - | 1 | 1 | 1 | |
| | Lost control off road | - | 2 | - | 3 | |
| | Manoeuvring | - | - | - | 2 | |
| | | - | - | - | - | |
| | | - | - | - | - | |
| | | - | - | - | - | |
| | | - | - | - | - | |
| | Total | 0 | 3 | 1 | 6 | |
| 4 | Description of likely causative factors: | Two single lane bridges, tortuous alignment | | | | |
| 5 | Description of project options & predicted accident savings | New two-lane bridges High standard realignment 975m of route shortening | | | | |
| 6 | Terrain type | Rolling | | | | |
| 7 | Traffic volume (time zero) | 1,923 | | | | |
| 8 | Traffic growth rate (time zero) | 2.4% | | | | |
| 9 | Length of project (km) | Do-minimum | 3.44 | | Option | 2.465 |
| 10 | Exposure (time zero) | | 2414518.8 | | | 1730171.175 |
| 11 | Injury accidents per year (time zero) | | 0.8 | | | 0.28 |
| 12 | Accident rate (time zero per 100M VKT) | | 33.13 | | | 16.18 |
| 13 | Typical accident rate (per 100M VKT) | | 34 | | | 18 |
| 14 | Summary of annual accident costs | | | | | |
| | Movement category | Do-minimum | | Option | | |
| | Head on | \$ | 616,533.96 | \$ | 127,359.62 | |
| | Loss of control (off road) | \$ | 620,849.11 | \$ | 308,103.81 | |
| | Crossing (turning) | \$ | 44,311.79 | \$ | 10,196.31 | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | Total | \$ | 1,281,694.86 | \$ | 445,659.75 | |

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Matakohe Bridges Crash History

| # | CRASH ROAD | CRASH DIST | CRASH DIRN | INTSN | SIDE ROAD | CRASH ID | CRASH DATE | CRASH DOW | CRASH TIME | MVMT | VEHICLES | CAUSES | OBJECTS STRUCK | ROAD CURVE | ROAD WET | LIGHT | WTHRa | JUNC TYPE | TRAF CTRL | ROAD MARK | SPD LIM | CRASH FATAL CNT | CRASH SEV CNT | CRASH MIN CNT | PERS AGE1 | PERS AGE2 | Proposed Crash Reduction | Reason |
|-----|---------------|------------|------------|-------|--------------------|-----------|------------|-----------|------------|------|----------|----------------|----------------|------------|----------|-------|-------|-----------|-----------|-----------|---------|-----------------|---------------|---------------|-----------|-----------|--------------------------|--------------------|
| 180 | 12/185/13.428 | 770 | E | | ARARUA ROAD | 201135826 | 17/05/2011 | Tue | 850 | BA | CE1C | 301A 341A | | R | W | ON | F | | G | N | 100 | 0 | 0 | 0 | | | 80 | 1-lane bridge gone |
| 175 | 12/185/12.158 | 270 | E | | MATAKOHE EAST ROAD | 201201872 | 8/03/2012 | Thu | 1607 | BA | VE14 | 301A | | R | D | ON | F | | G | C | 100 | 0 | 1 | 2 | | | 80 | 1-lane bridge gone |
| 176 | 12/185/12.258 | 400 | S | | ARARUA ROAD | 201416476 | 21/07/2014 | Mon | 1345 | BB | TS14 | 111A 123A 330A | | E | W | O | F | | | L | 100 | 0 | 0 | 2 | | | 80 | 1-lane bridge gone |
| 187 | 12/185/14.153 | 1000 | W | | PETLEY ROAD | 201203235 | 22/06/2012 | Fri | 1713 | DA | MW1 | 102A 131A | | M | W | DN | L | | N | C | 100 | 0 | 1 | 0 | | | 50 | Superior alignment |
| 170 | 12/185/11.458 | 1200 | S | | ARARUA ROAD | 201231254 | 2/01/2012 | Mon | 130 | DA | CN1 | 111A 131A | F | S | W | DN | L | | N | C | 100 | 0 | 0 | 0 | | | 50 | Superior alignment |
| 184 | 12/185/13.953 | 1200 | W | | PETLEY ROAD | 201234853 | 11/06/2012 | Mon | 813 | DB | TW1 | 137A 902 | V | M | W | BN | L | | N | C | 100 | 0 | 0 | 0 | | | 50 | Superior alignment |
| 183 | 12/185/13.783 | 1370 | W | | PETLEY ROAD | 201241440 | 29/11/2012 | Thu | 2130 | DB | CN1 | 135A 801 | E | M | W | DN | H | | N | C | 100 | 0 | 0 | 0 | | | 50 | Superior alignment |
| 182 | 12/185/13.748 | 1090 | E | | ARARUA ROAD | 201303353 | 3/02/2013 | Sun | 215 | DB | CW1 | 101A 131A | F | M | D | DN | F | | N | C | 100 | 0 | 1 | 0 | | | 50 | Superior alignment |
| 171 | 12/185/11.788 | 100 | W | | BARLOW LANE | 201436424 | 22/03/2014 | Sat | 1800 | MG | CN1T | 371B | | R | D | BN | F | | G | C | 100 | 0 | 0 | 0 | | | 80 | 1-lane bridge gone |
| 178 | 12/185/12.448 | 210 | W | | ARARUA ROAD | 201138138 | 18/06/2011 | Sat | 130 | MO | CW1 | 103A 129A 929 | V | E | W | DN | H | D | N | C | 100 | 0 | 0 | 0 | | | 5 | Improved Shoulders |

RELEASED UNDER THE OFFICIAL INFORMATION ACT

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Head on | Vehicle involvement | | | | Car, van, other |
|---|---------|---------------------|------------|----------|------------|-----------------|
| 1 Do-minimum mean speed | 70 | Road category | | | | RS |
| Posted speed limit | 100 | Traffic growth rate | | | | 2.4% |
| 2 Option mean speed | 100 | | | | | |
| Do-minimum | | Severity | | | | |
| | | Fatal | Serious | Minor | Non-injury | |
| 3 Number of years of typical accident rate records | | 5 | | | | |
| 4 Number of reported accidents over period | | 0 | 1 | 0 | 1 | |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.36 | 0.64 | 1.0 | 1.0 | |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0.36 | 0.64 | 0 | 1 | |
| 7 Accidents per year = (6) / (3) | | 0.072 | 0.128 | 0 | 0.2 | |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0.074592 | 0.132608 | 0 | 0.2072 | |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 | |
| 11 Total estimated accidents per year = (9) x (10) | | 0.074592 | 0.251952 | 0 | 3.8332 | |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$5,700,000 | \$675,000 | \$37,000 | \$3,300 | |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$5,400,000 | \$650,000 | \$35,000 | \$2,700 | |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$5,520,000 | \$660,000 | \$35,800 | \$2,940 | |
| 16 Accident cost per year = (11) x (15) | | \$411,748 | \$166,290 | \$0 | \$11,270 | |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 589,307.88 | | | | |
| Option | | | | | | |
| 18 Percentage accident reduction | | 80% | | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 20% | | | | |
| 20 Predicted accidents per year (11) x (19) | | 0.0149184 | 0.05039104 | 0 | 0.76664 | |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$5,700,000 | \$675,000 | \$37,000 | \$3,300 | |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$5,400,000 | \$650,000 | \$35,000 | \$2,700 | |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$5,700,000 | \$675,000 | \$37,000 | \$3,300 | |
| 25 Accident cost per year = (20) x (24) | | \$85,035 | \$34,014 | \$0 | \$2,530 | |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 121,578.74 | | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 467,729.14 | | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Head on | Vehicle involvement | Truck | |
|---|-------------|---------------------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | |
| 2 Option mean speed | 100 | | | |
| Do-minimum | Severity | | | |
| | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | 5 | | | |
| 4 Number of reported accidents over period | 0 | 0 | 1 | 0 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | 0.36 | 0.64 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | 0 | 0 | 1 | 0 |
| 7 Accidents per year = (6) / (3) | 0 | 0 | 0.2 | 0 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | 0 | 0 | 0.2072 | 0 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | 0 | 0 | 0.9324 | 0 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | \$5,050,000 | \$550,000 | \$31,000 | \$10,300 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | \$4,150,000 | \$460,000 | \$28,000 | \$7,900 |
| 14 Mean speed adjustment - ((1) - 50)/50 | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | \$4,510,000 | \$496,000 | \$29,200 | \$8,860 |
| 16 Accident cost per year = (11) x (15) | \$0 | \$0 | \$27,226 | \$0 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | \$ | | | 27,226.08 |
| Option | | | | |
| 18 Percentage accident reduction | 80% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | 20% | | | |
| 20 Predicted accidents per year (11) x (19) | 0 | 0 | 0.18648 | 0 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | \$5,050,000 | \$550,000 | \$31,000 | \$10,300 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | \$4,150,000 | \$460,000 | \$28,000 | \$7,900 |
| 23 Mean speed adjustment - ((2) - 50)/50 | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | \$5,050,000 | \$550,000 | \$31,000 | \$10,300 |
| 25 Accident cost per year = (20) x (24) | \$0 | \$0 | \$5,781 | \$0 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | \$ | | | 5,780.88 |
| 27 Annual accident cost savings = (17) - (26) | \$ | | | 21,445.20 |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Lost control off road | Vehicle involvement | Car, van, other | | |
|---|-----------------------|---------------------|-----------------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | | Severity | | | |
| | | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | | 5 | | | |
| 4 Number of reported accidents over period | | 0 | 1 | 0 | 2 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.13 | 0.87 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0.13 | 0.87 | 0 | 2 |
| 7 Accidents per year = (6) / (3) | | 0.026 | 0.174 | 0 | 0.4 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0.026936 | 0.180264 | 0 | 0.4144 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | | 0.026936 | 0.3425016 | 0 | 7.6664 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$4,700,000 | \$520,000 | \$29,000 | \$1,700 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$5,150,000 | \$525,000 | \$28,000 | \$1,700 |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$4,970,000 | \$523,000 | \$28,400 | \$1,700 |
| 16 Accident cost per year = (11) x (15) | | \$133,872 | \$179,128 | \$0 | \$13,033 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 326,033.14 | | | |
| Option | | | | | |
| 18 Percentage accident reduction | | 50% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 50% | | | |
| 20 Predicted accidents per year (11) x (19) | | 0.013468 | 0.1712508 | 0 | 3.8332 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$4,700,000 | \$520,000 | \$29,000 | \$1,700 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$5,150,000 | \$525,000 | \$28,000 | \$1,700 |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$4,700,000 | \$520,000 | \$29,000 | \$1,700 |
| 25 Accident cost per year = (20) x (24) | | \$63,300 | \$89,050 | \$0 | \$6,516 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 158,866.46 | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 167,166.68 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Lost control off road | Vehicle involvement | Motorcycle | | |
|---|-----------------------|---------------------|------------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | | Severity | | | |
| | | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | | 5 | | | |
| 4 Number of reported accidents over period | | 0 | 1 | 0 | 0 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.13 | 0.87 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0.13 | 0.87 | 0 | 0 |
| 7 Accidents per year = (6) / (3) | | 0.026 | 0.174 | 0 | 0 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0.026936 | 0.180264 | 0 | 0 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | | 0.026936 | 0.3425016 | 0 | 0 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$4,100,000 | \$455,000 | \$25,000 | \$1,800 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$4,200,000 | \$445,000 | \$24,000 | \$1,800 |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$4,160,000 | \$449,000 | \$24,400 | \$1,800 |
| 16 Accident cost per year = (11) x (15) | | \$112,054 | \$153,783 | \$0 | \$0 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 265,836.98 | | | |
| Option | | | | | |
| 18 Percentage accident reduction | | 50% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 50% | | | |
| 20 Predicted accidents per year (11) x (19) | | 0.013468 | 0.1712508 | 0 | 0 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$4,100,000 | \$455,000 | \$25,000 | \$1,800 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$4,200,000 | \$445,000 | \$24,000 | \$1,800 |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$4,100,000 | \$455,000 | \$25,000 | \$1,800 |
| 25 Accident cost per year = (20) x (24) | | \$55,219 | \$77,919 | \$0 | \$0 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 133,137.91 | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 132,699.06 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Lost control off road | Vehicle involvement | Truck | | |
|---|-----------------------|---------------------|-----------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | | Severity | | | |
| | | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | | 5 | | | |
| 4 Number of reported accidents over period | | 0 | 0 | 0 | 1 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.13 | 0.87 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0 | 0 | 0 | 1 |
| 7 Accidents per year = (6) / (3) | | 0 | 0 | 0 | 0.2 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0 | 0 | 0 | 0.2072 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | | 0 | 0 | 0 | 3.8332 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$4,300,000 | \$475,000 | \$26,000 | \$8,400 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$4,150,000 | \$505,000 | \$26,000 | \$7,000 |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$4,210,000 | \$493,000 | \$26,000 | \$7,560 |
| 16 Accident cost per year = (11) x (15) | | \$0 | \$0 | \$0 | \$28,979 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 28,978.99 | | | |
| Option | | | | | |
| 18 Percentage accident reduction | | 50% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 50% | | | |
| 20 Predicted accidents per year (11) x (19) | | 0 | 0 | 0 | 1.9166 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$4,300,000 | \$475,000 | \$26,000 | \$8,400 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$4,150,000 | \$505,000 | \$26,000 | \$7,000 |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$4,300,000 | \$475,000 | \$26,000 | \$8,400 |
| 25 Accident cost per year = (20) x (24) | | \$0 | \$0 | \$0 | \$16,099 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 16,099.44 | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 12,879.55 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Crossing, turning | Vehicle involvement | Truck | |
|---|-------------------|---------------------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | |
| 2 Option mean speed | 100 | | | |
| Do-minimum | Severity | | | |
| | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | 5 | | | |
| 4 Number of reported accidents over period | 0 | 0 | 0 | 1 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | 0.16 | 0.84 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | 0 | 0 | 0 | 1 |
| 7 Accidents per year = (6) / (3) | 0 | 0 | 0 | 0.2 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | 0 | 0 | 0 | 0.2072 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | 0 | 0 | 0 | 3.8332 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | \$5,000,000 | \$485,000 | \$30,000 | \$10,000 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | \$4,150,000 | \$535,000 | \$27,000 | \$7,800 |
| 14 Mean speed adjustment - ((1) - 50)/50 | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | \$4,490,000 | \$515,000 | \$28,200 | \$8,680 |
| 16 Accident cost per year = (11) x (15) | \$0 | \$0 | \$0 | \$33,272 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | \$ | | | 33,272.18 |
| Option | | | | |
| 18 Percentage accident reduction | 80% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | 20% | | | |
| 20 Predicted accidents per year (11) x (19) | 0 | 0 | 0 | 0.76664 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | \$5,000,000 | \$485,000 | \$30,000 | \$10,000 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | \$4,150,000 | \$535,000 | \$27,000 | \$7,800 |
| 23 Mean speed adjustment - ((2) - 50)/50 | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | \$5,000,000 | \$485,000 | \$30,000 | \$10,000 |
| 25 Accident cost per year = (20) x (24) | \$0 | \$0 | \$0 | \$7,666 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | \$ | | | 7,666.40 |
| 27 Annual accident cost savings = (17) - (26) | \$ | | | 25,605.78 |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Crossing, turning | Vehicle involvement | Car, van, other | | |
|---|-------------------|---------------------|-----------------|------------|--|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | Severity | | | | |
| | Fatal | Serious | Minor | Non-injury | |
| 3 Number of years of typical accident rate records | 5 | | | | |
| 4 Number of reported accidents over period | 0 | 0 | 0 | 1 | |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | 0.16 | 0.84 | 1.0 | 1.0 | |
| 6 Number of reported accidents adjusted by severity (4) x (5) | 0 | 0 | 0 | 1 | |
| 7 Accidents per year = (6) / (3) | 0 | 0 | 0 | 0.2 | |
| 8 Adjustment factor for accident trend (table A6.1(a)) | 1.036 | | | | |
| 9 Adjusted accidents per year = (7) x (8) | 0 | 0 | 0 | 0.2072 | |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | 1 | 1.9 | 4.5 | 18.5 | |
| 11 Total estimated accidents per year = (9) x (10) | 0 | 0 | 0 | 3.8332 | |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | \$4,500,000 | \$575,000 | \$36,000 | \$3,300 | |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | \$4,800,000 | \$490,000 | \$30,000 | \$2,600 | |
| 14 Mean speed adjustment - ((1) - 50)/50 | 0.4 | | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | \$4,680,000 | \$524,000 | \$32,400 | \$2,880 | |
| 16 Accident cost per year = (11) x (15) | \$0 | \$0 | \$0 | \$11,040 | |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | \$ | | | 11,039.62 | |
| Option | | | | | |
| 18 Percentage accident reduction | 80% | | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | 20% | | | | |
| 20 Predicted accidents per year (11) x (19) | 0 | 0 | 0 | 0.76664 | |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | \$4,500,000 | \$575,000 | \$36,000 | \$3,300 | |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | \$4,800,000 | \$490,000 | \$30,000 | \$2,600 | |
| 23 Mean speed adjustment - ((2) - 50)/50 | 1 | | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | \$4,500,000 | \$575,000 | \$36,000 | \$3,300 | |
| 25 Accident cost per year = (20) x (24) | \$0 | \$0 | \$0 | \$2,530 | |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | \$ | | | 2,529.91 | |
| 27 Annual accident cost savings = (17) - (26) | \$ | | | 8,509.70 | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

Worksheets A6: Accident cost savings continued



Worksheet A6.4a - Accident rate analysis

| Option | Matakohe - Do-Min Detour Route Crashes | | |
|---|--|----------------------------|-------------|
| Posted speed limit | 100km/h near rural | Traffic growth rate | 2.4% |
| Road category | Rural Strategic | Time zero | Jul-15 |
| Accident prediction model | | | |
| 1 | Table used | | |
| 2 | Parameter b_0 | | |
| 3 | Parameter b_1 | | |
| 4 | Parameter b_2 | | |
| 5 | Lowest or side road AADT (Q_{minor}) | | |
| 6 | Highest or primary AADT (Q_{major}) | | 192.3 |
| 7 | Typical accident rate (accidents per year), A_T (formula from crash compendium) | | |
| Go to step 8 | | | |
| Exposure-based accident prediction equation | | | |
| 1a | Table used | | 3.1 |
| 2a | Coefficient b_0 ($/10^8$ veh-km or $/10^8$ vehicles) | Primary Collector, Winding | 34 |
| 3a | Cross section adjustment factor from crash compendium table 5 (1.0 for no adjustment) | | 1.12 |
| 4a | Adjusted coefficient (2a) x (3a) | | 38.08 |
| 5a | Exposure at time zero (10^8 veh-km or 10^8 vehicles) | | 0.000171724 |
| 7 | Typical accident rate (accidents per year), A_T (4a) x (5a) | | 0.006539246 |
| 8 | Accident trends factor for adjusting typical accident rate (appendix A6.5 method B) | | -0.02 |
| 9 | Adjustment factor for accident trend ($1 + (8) \times (\text{time zero year} - 2006)$) (appendix A6.5 B) | | 0.82 |
| 10 | Typical accident rate per year adjusted for accident trends, A_T (7) x (9) | | 0.005362182 |
| 11 | Cost per reported injury accident (table A6.5) | \$ | 570,000 |
| 12 | Total accident cost per year (10) x (11) | \$ | 3,056.44 |

Network Resilience: Detour Calculations

Assumptions:-

- 3 Bridge closure in last 5 years = 60% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed Average Detour = 89.3km, 70 mins

| Year (1) | AADT (2) | % AADT affected (3) | P (Diversion) (4) | Number of Veh Diverted (5) = (2)x(3)x(4) | Additional Journey Time (6) |
|-------------|-------------|---------------------------|----------------------|--|-----------------------------------|
| 2016 | 1,923 | 16.67% | 0.6000 | 192.3000 | 70 |
| 2017 | 1,969 | 16.67% | 0.6000 | 196.9000 | 70 |
| 2018 | 2,015 | 16.67% | 0.6000 | 201.5000 | 70 |
| 2019 | 2,061 | 16.67% | 0.6000 | 206.1000 | 70 |
| 2020 | 2,107 | 16.67% | 0.6000 | 210.7000 | 70 |
| 2021 | 2,153 | 16.67% | 0.6000 | 215.3000 | 70 |
| 2022 | 2,199 | 16.67% | 0.6000 | 219.9000 | 70 |
| 2023 | 2,245 | 16.67% | 0.6000 | 224.5000 | 70 |
| 2024 | 2,291 | 16.67% | 0.6000 | 229.1000 | 70 |
| 2025 | 2,337 | 16.67% | 0.6000 | 233.7000 | 70 |
| 2026 | 2,383 | 16.67% | 0.6000 | 238.3000 | 70 |
| 2027 | 2,429 | 16.67% | 0.6000 | 242.9000 | 70 |
| 2028 | 2,475 | 16.67% | 0.6000 | 247.5000 | 70 |
| 2029 | 2,521 | 16.67% | 0.6000 | 252.1000 | 70 |
| 2030 | 2,567 | 16.67% | 0.6000 | 256.7000 | 70 |
| 2031 | 2,613 | 16.67% | 0.6000 | 261.3000 | 70 |
| 2032 | 2,659 | 16.67% | 0.6000 | 265.9000 | 70 |
| 2033 | 2,705 | 16.67% | 0.6000 | 270.5000 | 70 |
| 2034 | 2,751 | 16.67% | 0.6000 | 275.1000 | 70 |
| 2035 | 2,797 | 16.67% | 0.6000 | 279.7000 | 70 |
| 2036 | 2,843 | 16.67% | 0.6000 | 284.3000 | 70 |
| 2037 | 2,889 | 16.67% | 0.6000 | 288.9000 | 70 |
| 2038 | 2,935 | 16.67% | 0.6000 | 293.5000 | 70 |
| 2039 | 2,981 | 16.67% | 0.6000 | 298.1000 | 70 |
| 2040 | 3,027 | 16.67% | 0.6000 | 302.7000 | 70 |

Network Resilience: HPMV Waiting Time

HPMV Waiting Time on SH1 if no HPMV route available

- Last 10 years = 40 closures (RS 261-319)
- Total Closure time = 487.27 Hours
- Average Closure time per year = 48.727 hours
- SH1 RP 292/6.23 AADT = 10928 with 10%HCV
- 1093 HCV per year, assumed 50 HPMV with 3% growth rate
- EEM TTC Costs, used \$20.1 for driver, \$28.1 for HCV2 = \$48.2

| | |
|------------------------|------------------|
| Delay p.a. | 48.727 |
| | 2.030291667 days |
| % AADT | 203.03% |
| HPMV (T ₀) | 50 |
| Tzero | 101.5145833 |
| Growth | 0.03 |

Network Resilience: Layer 2 Benefits

Figures from Network Resilience Business Case (Opus,2013)

- Layer 1 = Traditional EEM Benefits
- Layer 2 = Extended Benefits from wider economy effects
- Layer 2 Benefits were from 48 Hour Closure
- Layer 2 benefits peer reviewed by ASCARI Partners
- Recognising that link severances have wider effects, propose to use results from 2013 study

| | |
|-----------------|-----------------------------|
| Layer 1 Benefit | 63000000 |
| Layer 2 Benefit | 15800000 |
| % | 25.08% For 48 hour closures |
| Adjustment | 2.09% For 4 Hour Closure |

| | |
|---------------------|---------------|
| TTC Detour Benefits | \$ 117,638.76 |
| VOC Detour Benefits | \$ 26,087.11 |
| ACC Detour Benefits | \$ 38,291.05 |
| Layer 2 Benefits | \$ 3,804.06 |

RELEASED UNDER THE OFFICIAL INFORMATION ACT

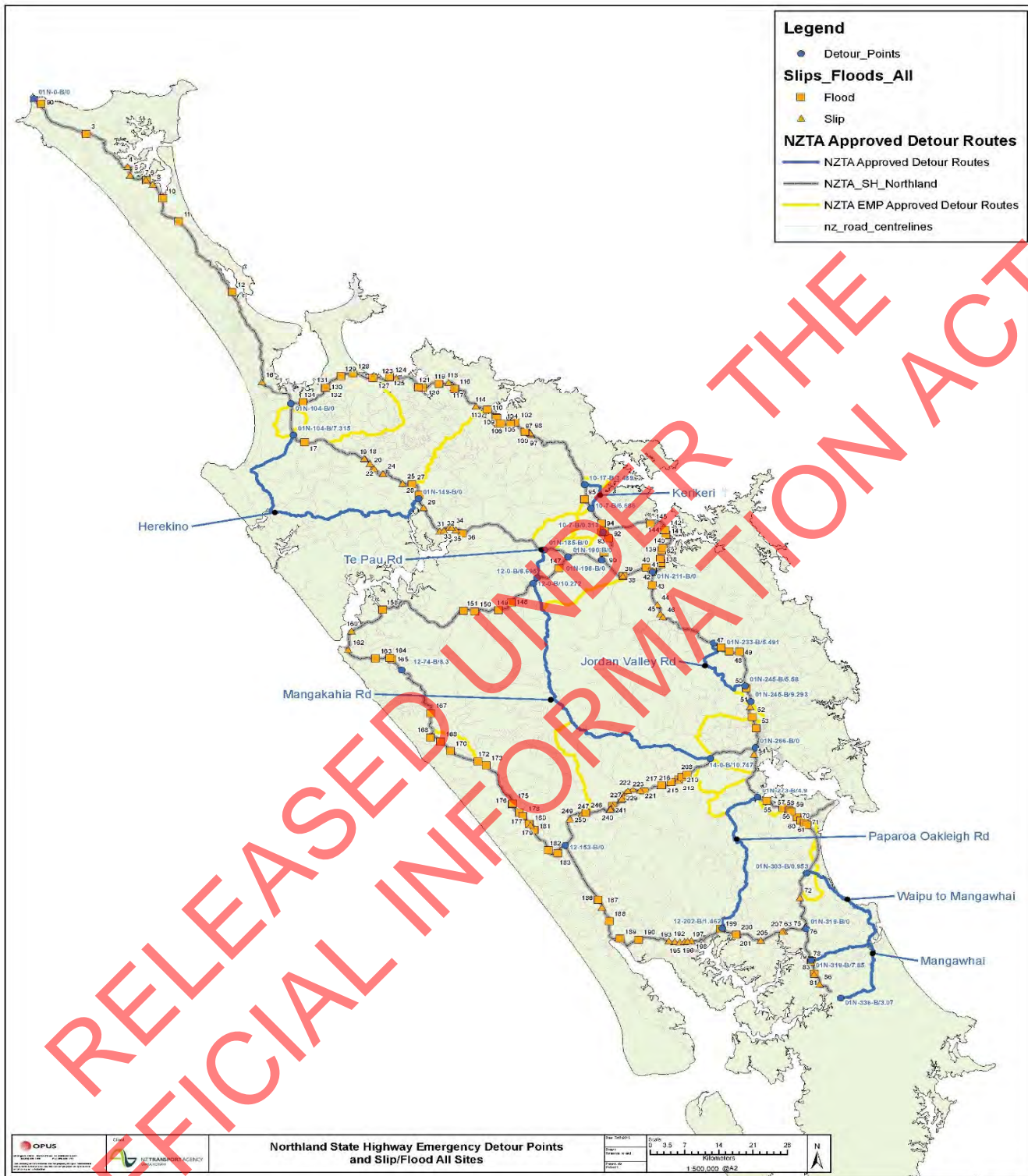
Matakohe, Replacement of One Lane Bridges Economic Summary

| NPV Benefits | NPV \$ | Comment |
|--|----------------------|--|
| Travel Time Costs - Delays at Bridge | \$ 543,630 | Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988) |
| Travel Time Costs - Detours for Closures | \$ 117,639 | Detours as per Fig.13 NZTA Approved Detours |
| Travel Time Costs - New Alignment | \$ 8,707,643 | As per EEM |
| Vehicle Operating Costs - Delays at Bridge | \$ 26,087 | Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988) |
| Vehicle Operating Costs - Detours for Closures | \$ 82,173 | Detours as per Fig.13 NZTA Approved Detours |
| Vehicle Operating Costs - New Alignment | \$ 3,402,080 | As per EEM |
| Crash Costs 1-Lane vs 2-Lane | \$ 8,828,651 | As per EEM |
| Crash Costs - Detours for Closures | \$ 38,291 | Additional Traffic on network |
| Crash Costs - New Alignment | \$ 5,199,242 | As per EEM |
| Emissions | \$ 175,517 | 5% of VOC as per EEM A9.6 |
| Network Resilience | \$ 5,126,570 | HPMV Waiting time during SH1 Closures |
| Wider Economic Benefits of reduced closures | \$ 3,804 | Used Results from 2013 Network resilience case |
| Total Benefits | \$ 32,251,326 | |
| NPV Costs | | |
| Do-Min - New Bridges in Year 20 | \$ 2,769,392 | Assumed 20 year life in existing bridge |
| Do-Min - Additional Maintenance Costs | \$ 28,204 | |
| Subtotal: NPV Do-Min Costs | \$ 2,797,596 | |
| Option - New Bridges in Year 0 | \$ 11,899,403 | |
| Option - New Alignment | \$ 13,330,547 | |
| Subtotal: NPV Option Costs | \$ 25,229,950 | |
| Net Costs | \$ 22,432,354 | |
| Indicative BCR | 1.44 | |

Matakohe Bridges + Realignment - Site Location, SH12 RP 185/10.87 to 14.31



NZTA Approved Detours



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| Matakohe Bridges - SH1 HPMV closures | | | | | | | |
|--------------------------------------|---------------|------------------|------------------|----------------------|-------------|---|------------------------|
| # | State Highway | Start Location | End Location | Impact | Description | Event Comments | Event Duration (hh.mm) |
| 70 | 1N | 01N-0261/02.43-D | 01N-0261/02.43-D | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 3.05 |
| 30 | 1N | 01N-0261/02.43-I | 01N-0261/02.43-I | Road Closed | Crash | Crash On St Hwy 1 In Whangarei At Intersection With Manse Street. Southbound Lane Is Closed At Manse Street Intersection. Diversions In Place On Northbound Lane On St Hwy 1 Which Is Open To Two-way Traffic. | 4.04 |
| 61 | 1N | 01N-0261/03.89 | 01N-0261/03.89 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. | 5.53 |
| 65 | 1N | 01N-0261/04.25 | 01N-0261/04.25 | Road Closed | Other | Utilities Disruption | 0.12 |
| 97 | 1N | 01N-0266/00.18 | 01N-0266/00.18 | Road Closed | Other | Otaika Road (sh1) Is Closed Between Maunu Road And Tarewa Road Due To A Gas Leak. | 0.2 |
| 35 | 1N | 01N-0266/00.34 | 01N-0266/00.34 | Road Closed | Flooding | State Highway01 At The Otaika Road Intersection With Matipo Place In Whangarei Flooding | 13.45 |
| 71 | 1N | 01N-0266/00.88 | 01N-0266/00.88 | Road Closed | Crash | Police Advise Of A Motor Vehicle Accident In The Area Near Raumanga Valley Road. Caution Is Advised, Take Extra Care, Expect Some Delays. | 3.24 |
| 104 | 1N | 01N-0266/02.09 | 01N-0266/02.09 | Road Closed | Crash | Road Has Been Reopened | 1.23 |
| 106 | 1N | 01N-0266/02.29 | 01N-0266/02.29 | Road Closed | Crash | Due To A Serious Incident In This Area The Road Is Closed Southbound. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route. | 1.11 |
| 46 | 1N | 01N-0266/03.53 | 01N-0266/03.53 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 0.18 |
| 64 | 1N | 01N-0266/05.20 | 01N-0266/05.20 | Road Closed | Crash | Due To A Crash Sh1 Is Closed At Otaika In Both Directions. Avoid This Area Or Delay Your Trip | 1.26 |
| 95 | 1N | 01N-0266/05.73 | 01N-0266/05.73 | Road Closed | Crash | Road Is Now Open. | 2.38 |
| 66 | 1N | 01N-0266/06.37 | 01N-0266/06.37 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 5.04 |
| 60 | 1N | 01N-0266/06.47 | 01N-0266/06.47 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 0.49 |
| 109 | 1N | 01N-0273/03.68 | 01N-0273/03.68 | Road Closed | Crash | Due To A Serious Incident In This Area The Road Is Closed. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route. | 3.15 |
| 2 | 1N | 01N-0273/04.57 | 01N-0273/04.57 | Road Closed | Crash | Sh1 Fatal Vehicle Accident Diversions In Place | 1.56 |
| 117 | 1N | 01N-0273/07.94 | 01N-0273/09.06 | Vehicle Restrictions | Road Works | Call Came Through From Police Asking If The 50km/h Speed Restriction Signs Can Be Removed, As The Roadworks Has Been Completed And Road Has Been Swept. Cones Have Been Pushed To The Side Of The Road. | 0.33 |
| 103 | 1N | 01N-0292/01.24 | 01N-0292/01.24 | Road Closed | Crash | Due To A Serious Crash This Section Of Highway Is Closed. Expect Delays Or Avoid The Area If Possible. | 2.36 |
| 73 | 1N | 01N-0292/01.96 | 01N-0292/01.96 | Road Closed | Crash | Due To An Incident, This Section Of The Highway Is Closed. Avoid This Area Or Delay Your Trip If Possible. | 6.02 |
| 10 | 1N | 01N-0292/10.10 | 01N-0292/10.10 | Road Closed | Crash | Vehicle Accident. | 3.44 |
| 98 | 1N | 01N-0303/00.00 | 01N-0303/00.00 | Road Closed | Crash | Incident Cleared | 3.39 |
| 12 | 1N | 01N-0303/00.20 | 01N-0303/00.20 | Road Closed | Crash | Fatal Car Accident - Diversions Needed. Northern Diversion : Waipu Gorge Road. Southern Diversion: Sh12. Needed Asap. | 0.37 |
| 5 | 1N | 01N-0303/00.29 | 01N-0303/15.63 | Road Closed | Other | Emergency Maintenance Work On Tuesday 21st October From 6.30am To 7.30pm. | 13 |
| 51 | 1N | 01N-0303/10.13 | 01N-0303/10.13 | Road Closed | Crash | Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible. | 3.39 |
| 88 | 1N | 01N-0303/12.82 | 01N-0303/12.82 | Road Closed | Resurfacing | Due To Road Surface Improvement Works, On The Southern Side Of The Brynderwyns, Allow An Extra 30-45min Driving Time For The Detours During Overnight Closures. Sh1 Will Be Closed From 6.45pm - 5am Each Night From April 6 To The Morning Of April 10 | 250.15 |
| 89 | 1N | 01N-0303/12.82 | 01N-0303/12.82 | Road Closed | Resurfacing | Sh1, At The Brynderwyn Hills, Will Close Overnight For Surface Improvement Road Works. The Road Will Be Closed Between 6:45pm Tonight And 5am Tomorrow. A Signposted Detour Will Be In Place. For More Info Plus Maps, Visit www.highwayinfo.govt.nz | 10.15 |

| Matakohe Bridges - SH1 HPMV closures | | | | | | | |
|--------------------------------------|---------------|----------------|----------------|-------------|------------------|---|------------------------|
| # | State Highway | Start Location | End Location | Impact | Description | Event Comments | Event Duration (hh.mm) |
| 63 | 1N | 01N-0303/12.94 | 01N-0303/12.94 | Road Closed | Crash | Due To A Crash This Portion Of Sh1 Is Closed. Expect Delays. Avoid This Area Or Delay Trip If Possible | 5.28 |
| 115 | 1N | 01N-0303/13.46 | 01N-0303/13.46 | Road Closed | Maintenance | Due To Road Works In This Area This Section Of Highway Will Be Closed. A Detour Will Be In Place. Follow Instructions From Traffic Management On Scene. Allow An Extra 30 To 45 Minutes To Your Journey. | 11 |
| 84 | 1N | 01N-0303/14.88 | 01N-0303/14.88 | Road Closed | Crash | Due To An Incident On The Southern Side Of The Brynderwyns The Road Is Now Closed. Expect Delays. Avoid This Area Or Delay Trip If Possible. | 3.37 |
| 94 | 1N | 01N-0303/15.03 | 01N-0303/15.03 | Road Closed | Crash | The Road Is Now Open. | 5.11 |
| 17 | 1N | 01N-0303/15.05 | 01N-0303/15.05 | Road Closed | Pavement Repairs | Night Time Closures For A 3 Week Period. Week 1 Road Will Be Closed From Monday To Thursday. Last 2 Weeks Road Will Be Closed From Tuesday To Thursday. Closures Start 9th Nov At 8pm | 10 |
| 91 | 1N | 01N-0303/15.08 | 01N-0303/15.08 | Road Closed | Crash | Road Now Fully Open. | 4.5 |
| 26 | 1N | 01N-0303/15.09 | 01N-0303/15.09 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 86 | 1N | 01N-0303/15.15 | 01N-0303/15.15 | Road Closed | Crash | A Two Vehicle Crash Involving Serious Injury Has Required The Highway To Be Closed. | 1.08 |
| 24 | 1N | 01N-0303/15.16 | 01N-0303/15.16 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 16 | 1N | 01N-0303/15.24 | 01N-0303/15.24 | Road Closed | Pavement Repairs | Night Time Closures For A 3 Week Period. Tuesday To Thursday Starting 9th November. | 10 |
| 25 | 1N | 01N-0303/15.24 | 01N-0303/15.24 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 23 | 1N | 01N-0303/15.29 | 01N-0303/15.29 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 27 | 1N | 01N-0303/15.33 | 01N-0303/15.33 | Road Closed | Resurfacing | Night Time Closures. Road Will Be Closed From Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am. | 10 |
| 21 | 1N | 01N-0303/15.38 | 01N-0303/15.38 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am. | 10 |
| 20 | 1N | 01N-0303/15.40 | 01N-0303/15.40 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am. | 10 |
| 19 | 1N | 01N-0303/15.42 | 01N-0303/15.42 | Road Closed | Resurfacing | Night Time Closures For A 3 Week Period. Week 1 Road Will Be Closed From Monday To Thursday. Last 2 Weeks Road Will Be Closed From Tuesday To Thursday. Closures Start 9th Nov At 8pm And Reopening At 6am. | 10 |
| 39 | 1N | 01N-0303/15.70 | 01N-0303/15.70 | Road Closed | Slip | Landslip On Southbound Lane. North Of Wellsford. Hole In The Road, Was Coned Off But Cones Have Been Moved By Members Of The Public. | 21.04 |
| 22 | 1N | 01N-0303/15.79 | 01N-0303/15.79 | Road Closed | Pavement Repairs | Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am. | 10 |

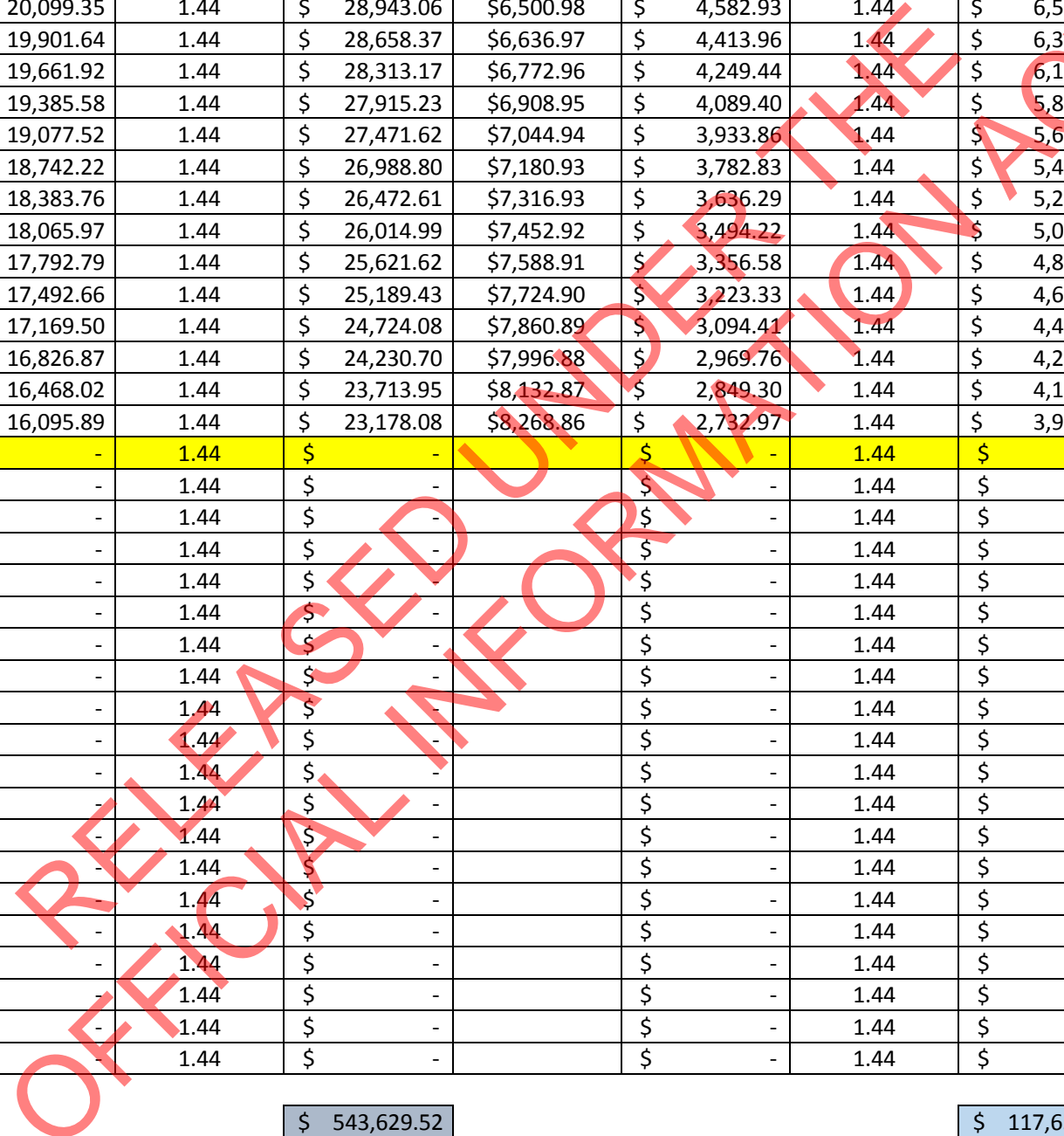
Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM TTC (Delays) | | | | DM TTC (Detours) | | | | DM TTC (HPMV Detours) | | | |
|------|------|-------------|------|-----------------|--------------|---------------|--------------|------------------|-------------|---------------|-------------|-----------------------|---------------|---------------|---------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL |
| 2016 | 0 | 1 | 1923 | \$ 20,596.23 | \$ 20,596.23 | 1.44 | \$ 29,658.57 | \$5,685.03 | \$ 5,685.03 | 1.44 | \$ 8,186.44 | \$ 238,421.35 | \$ 238,421.35 | 1.44 | \$ 343,326.75 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 21,671.89 | \$ 20,445.18 | 1.44 | \$ 29,441.06 | \$5,821.02 | \$ 5,491.53 | 1.44 | \$ 7,907.80 | \$ 245,573.99 | \$ 231,673.58 | 1.44 | \$ 333,609.95 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 22,857.69 | \$ 20,343.26 | 1.44 | \$ 29,294.30 | \$5,957.01 | \$ 5,301.72 | 1.44 | \$ 7,634.48 | \$ 252,726.63 | \$ 224,925.80 | 1.44 | \$ 323,893.16 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 24,271.09 | \$ 20,378.48 | 1.44 | \$ 29,345.01 | \$6,093.00 | \$ 5,115.80 | 1.44 | \$ 7,366.76 | \$ 259,879.27 | \$ 218,199.65 | 1.44 | \$ 314,207.50 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 25,684.50 | \$ 20,344.53 | 1.44 | \$ 29,296.12 | \$6,228.99 | \$ 4,933.95 | 1.44 | \$ 7,104.88 | \$ 267,031.92 | \$ 211,514.29 | 1.44 | \$ 304,580.57 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 27,097.90 | \$ 20,249.13 | 1.44 | \$ 29,158.75 | \$6,364.99 | \$ 4,756.29 | 1.44 | \$ 6,849.05 | \$ 274,184.56 | \$ 204,886.65 | 1.44 | \$ 295,036.78 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 28,511.31 | \$ 20,099.35 | 1.44 | \$ 28,943.06 | \$6,500.98 | \$ 4,582.93 | 1.44 | \$ 6,599.42 | \$ 281,337.20 | \$ 198,331.62 | 1.44 | \$ 285,597.54 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 29,924.71 | \$ 19,901.64 | 1.44 | \$ 28,658.37 | \$6,636.97 | \$ 4,413.96 | 1.44 | \$ 6,356.11 | \$ 288,489.84 | \$ 191,862.22 | 1.44 | \$ 276,281.59 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 31,338.12 | \$ 19,661.92 | 1.44 | \$ 28,313.17 | \$6,772.96 | \$ 4,249.44 | 1.44 | \$ 6,119.19 | \$ 295,642.48 | \$ 185,489.75 | 1.44 | \$ 267,105.24 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 32,751.52 | \$ 19,385.58 | 1.44 | \$ 27,915.23 | \$6,908.95 | \$ 4,089.40 | 1.44 | \$ 5,888.73 | \$ 302,795.12 | \$ 179,223.97 | 1.44 | \$ 258,082.51 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 34,164.93 | \$ 19,077.52 | 1.44 | \$ 27,471.62 | \$7,044.94 | \$ 3,933.86 | 1.44 | \$ 5,664.76 | \$ 309,947.76 | \$ 173,073.21 | 1.44 | \$ 249,225.42 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 35,578.33 | \$ 18,742.22 | 1.44 | \$ 26,988.80 | \$7,180.93 | \$ 3,782.83 | 1.44 | \$ 5,447.27 | \$ 317,100.40 | \$ 167,044.53 | 1.44 | \$ 240,544.13 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 36,991.74 | \$ 18,383.76 | 1.44 | \$ 26,472.61 | \$7,316.93 | \$ 3,636.29 | 1.44 | \$ 5,236.25 | \$ 324,253.04 | \$ 161,143.83 | 1.44 | \$ 232,047.11 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 38,533.41 | \$ 18,065.97 | 1.44 | \$ 26,014.99 | \$7,452.92 | \$ 3,494.22 | 1.44 | \$ 5,031.67 | \$ 331,405.68 | \$ 155,375.92 | 1.44 | \$ 223,741.32 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 40,227.79 | \$ 17,792.79 | 1.44 | \$ 25,621.62 | \$7,588.91 | \$ 3,356.58 | 1.44 | \$ 4,833.48 | \$ 338,558.32 | \$ 149,744.67 | 1.44 | \$ 215,632.33 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 41,922.18 | \$ 17,492.66 | 1.44 | \$ 25,189.43 | \$7,724.90 | \$ 3,223.33 | 1.44 | \$ 4,641.60 | \$ 345,710.96 | \$ 144,253.11 | 1.44 | \$ 207,724.47 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 43,616.56 | \$ 17,169.50 | 1.44 | \$ 24,724.08 | \$7,860.89 | \$ 3,094.41 | 1.44 | \$ 4,455.95 | \$ 352,863.60 | \$ 138,903.45 | 1.44 | \$ 200,020.96 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 45,310.94 | \$ 16,826.87 | 1.44 | \$ 24,230.70 | \$7,996.88 | \$ 2,969.76 | 1.44 | \$ 4,276.45 | \$ 360,016.24 | \$ 133,697.22 | 1.44 | \$ 192,524.00 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 47,005.33 | \$ 16,468.02 | 1.44 | \$ 23,713.95 | \$8,132.87 | \$ 2,849.30 | 1.44 | \$ 4,102.99 | \$ 367,168.88 | \$ 128,635.34 | 1.44 | \$ 185,234.89 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 48,699.71 | \$ 16,095.89 | 1.44 | \$ 23,178.08 | \$8,268.86 | \$ 2,732.97 | 1.44 | \$ 3,935.47 | \$ 374,321.52 | \$ 123,718.13 | 1.44 | \$ 178,154.11 |
| 2036 | 20 | 0.311804727 | 2843 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2037 | 21 | 0.294155403 | 2889 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - | \$ - | \$ - | 1.44 | \$ - |

\$ 543,629.52

\$ 117,638.76

\$ 5,126,570.33



Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM TTC (Alignment) | | | | OPT TTC (Alignment) | | | | DM VOC (Delays) | | | |
|------|------|-------------|------|--------------------|---------------|---------------|---------------|---------------------|---------------|---------------|---------------|-----------------|-------------|---------------|-------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL |
| 2016 | 0 | 1 | 1923 | \$ 586,694.99 | \$ 586,694.99 | 1.44 | \$ 844,840.79 | \$ 294,285.53 | \$ 294,285.53 | 1.44 | \$ 423,771.16 | \$ 1,495.49 | \$ 1,495.49 | 1 | \$ 1,495.49 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 600,775.67 | \$ 566,769.50 | 1.44 | \$ 816,148.08 | \$ 301,348.38 | \$ 284,290.92 | 1.44 | \$ 409,378.93 | \$ 1,563.55 | \$ 1,475.04 | 1 | \$ 1,475.04 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 614,856.35 | \$ 547,219.96 | 1.44 | \$ 787,996.75 | \$ 308,411.23 | \$ 274,484.90 | 1.44 | \$ 395,258.25 | \$ 1,637.94 | \$ 1,457.76 | 1 | \$ 1,457.76 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 628,937.03 | \$ 528,067.66 | 1.44 | \$ 760,417.43 | \$ 315,474.08 | \$ 264,878.12 | 1.44 | \$ 381,424.50 | \$ 1,725.45 | \$ 1,448.72 | 1 | \$ 1,448.72 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 643,017.71 | \$ 509,330.26 | 1.44 | \$ 733,435.57 | \$ 322,536.94 | \$ 255,479.46 | 1.44 | \$ 367,890.43 | \$ 1,812.96 | \$ 1,436.03 | 1 | \$ 1,436.03 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 657,098.39 | \$ 491,022.14 | 1.44 | \$ 707,071.89 | \$ 329,599.79 | \$ 246,296.14 | 1.44 | \$ 354,666.44 | \$ 1,900.46 | \$ 1,420.14 | 1 | \$ 1,420.14 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 671,179.07 | \$ 473,154.76 | 1.44 | \$ 681,342.86 | \$ 336,662.64 | \$ 237,333.88 | 1.44 | \$ 341,760.78 | \$ 1,987.97 | \$ 1,401.44 | 1 | \$ 1,401.44 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 685,259.75 | \$ 455,736.87 | 1.44 | \$ 656,261.10 | \$ 343,725.49 | \$ 228,597.09 | 1.44 | \$ 329,179.80 | \$ 2,075.47 | \$ 1,380.31 | 1 | \$ 1,380.31 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 699,340.43 | \$ 438,774.84 | 1.44 | \$ 631,835.77 | \$ 350,788.35 | \$ 220,088.95 | 1.44 | \$ 316,928.09 | \$ 2,162.98 | \$ 1,357.08 | 1 | \$ 1,357.08 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 713,421.11 | \$ 422,272.86 | 1.44 | \$ 608,072.92 | \$ 357,851.20 | \$ 211,811.58 | 1.44 | \$ 305,008.67 | \$ 2,250.49 | \$ 1,332.06 | 1 | \$ 1,332.06 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 727,501.79 | \$ 406,233.20 | 1.44 | \$ 584,975.81 | \$ 364,914.05 | \$ 203,766.10 | 1.44 | \$ 293,423.19 | \$ 2,337.99 | \$ 1,305.52 | 1 | \$ 1,305.52 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 741,582.47 | \$ 390,656.39 | 1.44 | \$ 562,545.21 | \$ 371,976.91 | \$ 195,952.79 | 1.44 | \$ 282,172.02 | \$ 2,425.50 | \$ 1,277.72 | 1 | \$ 1,277.72 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 755,663.15 | \$ 375,541.44 | 1.44 | \$ 540,779.67 | \$ 379,039.76 | \$ 188,371.15 | 1.44 | \$ 271,254.45 | \$ 2,513.00 | \$ 1,248.89 | 1 | \$ 1,248.89 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 769,743.83 | \$ 360,885.94 | 1.44 | \$ 519,675.76 | \$ 386,102.61 | \$ 181,019.97 | 1.44 | \$ 260,668.76 | \$ 2,608.91 | \$ 1,223.16 | 1 | \$ 1,223.16 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 783,824.51 | \$ 346,686.34 | 1.44 | \$ 499,228.33 | \$ 393,165.46 | \$ 173,897.46 | 1.44 | \$ 250,412.35 | \$ 2,714.80 | \$ 1,200.76 | 1 | \$ 1,200.76 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 797,905.19 | \$ 332,937.96 | 1.44 | \$ 479,430.66 | \$ 400,228.32 | \$ 167,001.29 | 1.44 | \$ 240,481.86 | \$ 2,820.70 | \$ 1,176.98 | 1 | \$ 1,176.98 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 811,985.87 | \$ 319,635.22 | 1.44 | \$ 460,274.72 | \$ 407,291.17 | \$ 160,328.65 | 1.44 | \$ 230,873.26 | \$ 2,926.60 | \$ 1,152.05 | 1 | \$ 1,152.05 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 826,066.55 | \$ 306,771.72 | 1.44 | \$ 441,751.28 | \$ 414,354.02 | \$ 153,876.34 | 1.44 | \$ 221,581.93 | \$ 3,032.50 | \$ 1,126.16 | 1 | \$ 1,126.16 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 840,147.23 | \$ 294,340.37 | 1.44 | \$ 423,850.13 | \$ 421,416.87 | \$ 147,640.79 | 1.44 | \$ 212,602.73 | \$ 3,138.40 | \$ 1,099.52 | 1 | \$ 1,099.52 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 854,227.91 | \$ 282,333.44 | 1.44 | \$ 406,560.15 | \$ 428,479.73 | \$ 141,618.12 | 1.44 | \$ 203,930.10 | \$ 3,244.29 | \$ 1,072.28 | 1 | \$ 1,072.28 |
| 2036 | 20 | 0.311804727 | 2843 | \$ 868,308.59 | \$ 270,742.72 | 1.44 | \$ 389,869.52 | \$ 435,542.58 | \$ 135,804.23 | 1.44 | \$ 195,558.10 | \$ - | \$ - | 1 | \$ - |
| 2037 | 21 | 0.294155403 | 2889 | \$ 882,389.27 | \$ 259,559.57 | 1.44 | \$ 373,765.78 | \$ 442,605.43 | \$ 130,194.78 | 1.44 | \$ 187,480.48 | \$ - | \$ - | 1 | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ 896,469.95 | \$ 248,774.98 | 1.44 | \$ 358,235.97 | \$ 449,668.28 | \$ 124,785.24 | 1.44 | \$ 179,690.75 | \$ - | \$ - | 1 | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ 910,550.63 | \$ 238,379.66 | 1.44 | \$ 343,266.71 | \$ 456,731.14 | \$ 119,570.96 | 1.44 | \$ 172,182.18 | \$ - | \$ - | 1 | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ 924,631.31 | \$ 228,364.10 | 1.44 | \$ 328,844.30 | \$ 463,793.99 | \$ 114,547.17 | 1.44 | \$ 164,947.92 | \$ - | \$ - | 1 | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ 938,711.99 | \$ 218,718.61 | 1.44 | \$ 314,954.80 | \$ 470,856.84 | \$ 109,709.00 | 1.44 | \$ 157,980.96 | \$ - | \$ - | 1 | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ 952,792.67 | \$ 209,433.38 | 1.44 | \$ 301,584.07 | \$ 477,919.69 | \$ 105,051.54 | 1.44 | \$ 151,274.22 | \$ - | \$ - | 1 | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ 966,873.35 | \$ 200,498.55 | 1.44 | \$ 288,717.91 | \$ 484,982.55 | \$ 100,569.84 | 1.44 | \$ 144,820.57 | \$ - | \$ - | 1 | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ 980,954.03 | \$ 191,904.18 | 1.44 | \$ 276,342.01 | \$ 492,045.40 | \$ 96,258.91 | 1.44 | \$ 138,612.83 | \$ - | \$ - | 1 | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ 995,034.71 | \$ 183,640.36 | 1.44 | \$ 264,442.12 | \$ 499,108.25 | \$ 92,113.79 | 1.44 | \$ 132,643.86 | \$ - | \$ - | 1 | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ 1,009,115.39 | \$ 175,697.21 | 1.44 | \$ 253,003.99 | \$ 506,171.11 | \$ 88,129.52 | 1.44 | \$ 126,906.51 | \$ - | \$ - | 1 | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ 1,023,196.07 | \$ 168,064.91 | 1.44 | \$ 242,013.47 | \$ 513,233.96 | \$ 84,301.16 | 1.44 | \$ 121,393.67 | \$ - | \$ - | 1 | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ 1,037,276.75 | \$ 160,733.70 | 1.44 | \$ 231,456.53 | \$ 520,296.81 | \$ 80,623.84 | 1.44 | \$ 116,098.33 | \$ - | \$ - | 1 | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ 1,051,357.43 | \$ 153,693.97 | 1.44 | \$ 221,319.32 | \$ 527,359.66 | \$ 77,092.72 | 1.44 | \$ 111,013.51 | \$ - | \$ - | 1 | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ 1,065,438.11 | \$ 146,936.20 | 1.44 | \$ 211,588.13 | \$ 534,422.52 | \$ 73,703.03 | 1.44 | \$ 106,132.36 | \$ - | \$ - | 1 | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ 1,079,518.79 | \$ 140,451.03 | 1.44 | \$ 202,249.48 | \$ 541,485.37 | \$ 70,450.07 | 1.44 | \$ 101,448.10 | \$ - | \$ - | 1 | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ 1,093,599.47 | \$ 134,229.24 | 1.44 | \$ 193,290.11 | \$ 548,548.22 | \$ 67,329.23 | 1.44 | \$ 96,954.09 | \$ - | \$ - | 1 | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ 1,107,680.15 | \$ 128,261.81 | 1.44 | \$ 184,697.00 | \$ 555,611.07 | \$ 64,335.97 | 1.44 | \$ 92,643.80 | \$ - | \$ - | 1 | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ 1,121,760.83 | \$ 122,539.86 | 1.44 | \$ 176,457.40 | \$ 562,673.93 | \$ 61,465.85 | 1.44 | \$ 88,510.83 | \$ - | \$ - | 1 | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ 1,135,841.51 | \$ 117,054.74 | 1.44 | \$ 168,558.82 | \$ 569,736.78 | \$ 58,714.52 | 1.44 | \$ 84,548.91 | \$ - | \$ - | 1 | \$ - |

\$ 17,471,152.3

\$ 8,763,509.7

\$ 26,087.11

Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM VOC (Detours) | | | | DM VOC (Alignment) | | | | OPT VOC (Alignment) | | | |
|------|------|-------------|------|------------------|-------------|---------------|-------------|--------------------|---------------|---------------|---------------|---------------------|---------------|---------------|---------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL |
| 2016 | 0 | 1 | 1923 | \$ 5,718.41 | \$ 5,718.41 | 1 | \$ 5,718.41 | \$ 582,481.16 | \$ 582,481.16 | 1 | \$ 582,481.16 | \$ 417,969.06 | \$ 417,969.06 | 1 | \$ 417,969.06 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 5,855.20 | \$ 5,523.77 | 1 | \$ 5,523.77 | \$ 596,460.71 | \$ 562,698.78 | 1 | \$ 562,698.78 | \$ 428,000.32 | \$ 403,773.89 | 1 | \$ 403,773.89 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 5,991.99 | \$ 5,332.85 | 1 | \$ 5,332.85 | \$ 610,440.26 | \$ 543,289.66 | 1 | \$ 543,289.66 | \$ 438,031.58 | \$ 389,846.55 | 1 | \$ 389,846.55 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 6,128.78 | \$ 5,145.84 | 1 | \$ 5,145.84 | \$ 624,419.80 | \$ 524,274.91 | 1 | \$ 524,274.91 | \$ 448,062.84 | \$ 376,202.20 | 1 | \$ 376,202.20 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 6,265.56 | \$ 4,962.91 | 1 | \$ 4,962.91 | \$ 638,399.35 | \$ 505,672.08 | 1 | \$ 505,672.08 | \$ 458,094.09 | \$ 362,853.43 | 1 | \$ 362,853.43 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 6,402.35 | \$ 4,784.21 | 1 | \$ 4,784.21 | \$ 652,378.90 | \$ 487,495.47 | 1 | \$ 487,495.47 | \$ 468,125.35 | \$ 349,810.50 | 1 | \$ 349,810.50 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 6,539.14 | \$ 4,609.84 | 1 | \$ 4,609.84 | \$ 666,358.45 | \$ 469,756.41 | 1 | \$ 469,756.41 | \$ 478,156.61 | \$ 337,081.54 | 1 | \$ 337,081.54 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 6,675.93 | \$ 4,439.88 | 1 | \$ 4,439.88 | \$ 680,338.00 | \$ 452,463.62 | 1 | \$ 452,463.62 | \$ 488,187.87 | \$ 324,672.81 | 1 | \$ 324,672.81 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 6,812.72 | \$ 4,274.39 | 1 | \$ 4,274.39 | \$ 694,317.54 | \$ 435,623.42 | 1 | \$ 435,623.42 | \$ 498,219.12 | \$ 312,588.84 | 1 | \$ 312,588.84 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 6,949.51 | \$ 4,113.41 | 1 | \$ 4,113.41 | \$ 708,297.09 | \$ 419,239.96 | 1 | \$ 419,239.96 | \$ 508,250.38 | \$ 300,832.62 | 1 | \$ 300,832.62 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 7,086.30 | \$ 3,956.95 | 1 | \$ 3,956.95 | \$ 722,276.64 | \$ 403,315.50 | 1 | \$ 403,315.50 | \$ 518,281.64 | \$ 289,405.76 | 1 | \$ 289,405.76 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 7,223.09 | \$ 3,805.04 | 1 | \$ 3,805.04 | \$ 736,256.19 | \$ 387,850.58 | 1 | \$ 387,850.58 | \$ 528,312.90 | \$ 278,308.64 | 1 | \$ 278,308.64 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 7,359.88 | \$ 3,657.64 | 1 | \$ 3,657.64 | \$ 750,235.74 | \$ 372,844.18 | 1 | \$ 372,844.18 | \$ 538,344.15 | \$ 267,540.55 | 1 | \$ 267,540.55 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 7,496.67 | \$ 3,514.73 | 1 | \$ 3,514.73 | \$ 764,215.28 | \$ 358,293.95 | 1 | \$ 358,293.95 | \$ 548,375.41 | \$ 257,099.79 | 1 | \$ 257,099.79 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 7,633.46 | \$ 3,376.29 | 1 | \$ 3,376.29 | \$ 778,194.83 | \$ 344,196.32 | 1 | \$ 344,196.32 | \$ 558,406.67 | \$ 246,983.81 | 1 | \$ 246,983.81 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 7,770.25 | \$ 3,242.25 | 1 | \$ 3,242.25 | \$ 792,174.38 | \$ 330,546.69 | 1 | \$ 330,546.69 | \$ 568,437.93 | \$ 237,189.29 | 1 | \$ 237,189.29 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 7,907.04 | \$ 3,112.58 | 1 | \$ 3,112.58 | \$ 806,153.93 | \$ 317,339.50 | 1 | \$ 317,339.50 | \$ 578,469.18 | \$ 227,712.24 | 1 | \$ 227,712.24 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 8,043.83 | \$ 2,987.19 | 1 | \$ 2,987.19 | \$ 820,133.48 | \$ 304,568.39 | 1 | \$ 304,568.39 | \$ 588,500.44 | \$ 218,548.12 | 1 | \$ 218,548.12 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 8,180.62 | \$ 2,866.03 | 1 | \$ 2,866.03 | \$ 834,113.02 | \$ 292,226.32 | 1 | \$ 292,226.32 | \$ 598,531.70 | \$ 209,691.86 | 1 | \$ 209,691.86 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 8,317.41 | \$ 2,749.01 | 1 | \$ 2,749.01 | \$ 848,092.57 | \$ 280,305.63 | 1 | \$ 280,305.63 | \$ 608,562.96 | \$ 201,137.98 | 1 | \$ 201,137.98 |
| 2036 | 20 | 0.311804727 | 2843 | \$ - | \$ - | 1 | \$ - | \$ 862,072.12 | \$ 268,798.16 | 1 | \$ 268,798.16 | \$ 618,594.22 | \$ 192,880.60 | 1 | \$ 192,880.60 |
| 2037 | 21 | 0.294155403 | 2889 | \$ - | \$ - | 1 | \$ - | \$ 876,051.67 | \$ 257,695.33 | 1 | \$ 257,695.33 | \$ 628,625.47 | \$ 184,913.58 | 1 | \$ 184,913.58 |
| 2038 | 22 | 0.277505097 | 2935 | \$ - | \$ - | 1 | \$ - | \$ 890,031.21 | \$ 246,988.20 | 1 | \$ 246,988.20 | \$ 638,656.73 | \$ 177,230.50 | 1 | \$ 177,230.50 |
| 2039 | 23 | 0.261797261 | 2981 | \$ - | \$ - | 1 | \$ - | \$ 904,010.76 | \$ 236,667.54 | 1 | \$ 236,667.54 | \$ 648,687.99 | \$ 169,824.74 | 1 | \$ 169,824.74 |
| 2040 | 24 | 0.246978548 | 3027 | \$ - | \$ - | 1 | \$ - | \$ 917,990.31 | \$ 226,723.91 | 1 | \$ 226,723.91 | \$ 658,719.25 | \$ 162,689.52 | 1 | \$ 162,689.52 |
| 2041 | 25 | 0.232998631 | 3073 | \$ - | \$ - | 1 | \$ - | \$ 931,969.86 | \$ 217,147.70 | 1 | \$ 217,147.70 | \$ 668,750.50 | \$ 155,817.95 | 1 | \$ 155,817.95 |
| 2042 | 26 | 0.219810029 | 3119 | \$ - | \$ - | 1 | \$ - | \$ 945,949.41 | \$ 207,929.17 | 1 | \$ 207,929.17 | \$ 678,781.76 | \$ 149,203.04 | 1 | \$ 149,203.04 |
| 2043 | 27 | 0.207367952 | 3165 | \$ - | \$ - | 1 | \$ - | \$ 959,928.95 | \$ 199,058.50 | 1 | \$ 199,058.50 | \$ 688,813.02 | \$ 142,837.74 | 1 | \$ 142,837.74 |
| 2044 | 28 | 0.195630143 | 3211 | \$ - | \$ - | 1 | \$ - | \$ 973,908.50 | \$ 190,525.86 | 1 | \$ 190,525.86 | \$ 698,844.28 | \$ 136,715.01 | 1 | \$ 136,715.01 |
| 2045 | 29 | 0.184556739 | 3257 | \$ - | \$ - | 1 | \$ - | \$ 987,888.05 | \$ 182,321.40 | 1 | \$ 182,321.40 | \$ 708,875.53 | \$ 130,827.76 | 1 | \$ 130,827.76 |
| 2046 | 30 | 0.174110131 | 3303 | \$ - | \$ - | 1 | \$ - | \$ 1,001,867.60 | \$ 174,435.30 | 1 | \$ 174,435.30 | \$ 718,906.79 | \$ 125,168.96 | 1 | \$ 125,168.96 |
| 2047 | 31 | 0.16425484 | 3349 | \$ - | \$ - | 1 | \$ - | \$ 1,015,847.15 | \$ 166,857.81 | 1 | \$ 166,857.81 | \$ 728,938.05 | \$ 119,731.60 | 1 | \$ 119,731.60 |
| 2048 | 32 | 0.154957397 | 3395 | \$ - | \$ - | 1 | \$ - | \$ 1,029,826.69 | \$ 159,579.26 | 1 | \$ 159,579.26 | \$ 738,969.31 | \$ 114,508.76 | 1 | \$ 114,508.76 |
| 2049 | 33 | 0.146186223 | 3441 | \$ - | \$ - | 1 | \$ - | \$ 1,043,806.24 | \$ 152,590.09 | 1 | \$ 152,590.09 | \$ 749,000.56 | \$ 109,493.56 | 1 | \$ 109,493.56 |
| 2050 | 34 | 0.137911531 | 3487 | \$ - | \$ - | 1 | \$ - | \$ 1,057,785.79 | \$ 145,880.86 | 1 | \$ 145,880.86 | \$ 759,031.82 | \$ 104,679.24 | 1 | \$ 104,679.24 |
| 2051 | 35 | 0.130105218 | 3533 | \$ - | \$ - | 1 | \$ - | \$ 1,071,765.34 | \$ 139,442.26 | 1 | \$ 139,442.26 | \$ 769,063.08 | \$ 100,059.12 | 1 | \$ 100,059.12 |
| 2052 | 36 | 0.122740772 | 3579 | \$ - | \$ - | 1 | \$ - | \$ 1,085,744.88 | \$ 133,265.17 | 1 | \$ 133,265.17 | \$ 779,094.34 | \$ 95,626.64 | 1 | \$ 95,626.64 |
| 2053 | 37 | 0.115793181 | 3625 | \$ - | \$ - | 1 | \$ - | \$ 1,099,724.43 | \$ 127,340.59 | 1 | \$ 127,340.59 | \$ 789,125.59 | \$ 91,375.36 | 1 | \$ 91,375.36 |
| 2054 | 38 | 0.10923885 | 3671 | \$ - | \$ - | 1 | \$ - | \$ 1,113,703.98 | \$ 121,659.74 | 1 | \$ 121,659.74 | \$ 799,156.85 | \$ 87,298.98 | 1 | \$ 87,298.98 |
| 2055 | 39 | 0.103055519 | 3717 | \$ - | \$ - | 1 | \$ - | \$ 1,127,683.53 | \$ 116,214.01 | 1 | \$ 116,214.01 | \$ 809,188.11 | \$ 83,391.30 | 1 | \$ 83,391.30 |

\$ 82,173.21

\$ 12,045,603.4

\$ 8,643,523.45



Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM CO2 | | | | OPT CO2 | | | | DM ACC (Bridges) | | |
|------|------|-------------|------|--------------|--------------|---------------|--------------|--------------|--------------|---------------|--------------|------------------|----------------|---------------|
| | | SPPWF | AADT | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST | PV COST | UPDATE FACTOR | SUBTOTAL | COST (Andersons) | Cost (Hardies) | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 29,484.75 | \$ 29,484.75 | 1 | \$ 29,484.75 | \$ 20,898.45 | \$ 20,898.45 | 1 | \$ 20,898.45 | \$ 245,467.70 | \$ 30,429.88 | \$ 275,897.58 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 30,193.97 | \$ 28,484.88 | 1 | \$ 28,484.88 | \$ 21,400.02 | \$ 20,188.69 | 1 | \$ 20,188.69 | \$ 246,449.57 | \$ 30,551.60 | \$ 261,321.86 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 30,903.51 | \$ 27,504.01 | 1 | \$ 27,504.01 | \$ 21,901.58 | \$ 19,492.33 | 1 | \$ 19,492.33 | \$ 247,431.45 | \$ 30,673.32 | \$ 247,512.25 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 31,613.70 | \$ 26,543.47 | 1 | \$ 26,543.47 | \$ 22,403.14 | \$ 18,810.11 | 1 | \$ 18,810.11 | \$ 248,413.32 | \$ 30,795.04 | \$ 234,428.72 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 32,323.89 | \$ 25,603.55 | 1 | \$ 25,603.55 | \$ 22,904.70 | \$ 18,142.67 | 1 | \$ 18,142.67 | \$ 249,395.19 | \$ 30,916.76 | \$ 222,033.32 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 33,034.09 | \$ 24,684.99 | 1 | \$ 24,684.99 | \$ 23,406.27 | \$ 17,490.52 | 1 | \$ 17,490.52 | \$ 250,377.06 | \$ 31,038.48 | \$ 210,290.06 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 33,744.28 | \$ 23,788.38 | 1 | \$ 23,788.38 | \$ 23,907.83 | \$ 16,854.08 | 1 | \$ 16,854.08 | \$ 251,358.93 | \$ 31,160.20 | \$ 199,164.84 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 34,454.47 | \$ 22,914.19 | 1 | \$ 22,914.19 | \$ 24,409.39 | \$ 16,233.64 | 1 | \$ 16,233.64 | \$ 252,340.80 | \$ 31,281.92 | \$ 188,625.31 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 35,164.66 | \$ 22,062.74 | 1 | \$ 22,062.74 | \$ 24,910.96 | \$ 15,629.44 | 1 | \$ 15,629.44 | \$ 253,322.67 | \$ 31,403.64 | \$ 178,640.81 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 35,874.85 | \$ 21,234.27 | 1 | \$ 21,234.27 | \$ 25,412.52 | \$ 15,041.63 | 1 | \$ 15,041.63 | \$ 254,304.54 | \$ 31,525.36 | \$ 169,182.28 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 36,585.05 | \$ 20,428.90 | 1 | \$ 20,428.90 | \$ 25,914.08 | \$ 14,470.29 | 1 | \$ 14,470.29 | \$ 255,286.41 | \$ 31,647.08 | \$ 160,222.16 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 37,295.24 | \$ 19,646.67 | 1 | \$ 19,646.67 | \$ 26,415.64 | \$ 13,915.43 | 1 | \$ 13,915.43 | \$ 256,268.28 | \$ 31,768.80 | \$ 151,734.34 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 38,005.43 | \$ 18,887.53 | 1 | \$ 18,887.53 | \$ 26,917.21 | \$ 13,377.03 | 1 | \$ 13,377.03 | \$ 257,250.15 | \$ 31,890.51 | \$ 143,694.05 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 38,716.04 | \$ 18,151.59 | 1 | \$ 18,151.59 | \$ 27,418.77 | \$ 12,854.99 | 1 | \$ 12,854.99 | \$ 258,232.02 | \$ 32,012.23 | \$ 136,077.83 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 39,427.15 | \$ 17,438.67 | 1 | \$ 17,438.67 | \$ 27,920.33 | \$ 12,349.19 | 1 | \$ 12,349.19 | \$ 259,213.90 | \$ 32,133.95 | \$ 128,863.43 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 40,138.27 | \$ 16,748.30 | 1 | \$ 16,748.30 | \$ 28,421.90 | \$ 11,859.46 | 1 | \$ 11,859.46 | \$ 260,195.77 | \$ 32,255.67 | \$ 122,029.77 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 40,849.38 | \$ 16,080.21 | 1 | \$ 16,080.21 | \$ 28,923.46 | \$ 11,385.61 | 1 | \$ 11,385.61 | \$ 261,177.64 | \$ 32,377.39 | \$ 115,556.85 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 41,560.49 | \$ 15,434.09 | 1 | \$ 15,434.09 | \$ 29,425.02 | \$ 10,927.41 | 1 | \$ 10,927.41 | \$ 262,159.51 | \$ 32,499.11 | \$ 109,425.73 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 42,271.60 | \$ 14,809.59 | 1 | \$ 14,809.59 | \$ 29,926.58 | \$ 10,484.59 | 1 | \$ 10,484.59 | \$ 263,141.38 | \$ 32,620.83 | \$ 103,618.45 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 42,982.71 | \$ 14,206.35 | 1 | \$ 14,206.35 | \$ 30,428.15 | \$ 10,056.90 | 1 | \$ 10,056.90 | \$ 264,123.25 | \$ 32,742.55 | \$ 98,118.01 |
| 2036 | 20 | 0.311804727 | 2843 | \$ 43,103.61 | \$ 13,439.91 | 1 | \$ 13,439.91 | \$ 30,929.71 | \$ 9,644.03 | 1 | \$ 9,644.03 | \$ 37,705.76 | \$ 37,705.76 | \$ 23,513.67 |
| 2037 | 21 | 0.294155403 | 2889 | \$ 43,802.58 | \$ 12,884.77 | 1 | \$ 12,884.77 | \$ 31,431.27 | \$ 9,245.68 | 1 | \$ 9,245.68 | \$ 37,845.41 | \$ 37,845.41 | \$ 22,264.86 |
| 2038 | 22 | 0.277505097 | 2935 | \$ 44,501.56 | \$ 12,349.41 | 1 | \$ 12,349.41 | \$ 31,932.84 | \$ 8,861.52 | 1 | \$ 8,861.52 | \$ 37,985.06 | \$ 37,985.06 | \$ 21,082.09 |
| 2039 | 23 | 0.261797261 | 2981 | \$ 45,200.54 | \$ 11,833.38 | 1 | \$ 11,833.38 | \$ 32,434.40 | \$ 8,491.24 | 1 | \$ 8,491.24 | \$ 38,124.71 | \$ 38,124.71 | \$ 19,961.89 |
| 2040 | 24 | 0.246978548 | 3027 | \$ 45,899.52 | \$ 11,336.20 | 1 | \$ 11,336.20 | \$ 32,935.96 | \$ 8,134.48 | 1 | \$ 8,134.48 | \$ 38,264.36 | \$ 38,264.36 | \$ 18,900.95 |
| 2041 | 25 | 0.232998631 | 3073 | \$ 46,598.49 | \$ 10,857.39 | 1 | \$ 10,857.39 | \$ 33,437.53 | \$ 7,790.90 | 1 | \$ 7,790.90 | \$ 38,404.01 | \$ 38,404.01 | \$ 17,896.16 |
| 2042 | 26 | 0.219810029 | 3119 | \$ 47,297.47 | \$ 10,396.46 | 1 | \$ 10,396.46 | \$ 33,939.09 | \$ 7,460.15 | 1 | \$ 7,460.15 | \$ 38,543.66 | \$ 38,543.66 | \$ 16,944.57 |
| 2043 | 27 | 0.207367952 | 3165 | \$ 47,996.45 | \$ 9,952.93 | 1 | \$ 9,952.93 | \$ 34,440.65 | \$ 7,141.89 | 1 | \$ 7,141.89 | \$ 38,683.31 | \$ 38,683.31 | \$ 16,043.36 |
| 2044 | 28 | 0.195630143 | 3211 | \$ 48,695.43 | \$ 9,526.29 | 1 | \$ 9,526.29 | \$ 34,942.21 | \$ 6,835.75 | 1 | \$ 6,835.75 | \$ 38,822.96 | \$ 38,822.96 | \$ 15,189.88 |
| 2045 | 29 | 0.184556739 | 3257 | \$ 49,394.40 | \$ 9,116.07 | 1 | \$ 9,116.07 | \$ 35,443.78 | \$ 6,541.39 | 1 | \$ 6,541.39 | \$ 38,962.61 | \$ 38,962.61 | \$ 14,381.63 |
| 2046 | 30 | 0.174110131 | 3303 | \$ 50,093.38 | \$ 8,721.76 | 1 | \$ 8,721.76 | \$ 35,945.34 | \$ 6,258.45 | 1 | \$ 6,258.45 | \$ 39,102.27 | \$ 39,102.27 | \$ 13,616.20 |
| 2047 | 31 | 0.16425484 | 3349 | \$ 50,792.36 | \$ 8,342.89 | 1 | \$ 8,342.89 | \$ 36,446.90 | \$ 5,986.58 | 1 | \$ 5,986.58 | \$ 39,241.92 | \$ 39,241.92 | \$ 12,891.35 |
| 2048 | 32 | 0.154957397 | 3395 | \$ 51,491.33 | \$ 7,978.96 | 1 | \$ 7,978.96 | \$ 36,948.47 | \$ 5,725.44 | 1 | \$ 5,725.44 | \$ 39,381.57 | \$ 39,381.57 | \$ 12,204.93 |
| 2049 | 33 | 0.146186223 | 3441 | \$ 52,190.31 | \$ 7,629.50 | 1 | \$ 7,629.50 | \$ 37,450.03 | \$ 5,474.68 | 1 | \$ 5,474.68 | \$ 39,521.22 | \$ 39,521.22 | \$ 11,554.92 |
| 2050 | 34 | 0.137911531 | 3487 | \$ 52,889.29 | \$ 7,294.04 | 1 | \$ 7,294.04 | \$ 37,951.59 | \$ 5,233.96 | 1 | \$ 5,233.96 | \$ 39,660.87 | \$ 39,660.87 | \$ 10,939.38 |
| 2051 | 35 | 0.130105218 | 3533 | \$ 53,588.27 | \$ 6,972.11 | 1 | \$ 6,972.11 | \$ 38,453.15 | \$ 5,002.96 | 1 | \$ 5,002.96 | \$ 39,800.52 | \$ 39,800.52 | \$ 10,356.51 |
| 2052 | 36 | 0.122740772 | 3579 | \$ 54,287.24 | \$ 6,663.26 | 1 | \$ 6,663.26 | \$ 38,954.72 | \$ 4,781.33 | 1 | \$ 4,781.33 | \$ 39,940.17 | \$ 39,940.17 | \$ 9,804.57 |
| 2053 | 37 | 0.115793181 | 3625 | \$ 54,986.22 | \$ 6,367.03 | 1 | \$ 6,367.03 | \$ 39,456.28 | \$ 4,568.77 | 1 | \$ 4,568.77 | \$ 40,079.82 | \$ 40,079.82 | \$ 9,281.94 |
| 2054 | 38 | 0.10923885 | 3671 | \$ 55,685.20 | \$ 6,082.99 | 1 | \$ 6,082.99 | \$ 39,957.84 | \$ 4,364.95 | 1 | \$ 4,364.95 | \$ 40,219.47 | \$ 40,219.47 | \$ 8,787.06 |
| 2055 | 39 | 0.103055519 | 3717 | \$ 56,384.18 | \$ 5,810.70 | 1 | \$ 5,810.70 | \$ 40,459.41 | \$ 4,169.57 | 1 | \$ 4,169.57 | \$ 40,359.12 | \$ 40,359.12 | \$ 8,318.46 |

\$ 607,693.19

\$ 432,176.17

\$ 3,750,372.03

Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | DM ACC (Method A) | | DM ACC (Detours) | | DM ACC (Alignment) | | DM ACC (Method A) | | OPT ACC (Bridges) | | |
|------|------|-------------|------|-------------------|---------------|------------------|-------------|--------------------|---------------|-------------------|---------------|-------------------|----------------|--------------|
| | | SPPWF | AADT | COST | PV COST | COST | PV COST | COST | PV COST | COST | PV COST | COST (Andersons) | Cost (Hardies) | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 649,806.14 | \$ 925,703.72 | \$ 3,056.44 | \$ 3,056.44 | \$ 340,791.83 | \$ 340,791.83 | \$ 631,888.72 | \$ 631,888.72 | \$ 34,912.74 | \$ 34,912.74 | \$ 69,825.47 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 652,405.36 | \$ 862,006.81 | \$ 3,068.67 | \$ 2,894.97 | \$ 342,154.99 | \$ 322,787.73 | \$ 634,416.28 | \$ 598,505.92 | \$ 35,052.39 | \$ 35,052.39 | \$ 66,136.58 |
| 2018 | 2 | 0.88999644 | 2015 | \$ 655,004.59 | \$ 803,236.77 | \$ 3,080.90 | \$ 2,741.99 | \$ 343,518.16 | \$ 305,729.94 | \$ 636,943.83 | \$ 566,877.74 | \$ 35,192.04 | \$ 35,192.04 | \$ 62,641.58 |
| 2019 | 3 | 0.839619283 | 2061 | \$ 657,603.81 | \$ 748,967.71 | \$ 3,093.12 | \$ 2,597.04 | \$ 344,881.33 | \$ 289,569.01 | \$ 639,471.39 | \$ 536,912.51 | \$ 35,331.69 | \$ 35,331.69 | \$ 59,330.34 |
| 2020 | 4 | 0.792093663 | 2107 | \$ 660,203.03 | \$ 698,813.82 | \$ 3,105.35 | \$ 2,459.73 | \$ 346,244.49 | \$ 274,258.07 | \$ 641,998.94 | \$ 508,523.29 | \$ 35,471.34 | \$ 35,471.34 | \$ 56,193.25 |
| 2021 | 5 | 0.747258173 | 2153 | \$ 662,802.26 | \$ 652,425.37 | \$ 3,117.57 | \$ 2,329.63 | \$ 347,607.66 | \$ 259,752.67 | \$ 644,526.50 | \$ 481,627.69 | \$ 35,610.99 | \$ 35,610.99 | \$ 53,221.21 |
| 2022 | 6 | 0.70496054 | 2199 | \$ 665,401.48 | \$ 609,485.14 | \$ 3,129.80 | \$ 2,206.38 | \$ 348,970.83 | \$ 246,010.66 | \$ 647,054.05 | \$ 456,147.57 | \$ 35,750.64 | \$ 35,750.64 | \$ 50,405.58 |
| 2023 | 7 | 0.665057114 | 2245 | \$ 668,000.71 | \$ 569,705.22 | \$ 3,142.02 | \$ 2,089.63 | \$ 350,334.00 | \$ 232,992.12 | \$ 649,581.61 | \$ 432,008.87 | \$ 35,890.29 | \$ 35,890.29 | \$ 47,738.19 |
| 2024 | 8 | 0.627412371 | 2291 | \$ 670,599.93 | \$ 532,824.15 | \$ 3,154.25 | \$ 1,979.02 | \$ 351,697.16 | \$ 220,659.15 | \$ 652,109.16 | \$ 409,141.36 | \$ 36,029.94 | \$ 36,029.94 | \$ 45,211.27 |
| 2025 | 9 | 0.591898464 | 2337 | \$ 673,199.16 | \$ 498,604.28 | \$ 3,166.48 | \$ 1,874.23 | \$ 353,060.33 | \$ 208,975.87 | \$ 654,636.72 | \$ 387,478.47 | \$ 36,169.60 | \$ 36,169.60 | \$ 42,817.46 |
| 2026 | 10 | 0.558394777 | 2383 | \$ 675,798.38 | \$ 466,829.50 | \$ 3,178.70 | \$ 1,774.97 | \$ 354,423.50 | \$ 197,908.23 | \$ 657,164.27 | \$ 366,957.10 | \$ 36,309.25 | \$ 36,309.25 | \$ 40,549.79 |
| 2027 | 11 | 0.526787525 | 2429 | \$ 678,397.61 | \$ 437,303.15 | \$ 3,190.93 | \$ 1,680.94 | \$ 355,786.67 | \$ 187,423.98 | \$ 659,691.83 | \$ 347,517.43 | \$ 36,448.90 | \$ 36,448.90 | \$ 38,401.65 |
| 2028 | 12 | 0.496969364 | 2475 | \$ 680,996.83 | \$ 409,846.10 | \$ 3,203.15 | \$ 1,591.87 | \$ 357,149.83 | \$ 177,492.53 | \$ 662,219.38 | \$ 329,102.74 | \$ 36,588.55 | \$ 36,588.55 | \$ 36,366.78 |
| 2029 | 13 | 0.468839022 | 2521 | \$ 683,596.06 | \$ 384,295.10 | \$ 3,215.38 | \$ 1,507.50 | \$ 358,513.00 | \$ 168,084.88 | \$ 664,746.94 | \$ 311,659.30 | \$ 36,728.20 | \$ 36,728.20 | \$ 34,439.23 |
| 2030 | 14 | 0.442300964 | 2567 | \$ 686,195.28 | \$ 360,501.26 | \$ 3,227.60 | \$ 1,427.57 | \$ 359,876.17 | \$ 159,173.58 | \$ 667,274.49 | \$ 295,136.15 | \$ 36,867.85 | \$ 36,867.85 | \$ 32,613.37 |
| 2031 | 15 | 0.417265061 | 2613 | \$ 688,794.50 | \$ 338,328.64 | \$ 3,239.83 | \$ 1,351.87 | \$ 361,239.33 | \$ 150,732.55 | \$ 669,802.05 | \$ 279,484.99 | \$ 37,007.50 | \$ 37,007.50 | \$ 30,883.87 |
| 2032 | 16 | 0.393646284 | 2659 | \$ 691,393.73 | \$ 317,653.10 | \$ 3,252.06 | \$ 1,280.16 | \$ 362,602.50 | \$ 142,737.13 | \$ 672,329.60 | \$ 264,660.05 | \$ 37,147.15 | \$ 37,147.15 | \$ 29,245.68 |
| 2033 | 17 | 0.371364419 | 2705 | \$ 693,992.95 | \$ 298,361.11 | \$ 3,264.28 | \$ 1,212.24 | \$ 363,965.67 | \$ 135,163.90 | \$ 674,857.16 | \$ 250,617.94 | \$ 37,286.80 | \$ 37,286.80 | \$ 27,693.98 |
| 2034 | 18 | 0.350343791 | 2751 | \$ 696,592.18 | \$ 280,348.83 | \$ 3,276.51 | \$ 1,147.90 | \$ 365,328.84 | \$ 127,990.69 | \$ 677,384.71 | \$ 237,317.53 | \$ 37,426.45 | \$ 37,426.45 | \$ 26,224.25 |
| 2035 | 19 | 0.33051301 | 2797 | \$ 699,191.40 | \$ 263,521.13 | \$ 3,288.73 | \$ 1,086.97 | \$ 366,692.00 | \$ 121,196.48 | \$ 679,912.27 | \$ 224,719.85 | \$ 37,566.10 | \$ 37,566.10 | \$ 24,832.17 |
| 2036 | 20 | 0.311804727 | 2843 | \$ 145,828.11 | \$ 52,801.56 | \$ - | \$ - | \$ 368,055.17 | \$ 114,761.34 | \$ 682,439.82 | \$ 212,787.96 | \$ 37,705.76 | \$ 37,705.76 | \$ 23,513.67 |
| 2037 | 21 | 0.294155403 | 2889 | \$ 146,368.21 | \$ 49,604.33 | \$ - | \$ - | \$ 369,418.34 | \$ 108,666.40 | \$ 684,967.38 | \$ 201,486.85 | \$ 37,845.41 | \$ 37,845.41 | \$ 22,264.86 |
| 2038 | 22 | 0.277505097 | 2935 | \$ 146,908.31 | \$ 46,618.19 | \$ - | \$ - | \$ 370,781.51 | \$ 102,893.76 | \$ 687,494.93 | \$ 190,783.35 | \$ 37,985.06 | \$ 37,985.06 | \$ 21,082.09 |
| 2039 | 23 | 0.261797261 | 2981 | \$ 147,448.42 | \$ 43,827.56 | \$ - | \$ - | \$ 372,144.67 | \$ 97,426.46 | \$ 690,022.49 | \$ 180,646.00 | \$ 38,124.71 | \$ 38,124.71 | \$ 19,961.89 |
| 2040 | 24 | 0.246978548 | 3027 | \$ 147,988.52 | \$ 41,218.12 | \$ - | \$ - | \$ 373,507.84 | \$ 92,248.42 | \$ 692,550.04 | \$ 171,045.00 | \$ 38,264.36 | \$ 38,264.36 | \$ 18,900.95 |
| 2041 | 25 | 0.232998631 | 3073 | \$ 148,528.63 | \$ 38,776.75 | \$ - | \$ - | \$ 374,871.01 | \$ 87,344.43 | \$ 695,077.60 | \$ 161,952.13 | \$ 38,404.01 | \$ 38,404.01 | \$ 17,896.16 |
| 2042 | 26 | 0.219810029 | 3119 | \$ 149,068.73 | \$ 36,491.39 | \$ - | \$ - | \$ 376,234.18 | \$ 82,700.04 | \$ 697,605.15 | \$ 153,340.61 | \$ 38,543.66 | \$ 38,543.66 | \$ 16,944.57 |
| 2043 | 27 | 0.207367952 | 3165 | \$ 149,608.83 | \$ 34,350.96 | \$ - | \$ - | \$ 377,597.34 | \$ 78,301.59 | \$ 700,132.71 | \$ 145,185.09 | \$ 38,683.31 | \$ 38,683.31 | \$ 16,043.36 |
| 2044 | 28 | 0.195630143 | 3211 | \$ 150,148.94 | \$ 32,345.26 | \$ - | \$ - | \$ 378,960.51 | \$ 74,136.10 | \$ 702,660.26 | \$ 137,461.53 | \$ 38,822.96 | \$ 38,822.96 | \$ 15,189.88 |
| 2045 | 29 | 0.184556739 | 3257 | \$ 150,689.04 | \$ 30,464.90 | \$ - | \$ - | \$ 380,323.68 | \$ 70,191.30 | \$ 705,187.82 | \$ 130,147.16 | \$ 38,962.61 | \$ 38,962.61 | \$ 14,381.63 |
| 2046 | 30 | 0.174110131 | 3303 | \$ 151,229.15 | \$ 28,701.25 | \$ - | \$ - | \$ 381,686.84 | \$ 66,455.55 | \$ 707,715.37 | \$ 123,220.42 | \$ 39,102.27 | \$ 39,102.27 | \$ 13,616.20 |
| 2047 | 31 | 0.16425484 | 3349 | \$ 151,769.25 | \$ 27,046.30 | \$ - | \$ - | \$ 383,050.01 | \$ 62,917.82 | \$ 710,242.92 | \$ 116,660.84 | \$ 39,241.92 | \$ 39,241.92 | \$ 12,891.35 |
| 2048 | 32 | 0.154957397 | 3395 | \$ 152,309.36 | \$ 25,492.71 | \$ - | \$ - | \$ 384,413.18 | \$ 59,567.67 | \$ 712,770.48 | \$ 110,449.06 | \$ 39,381.57 | \$ 39,381.57 | \$ 12,204.93 |
| 2049 | 33 | 0.146186223 | 3441 | \$ 152,849.46 | \$ 24,033.65 | \$ - | \$ - | \$ 385,776.35 | \$ 56,395.19 | \$ 715,298.03 | \$ 104,566.72 | \$ 39,521.22 | \$ 39,521.22 | \$ 11,554.92 |
| 2050 | 34 | 0.137911531 | 3487 | \$ 153,389.56 | \$ 22,662.86 | \$ - | \$ - | \$ 387,139.51 | \$ 53,391.00 | \$ 717,825.59 | \$ 98,996.43 | \$ 39,660.87 | \$ 39,660.87 | \$ 10,939.38 |
| 2051 | 35 | 0.130105218 | 3533 | \$ 153,929.67 | \$ 21,374.49 | \$ - | \$ - | \$ 388,502.68 | \$ 50,546.23 | \$ 720,353.14 | \$ 93,721.70 | \$ 39,800.52 | \$ 39,800.52 | \$ 10,356.51 |
| 2052 | 36 | 0.122740772 | 3579 | \$ 154,469.77 | \$ 20,163.16 | \$ - | \$ - | \$ 389,865.85 | \$ 47,852.44 | \$ 722,880.70 | \$ 88,726.94 | \$ 39,940.17 | \$ 39,940.17 | \$ 9,804.57 |
| 2053 | 37 | 0.115793181 | 3625 | \$ 155,009.88 | \$ 19,023.87 | \$ - | \$ - | \$ 391,229.02 | \$ 45,301.65 | \$ 725,408.25 | \$ 83,997.33 | \$ 40,079.82 | \$ 40,079.82 | \$ 9,281.94 |
| 2054 | 38 | 0.10923885 | 3671 | \$ 155,549.98 | \$ 17,951.99 | \$ - | \$ - | \$ 392,592.18 | \$ 42,886.32 | \$ 727,935.81 | \$ 79,518.87 | \$ 40,219.47 | \$ 40,219.47 | \$ 8,787.06 |
| 2055 | 39 | 0.103055519 | 3717 | \$ 156,090.08 | \$ 16,943.21 | \$ - | \$ - | \$ 393,955.35 | \$ 40,599.27 | \$ 730,463.36 | \$ 75,278.28 | \$ 40,359.12 | \$ 40,359.12 | \$ 8,318.46 |

\$ 11,088,653.4

\$ 38,291.05

\$ 5,704,013.95

\$ 10,576,257.5

\$ 1,168,706.07

NOT USED

NOT USED

Worksheet A1 - Discounting

| YEAR | TIME | Growth | 2.4% | OPT ACC (Method A) | | OPT ACC (Detours) | | OPT ACC (Alignment) | | OPT ACC (Method A) | | DM BRIDGE CONSTRUCTION | |
|------|------|-------------|------|--------------------|---------------|-------------------|---------|---------------------|--------------|--------------------|---------------|------------------------|------------------|
| | | SPPWF | AADT | COST | PV COST | COST | PV COST | COST | PV COST | COST | PV COST | COST | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 135,026.02 | \$ 135,026.02 | \$ - | \$ - | \$ 98,982.68 | \$ 98,982.68 | \$ 321,255.00 | \$ 321,255.00 | \$ - | \$ - |
| 2017 | 1 | 0.943396226 | 1969 | \$ 135,566.13 | \$ 127,892.57 | \$ - | \$ - | \$ 99,378.61 | \$ 93,753.40 | \$ 322,540.02 | \$ 304,283.04 | \$ - | \$ - |
| 2018 | 2 | 0.88999644 | 2015 | \$ 136,106.23 | \$ 121,134.06 | \$ - | \$ - | \$ 99,774.54 | \$ 88,798.98 | \$ 323,825.04 | \$ 288,203.13 | \$ - | \$ - |
| 2019 | 3 | 0.839619283 | 2061 | \$ 136,646.34 | \$ 114,730.90 | \$ - | \$ - | \$ 100,170.47 | \$ 84,105.06 | \$ 325,110.06 | \$ 272,968.68 | \$ - | \$ - |
| 2020 | 4 | 0.792093663 | 2107 | \$ 137,186.44 | \$ 108,664.51 | \$ - | \$ - | \$ 100,566.40 | \$ 79,658.01 | \$ 326,395.08 | \$ 258,535.48 | \$ - | \$ - |
| 2021 | 5 | 0.747258173 | 2153 | \$ 137,726.54 | \$ 102,917.29 | \$ - | \$ - | \$ 100,962.33 | \$ 75,444.93 | \$ 327,680.10 | \$ 244,861.63 | \$ - | \$ - |
| 2022 | 6 | 0.70496054 | 2199 | \$ 138,266.65 | \$ 97,472.53 | \$ - | \$ - | \$ 101,358.26 | \$ 71,453.58 | \$ 328,965.12 | \$ 231,907.43 | \$ - | \$ - |
| 2023 | 7 | 0.665057114 | 2245 | \$ 138,806.75 | \$ 92,314.42 | \$ - | \$ - | \$ 101,754.19 | \$ 67,672.35 | \$ 330,250.14 | \$ 219,635.21 | \$ - | \$ - |
| 2024 | 8 | 0.627412371 | 2291 | \$ 139,346.86 | \$ 87,427.94 | \$ - | \$ - | \$ 102,150.12 | \$ 64,090.25 | \$ 331,535.16 | \$ 208,009.26 | \$ - | \$ - |
| 2025 | 9 | 0.591898464 | 2337 | \$ 139,886.96 | \$ 82,798.88 | \$ - | \$ - | \$ 102,546.05 | \$ 60,696.85 | \$ 332,820.18 | \$ 196,995.75 | \$ - | \$ - |
| 2026 | 10 | 0.558394777 | 2383 | \$ 140,427.06 | \$ 78,413.74 | \$ - | \$ - | \$ 102,941.98 | \$ 57,482.27 | \$ 334,105.20 | \$ 186,562.60 | \$ - | \$ - |
| 2027 | 11 | 0.526787525 | 2429 | \$ 140,967.17 | \$ 74,259.75 | \$ - | \$ - | \$ 103,337.92 | \$ 54,437.12 | \$ 335,390.22 | \$ 176,679.38 | \$ - | \$ - |
| 2028 | 12 | 0.496969364 | 2475 | \$ 141,507.27 | \$ 70,324.78 | \$ - | \$ - | \$ 103,733.85 | \$ 51,552.54 | \$ 336,675.24 | \$ 167,317.28 | \$ - | \$ - |
| 2029 | 13 | 0.468839022 | 2521 | \$ 142,047.38 | \$ 66,597.35 | \$ - | \$ - | \$ 104,129.78 | \$ 48,820.10 | \$ 337,960.26 | \$ 158,448.96 | \$ - | \$ - |
| 2030 | 14 | 0.442300964 | 2567 | \$ 142,587.48 | \$ 63,066.58 | \$ - | \$ - | \$ 104,525.71 | \$ 46,231.82 | \$ 339,245.28 | \$ 150,048.52 | \$ - | \$ - |
| 2031 | 15 | 0.417265061 | 2613 | \$ 143,127.59 | \$ 59,722.14 | \$ - | \$ - | \$ 104,921.64 | \$ 43,780.13 | \$ 340,530.30 | \$ 142,091.40 | \$ - | \$ - |
| 2032 | 16 | 0.393646284 | 2659 | \$ 143,667.69 | \$ 56,554.25 | \$ - | \$ - | \$ 105,317.57 | \$ 41,457.87 | \$ 341,815.32 | \$ 134,554.33 | \$ - | \$ - |
| 2033 | 17 | 0.371364419 | 2705 | \$ 144,207.79 | \$ 53,553.64 | \$ - | \$ - | \$ 105,713.50 | \$ 39,258.23 | \$ 343,100.34 | \$ 127,415.26 | \$ - | \$ - |
| 2034 | 18 | 0.350343791 | 2751 | \$ 144,747.90 | \$ 50,711.53 | \$ - | \$ - | \$ 106,109.43 | \$ 37,174.78 | \$ 344,385.36 | \$ 120,653.27 | \$ - | \$ - |
| 2035 | 19 | 0.33051301 | 2797 | \$ 145,288.00 | \$ 48,019.57 | \$ - | \$ - | \$ 106,505.36 | \$ 35,201.41 | \$ 345,670.38 | \$ 114,248.56 | \$ - | \$ - |
| 2036 | 20 | 0.311804727 | 2843 | \$ 145,828.11 | \$ 45,469.89 | \$ - | \$ - | \$ 106,901.29 | \$ 33,332.33 | \$ 346,955.40 | \$ 108,182.33 | \$ 13,227,500.00 | \$ 4,124,397.02 |
| 2037 | 21 | 0.294155403 | 2889 | \$ 146,368.21 | \$ 43,055.00 | \$ - | \$ - | \$ 107,297.22 | \$ 31,562.06 | \$ 348,240.42 | \$ 102,436.80 | \$ - | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ 146,908.31 | \$ 40,767.81 | \$ - | \$ - | \$ 107,693.15 | \$ 29,885.40 | \$ 349,525.44 | \$ 96,995.09 | \$ - | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ 147,448.42 | \$ 38,601.59 | \$ - | \$ - | \$ 108,089.08 | \$ 28,297.43 | \$ 350,810.46 | \$ 91,841.22 | \$ - | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ 147,988.52 | \$ 36,549.99 | \$ - | \$ - | \$ 108,485.01 | \$ 26,793.47 | \$ 352,095.48 | \$ 86,960.03 | \$ - | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ 148,528.63 | \$ 34,606.97 | \$ - | \$ - | \$ 108,880.95 | \$ 25,369.11 | \$ 353,380.50 | \$ 82,337.17 | \$ - | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ 149,068.73 | \$ 32,766.80 | \$ - | \$ - | \$ 109,276.88 | \$ 24,020.15 | \$ 354,665.52 | \$ 77,959.04 | \$ - | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ 149,608.83 | \$ 31,024.08 | \$ - | \$ - | \$ 109,672.81 | \$ 22,742.63 | \$ 355,950.54 | \$ 73,812.73 | \$ - | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ 150,148.94 | \$ 29,373.66 | \$ - | \$ - | \$ 110,068.74 | \$ 21,532.76 | \$ 357,235.56 | \$ 69,886.04 | \$ - | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ 150,689.04 | \$ 27,810.68 | \$ - | \$ - | \$ 110,464.67 | \$ 20,387.00 | \$ 358,520.58 | \$ 66,167.39 | \$ - | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ 151,229.15 | \$ 26,330.53 | \$ - | \$ - | \$ 110,860.60 | \$ 19,301.95 | \$ 359,805.60 | \$ 62,645.80 | \$ - | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ 151,769.25 | \$ 24,928.83 | \$ - | \$ - | \$ 111,256.53 | \$ 18,274.42 | \$ 361,090.62 | \$ 59,310.88 | \$ - | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ 152,309.36 | \$ 23,601.46 | \$ - | \$ - | \$ 111,652.46 | \$ 17,301.37 | \$ 362,375.64 | \$ 56,152.79 | \$ - | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ 152,849.46 | \$ 22,344.49 | \$ - | \$ - | \$ 112,048.39 | \$ 16,379.93 | \$ 363,660.66 | \$ 53,162.18 | \$ - | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ 153,389.56 | \$ 21,154.19 | \$ - | \$ - | \$ 112,444.32 | \$ 15,507.37 | \$ 364,945.68 | \$ 50,330.22 | \$ - | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ 153,929.67 | \$ 20,027.05 | \$ - | \$ - | \$ 112,840.25 | \$ 14,681.11 | \$ 366,230.70 | \$ 47,648.53 | \$ - | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ 154,469.77 | \$ 18,959.74 | \$ - | \$ - | \$ 113,236.18 | \$ 13,898.70 | \$ 367,515.72 | \$ 45,109.16 | \$ - | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ 155,009.88 | \$ 17,949.09 | \$ - | \$ - | \$ 113,632.11 | \$ 13,157.82 | \$ 368,800.74 | \$ 42,704.61 | \$ - | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ 155,549.98 | \$ 16,992.10 | \$ - | \$ - | \$ 114,028.04 | \$ 12,456.29 | \$ 370,085.76 | \$ 40,427.74 | \$ - | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ 156,090.08 | \$ 16,085.94 | \$ - | \$ - | \$ 114,423.98 | \$ 11,792.02 | \$ 371,370.78 | \$ 38,271.81 | -\$ 13,148,299.73 | -\$ 1,355,004.85 |

\$ 2,260,002.35

\$ -

\$ 1,656,725.70

\$ 5,377,015.74

\$ 2,769,392.17

NOT USED

| Worksheet A1 - Discounting | | | | | | | | | |
|----------------------------|------|-------------|------|----------------------|-------------|-------------------------|------------------|---------------------|------------------|
| YEAR | TIME | Growth | 2.4% | DM Maintenance Costs | | OPT BRIDGE CONSTRUCTION | | OPT Alignment Costs | |
| | | SPPWF | AADT | COST | PV COST | COST | PV COST | COST | PV COST |
| 2016 | 0 | 1 | 1923 | \$ 2,243.75 | \$ 2,243.75 | \$ 13,227,500.00 | \$ 13,227,500.00 | \$ 13,330,547.00 | \$ 13,330,547.00 |
| 2017 | 1 | 0.943396226 | 1969 | \$ 2,243.75 | \$ 2,116.75 | \$ - | \$ - | \$ - | \$ - |
| 2018 | 2 | 0.88999644 | 2015 | \$ 2,243.75 | \$ 1,996.93 | \$ - | \$ - | \$ - | \$ - |
| 2019 | 3 | 0.839619283 | 2061 | \$ 2,243.75 | \$ 1,883.90 | \$ - | \$ - | \$ - | \$ - |
| 2020 | 4 | 0.792093663 | 2107 | \$ 2,243.75 | \$ 1,777.26 | \$ - | \$ - | \$ - | \$ - |
| 2021 | 5 | 0.747258173 | 2153 | \$ 2,243.75 | \$ 1,676.66 | \$ - | \$ - | \$ - | \$ - |
| 2022 | 6 | 0.70496054 | 2199 | \$ 2,243.75 | \$ 1,581.76 | \$ - | \$ - | \$ - | \$ - |
| 2023 | 7 | 0.665057114 | 2245 | \$ 2,243.75 | \$ 1,492.22 | \$ - | \$ - | \$ - | \$ - |
| 2024 | 8 | 0.627412371 | 2291 | \$ 2,243.75 | \$ 1,407.76 | \$ - | \$ - | \$ - | \$ - |
| 2025 | 9 | 0.591898464 | 2337 | \$ 2,243.75 | \$ 1,328.07 | \$ - | \$ - | \$ - | \$ - |
| 2026 | 10 | 0.558394777 | 2383 | \$ 2,243.75 | \$ 1,252.90 | \$ - | \$ - | \$ - | \$ - |
| 2027 | 11 | 0.526787525 | 2429 | \$ 2,243.75 | \$ 1,181.98 | \$ - | \$ - | \$ - | \$ - |
| 2028 | 12 | 0.496969364 | 2475 | \$ 2,243.75 | \$ 1,115.08 | \$ - | \$ - | \$ - | \$ - |
| 2029 | 13 | 0.468839022 | 2521 | \$ 2,243.75 | \$ 1,051.96 | \$ - | \$ - | \$ - | \$ - |
| 2030 | 14 | 0.442300964 | 2567 | \$ 2,243.75 | \$ 992.41 | \$ - | \$ - | \$ - | \$ - |
| 2031 | 15 | 0.417265061 | 2613 | \$ 2,243.75 | \$ 936.24 | \$ - | \$ - | \$ - | \$ - |
| 2032 | 16 | 0.393646284 | 2659 | \$ 2,243.75 | \$ 883.24 | \$ - | \$ - | \$ - | \$ - |
| 2033 | 17 | 0.371364419 | 2705 | \$ 2,243.75 | \$ 833.25 | \$ - | \$ - | \$ - | \$ - |
| 2034 | 18 | 0.350343791 | 2751 | \$ 2,243.75 | \$ 786.08 | \$ - | \$ - | \$ - | \$ - |
| 2035 | 19 | 0.33051301 | 2797 | \$ 2,243.75 | \$ 741.59 | \$ - | \$ - | \$ - | \$ - |
| 2036 | 20 | 0.311804727 | 2843 | \$ 243.75 | \$ 76.00 | \$ - | \$ - | \$ - | \$ - |
| 2037 | 21 | 0.294155403 | 2889 | \$ 243.75 | \$ 71.70 | \$ - | \$ - | \$ - | \$ - |
| 2038 | 22 | 0.277505097 | 2935 | \$ 243.75 | \$ 67.64 | \$ - | \$ - | \$ - | \$ - |
| 2039 | 23 | 0.261797261 | 2981 | \$ 243.75 | \$ 63.81 | \$ - | \$ - | \$ - | \$ - |
| 2040 | 24 | 0.246978548 | 3027 | \$ 243.75 | \$ 60.20 | \$ - | \$ - | \$ - | \$ - |
| 2041 | 25 | 0.232998631 | 3073 | \$ 243.75 | \$ 56.79 | \$ - | \$ - | \$ - | \$ - |
| 2042 | 26 | 0.219810029 | 3119 | \$ 243.75 | \$ 53.58 | \$ - | \$ - | \$ - | \$ - |
| 2043 | 27 | 0.207367952 | 3165 | \$ 243.75 | \$ 50.55 | \$ - | \$ - | \$ - | \$ - |
| 2044 | 28 | 0.195630143 | 3211 | \$ 243.75 | \$ 47.68 | \$ - | \$ - | \$ - | \$ - |
| 2045 | 29 | 0.184556739 | 3257 | \$ 243.75 | \$ 44.99 | \$ - | \$ - | \$ - | \$ - |
| 2046 | 30 | 0.174110131 | 3303 | \$ 243.75 | \$ 42.44 | \$ - | \$ - | \$ - | \$ - |
| 2047 | 31 | 0.16425484 | 3349 | \$ 243.75 | \$ 40.04 | \$ - | \$ - | \$ - | \$ - |
| 2048 | 32 | 0.154957397 | 3395 | \$ 243.75 | \$ 37.77 | \$ - | \$ - | \$ - | \$ - |
| 2049 | 33 | 0.146186223 | 3441 | \$ 243.75 | \$ 35.63 | \$ - | \$ - | \$ - | \$ - |
| 2050 | 34 | 0.137911531 | 3487 | \$ 243.75 | \$ 33.62 | \$ - | \$ - | \$ - | \$ - |
| 2051 | 35 | 0.130105218 | 3533 | \$ 243.75 | \$ 31.71 | \$ - | \$ - | \$ - | \$ - |
| 2052 | 36 | 0.122740772 | 3579 | \$ 243.75 | \$ 29.92 | \$ - | \$ - | \$ - | \$ - |
| 2053 | 37 | 0.115793181 | 3625 | \$ 243.75 | \$ 28.22 | \$ - | \$ - | \$ - | \$ - |
| 2054 | 38 | 0.10923885 | 3671 | \$ 243.75 | \$ 26.63 | \$ - | \$ - | \$ - | \$ - |
| 2055 | 39 | 0.103055519 | 3717 | \$ 243.75 | \$ 25.12 | -\$ 12,887,195.72 | -\$ 1,328,096.64 | \$ - | \$ - |
| | | | | \$ 28,203.82 | | \$ 11,899,403.36 | | \$ 13,330,547.00 | |

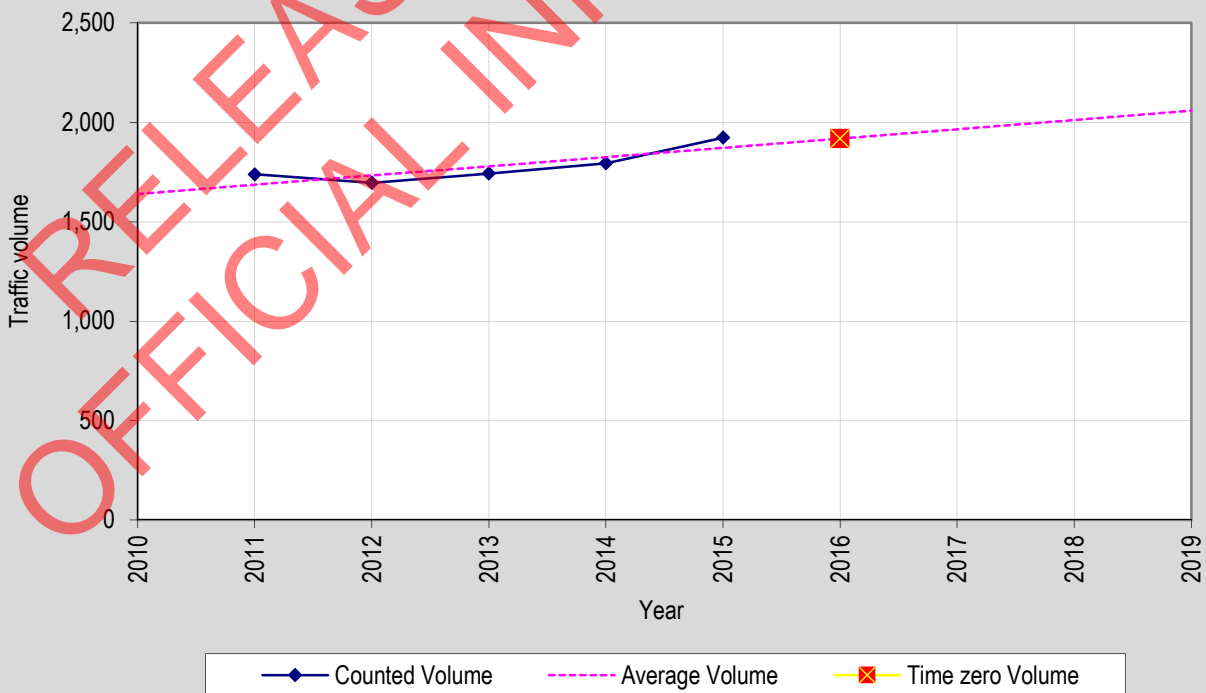
OFFICIAL INFORMATION ACT

Worksheets A2: Traffic Data

Worksheet A2.4 - Time zero traffic volume and growth rates

| | | |
|---|-----------------------|--|
| 1 | Activity option | Count Station 01200198 |
| 2 | Road/section/movement | SH12 RS 185 RP 14.2: About 1.5km east of Ararua Rd, 1km west of Petley Rd. |
| 3 | Time period | 2011-2015 Traffic Count Data |

| Year (4) | AADT or average volume (5) | Regression output | | |
|-------------|-------------------------------|-------------------|--------------------------|-------------|
| 2010 | | 6 | Constant | -92026.8 |
| 2011 | 1739 | 7 | X coefficient | 46.6 |
| 2012 | 1696 | 8 | R squared | 0.706290249 |
| 2013 | 1743 | 9 | Time zero | 2016 |
| 2014 | 1794 | 10 | Time zero traffic volume | 1,919 |
| 2015 | 1923 | 11 | Growth rate at time zero | 2.4% |



| Delays & Conflicts at One Lane Bridges | | | | | | Andersons | | | Hardies | | | | |
|--|-------|--------|--------|--------|--------|-----------|------|----------------------|---------------------|-------------|----------------------|---------------------|-------------|
| Andersons (25m) & Hardies (65m) Bridges | | | | | | Year | AADT | Delay (mins per day) | Wait (mins per day) | Total Stops | Delay (mins per day) | Wait (mins per day) | Total Stops |
| Table 3: Total Delay in minutes per day | | | | | | 2016 | 1923 | 45.919 | 4.961 | 65.303 | 120.9895 | 22.152 | 180.6595 |
| Interpolated figures for 25m & 65m Bridges | | | | | | 2017 | 1969 | 48.357 | 5.283 | 68.109 | 127.2685 | 23.256 | 188.7785 |
| AADT | 1500 | 2000 | 2500 | 3000 | 3500 | 2018 | 2015 | 51.035 | 5.62 | 71.155 | 134.2 | 24.525 | 197.61 |
| 20m | 18 | 39 | 65 | 93 | 123 | 2019 | 2061 | 54.209 | 5.988 | 74.697 | 142.48 | 26.135 | 207.914 |
| 30m | 29 | 61 | 104 | 153 | 220 | 2020 | 2107 | 57.383 | 6.356 | 78.239 | 150.76 | 27.745 | 218.218 |
| 60m | 59 | 123 | 208 | 313 | 440 | 2021 | 2153 | 60.557 | 6.724 | 81.781 | 159.04 | 29.355 | 228.522 |
| 80m | 76 | 157 | 262 | 390 | 542 | 2022 | 2199 | 63.731 | 7.092 | 85.323 | 167.32 | 30.965 | 238.826 |
| 25m | 23.5 | 50 | 84.5 | 123 | 171.5 | 2023 | 2245 | 66.905 | 7.46 | 88.865 | 175.6 | 32.575 | 249.13 |
| 65m | 63.25 | 131.5 | 221.5 | 332.25 | 465.5 | 2024 | 2291 | 70.079 | 7.828 | 92.407 | 183.88 | 34.185 | 259.434 |
| | | | | | | 2025 | 2337 | 73.253 | 8.196 | 95.949 | 192.16 | 35.795 | 269.738 |
| Table 4: Total waiting time in minutes per day | | | | | | 2026 | 2383 | 76.427 | 8.564 | 99.491 | 200.44 | 37.405 | 280.042 |
| AADT | 1500 | 2000 | 2500 | 3000 | 3500 | 2027 | 2429 | 79.601 | 8.932 | 103.033 | 208.72 | 39.015 | 290.346 |
| 20m | 1 | 4 | 6 | 8 | 11 | 2028 | 2475 | 82.775 | 9.3 | 106.575 | 217 | 40.625 | 300.65 |
| 30m | 3 | 7 | 13 | 19 | 26 | 2029 | 2521 | 86.117 | 9.668 | 110.201 | 226.1515 | 42.361 | 312.2875 |
| 60m | 11 | 22 | 38 | 57 | 77 | 2030 | 2567 | 89.659 | 10.036 | 113.927 | 236.3405 | 44.247 | 325.5125 |
| 80m | 15 | 30 | 52 | 77 | 105 | 2031 | 2613 | 93.201 | 10.404 | 117.653 | 246.5295 | 46.133 | 338.7375 |
| 25m | 2 | 5.5 | 9.5 | 13.5 | 18.5 | 2032 | 2659 | 96.743 | 10.772 | 121.379 | 256.7185 | 48.019 | 351.9625 |
| 65m | 12 | 24 | 41.5 | 62 | 84 | 2033 | 2705 | 100.285 | 11.14 | 125.105 | 266.9075 | 49.905 | 365.1875 |
| | | | | | | 2034 | 2751 | 103.827 | 11.508 | 128.831 | 277.0965 | 51.791 | 378.4125 |
| Table 5: Total number of stops per day | | | | | | 2035 | 2797 | 107.369 | 11.876 | 132.557 | 287.2855 | 53.677 | 391.6375 |
| AADT | 1500 | 2000 | 2500 | 3000 | 3500 | 2036 | 2843 | 110.911 | 12.244 | 136.283 | 297.4745 | 55.563 | 404.8625 |
| 20m | 32 | 55 | 83 | 110 | 133 | 2037 | 2889 | 114.453 | 12.612 | 140.009 | 307.6635 | 57.449 | 418.0875 |
| 30m | 47 | 85 | 134 | 188 | 247 | 2038 | 2935 | 117.995 | 12.98 | 143.735 | 317.8525 | 59.335 | 431.3125 |
| 60m | 98 | 181 | 287 | 424 | 589 | 2039 | 2981 | 121.537 | 13.348 | 147.461 | 328.0415 | 61.221 | 444.5375 |
| 80m | 130 | 234 | 364 | 528 | 726 | 2040 | 3027 | 125.619 | 13.77 | 151.214 | 339.4455 | 63.188 | 459.3555 |
| 25m | 39.5 | 70 | 108.5 | 149 | 190 | | | | | | | | |
| 65m | 106 | 194.25 | 306.25 | 450 | 623.25 | | | | | | | | |

Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

| Option (1) | Direction (2) | Period (3) | No./Year (4) | Road Category (5) | Period Volume (6) | TT (mins) (7) | TTC (\$/hr) (8) | Congest (\$/hr) (9) | Reliability (\$/hr) (10) | Annual Cost (\$) (11) |
|--------------------|------------------|---------------|-----------------|----------------------|----------------------|------------------|--------------------|------------------------|-----------------------------|--------------------------|
| DM - Bridge Delays | Both | 2016 | 245 | RS | 1,923 | 166.9085 | \$25.34 | \$4.88 | \$0.00 | \$20,596 |
| DM - Bridge Delays | Both | 2017 | 245 | RS | 1,969 | 175.6255 | \$25.34 | \$4.88 | \$0.00 | \$21,672 |
| DM - Bridge Delays | Both | 2018 | 245 | RS | 2,015 | 185.2350 | \$25.34 | \$4.88 | \$0.00 | \$22,858 |
| DM - Bridge Delays | Both | 2019 | 245 | RS | 2,061 | 196.6890 | \$25.34 | \$4.88 | \$0.00 | \$24,271 |
| DM - Bridge Delays | Both | 2020 | 245 | RS | 2,107 | 208.1430 | \$25.34 | \$4.88 | \$0.00 | \$25,684 |
| DM - Bridge Delays | Both | 2021 | 245 | RS | 2,153 | 219.5970 | \$25.34 | \$4.88 | \$0.00 | \$27,098 |
| DM - Bridge Delays | Both | 2022 | 245 | RS | 2,199 | 231.0510 | \$25.34 | \$4.88 | \$0.00 | \$28,511 |
| DM - Bridge Delays | Both | 2023 | 245 | RS | 2,245 | 242.5050 | \$25.34 | \$4.88 | \$0.00 | \$29,925 |
| DM - Bridge Delays | Both | 2024 | 245 | RS | 2,291 | 253.9590 | \$25.34 | \$4.88 | \$0.00 | \$31,338 |
| DM - Bridge Delays | Both | 2025 | 245 | RS | 2,337 | 265.4130 | \$25.34 | \$4.88 | \$0.00 | \$32,752 |
| DM - Bridge Delays | Both | 2026 | 245 | RS | 2,383 | 276.8670 | \$25.34 | \$4.88 | \$0.00 | \$34,165 |
| DM - Bridge Delays | Both | 2027 | 245 | RS | 2,429 | 288.3210 | \$25.34 | \$4.88 | \$0.00 | \$35,578 |
| DM - Bridge Delays | Both | 2028 | 245 | RS | 2,475 | 299.7750 | \$25.34 | \$4.88 | \$0.00 | \$36,992 |
| DM - Bridge Delays | Both | 2029 | 245 | RS | 2,521 | 312.2685 | \$25.34 | \$4.88 | \$0.00 | \$38,533 |
| DM - Bridge Delays | Both | 2030 | 245 | RS | 2,567 | 325.9995 | \$25.34 | \$4.88 | \$0.00 | \$40,228 |
| DM - Bridge Delays | Both | 2031 | 245 | RS | 2,613 | 339.7305 | \$25.34 | \$4.88 | \$0.00 | \$41,922 |
| DM - Bridge Delays | Both | 2032 | 245 | RS | 2,659 | 353.4615 | \$25.34 | \$4.88 | \$0.00 | \$43,617 |
| DM - Bridge Delays | Both | 2033 | 245 | RS | 2,705 | 367.1925 | \$25.34 | \$4.88 | \$0.00 | \$45,311 |
| DM - Bridge Delays | Both | 2034 | 245 | RS | 2,751 | 380.9235 | \$25.34 | \$4.88 | \$0.00 | \$47,005 |
| DM - Bridge Delays | Both | 2035 | 245 | RS | 2,797 | 394.6545 | \$25.34 | \$4.88 | \$0.00 | \$48,700 |
| DM - Bridge Delays | Both | 2036 | 245 | RS | 2,843 | 408.3855 | \$25.34 | \$4.88 | \$0.00 | \$50,394 |
| DM - Bridge Delays | Both | 2037 | 245 | RS | 2,889 | 422.1165 | \$25.34 | \$4.88 | \$0.00 | \$52,088 |
| DM - Bridge Delays | Both | 2038 | 245 | RS | 2,935 | 435.8475 | \$25.34 | \$4.88 | \$0.00 | \$53,783 |
| DM - Bridge Delays | Both | 2039 | 245 | RS | 2,981 | 449.5785 | \$25.34 | \$4.88 | \$0.00 | \$55,477 |
| DM - Bridge Delays | Both | 2040 | 245 | RS | 3,027 | 463.3095 | \$25.34 | \$4.88 | \$0.00 | \$57,171 |

Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

| Option (1) | Direction (2) | Period (3) | No./Year (4) | Road Category (5) | Period Volume (6) | TT (mins) (7) | TTC (\$/hr) (8) | Congest (\$/hr) (9) | Reliability (\$/hr) (10) | Annual Cost (\$) (11) |
|-----------------|------------------|---------------|-----------------|----------------------|----------------------|------------------|--------------------|------------------------|-----------------------------|--------------------------|
| DM - Diversions | Both | 2016 | - | RS | 1,923 | 13,461 | \$25.34 | \$0.00 | \$0.00 | \$5,685 |
| DM - Diversions | Both | 2017 | - | RS | 1,969 | 13,783 | \$25.34 | \$0.00 | \$0.00 | \$5,821 |
| DM - Diversions | Both | 2018 | - | RS | 2,015 | 14,105 | \$25.34 | \$0.00 | \$0.00 | \$5,957 |
| DM - Diversions | Both | 2019 | - | RS | 2,061 | 14,427 | \$25.34 | \$0.00 | \$0.00 | \$6,093 |
| DM - Diversions | Both | 2020 | - | RS | 2,107 | 14,749 | \$25.34 | \$0.00 | \$0.00 | \$6,229 |
| DM - Diversions | Both | 2021 | - | RS | 2,153 | 15,071 | \$25.34 | \$0.00 | \$0.00 | \$6,365 |
| DM - Diversions | Both | 2022 | - | RS | 2,199 | 15,393 | \$25.34 | \$0.00 | \$0.00 | \$6,501 |
| DM - Diversions | Both | 2023 | - | RS | 2,245 | 15,715 | \$25.34 | \$0.00 | \$0.00 | \$6,637 |
| DM - Diversions | Both | 2024 | - | RS | 2,291 | 16,037 | \$25.34 | \$0.00 | \$0.00 | \$6,773 |
| DM - Diversions | Both | 2025 | - | RS | 2,337 | 16,359 | \$25.34 | \$0.00 | \$0.00 | \$6,909 |
| DM - Diversions | Both | 2026 | - | RS | 2,383 | 16,681 | \$25.34 | \$0.00 | \$0.00 | \$7,045 |
| DM - Diversions | Both | 2027 | - | RS | 2,429 | 17,003 | \$25.34 | \$0.00 | \$0.00 | \$7,181 |
| DM - Diversions | Both | 2028 | - | RS | 2,475 | 17,325 | \$25.34 | \$0.00 | \$0.00 | \$7,317 |
| DM - Diversions | Both | 2029 | - | RS | 2,521 | 17,647 | \$25.34 | \$0.00 | \$0.00 | \$7,453 |
| DM - Diversions | Both | 2030 | - | RS | 2,567 | 17,969 | \$25.34 | \$0.00 | \$0.00 | \$7,589 |
| DM - Diversions | Both | 2031 | - | RS | 2,613 | 18,291 | \$25.34 | \$0.00 | \$0.00 | \$7,725 |
| DM - Diversions | Both | 2032 | - | RS | 2,659 | 18,613 | \$25.34 | \$0.00 | \$0.00 | \$7,861 |
| DM - Diversions | Both | 2033 | - | RS | 2,705 | 18,935 | \$25.34 | \$0.00 | \$0.00 | \$7,997 |
| DM - Diversions | Both | 2034 | - | RS | 2,751 | 19,257 | \$25.34 | \$0.00 | \$0.00 | \$8,133 |
| DM - Diversions | Both | 2035 | - | RS | 2,797 | 19,579 | \$25.34 | \$0.00 | \$0.00 | \$8,269 |
| DM - Diversions | Both | 2036 | - | RS | 2,843 | 19,901 | \$25.34 | \$0.00 | \$0.00 | \$8,405 |
| DM - Diversions | Both | 2037 | - | RS | 2,889 | 20,223 | \$25.34 | \$0.00 | \$0.00 | \$8,541 |
| DM - Diversions | Both | 2038 | - | RS | 2,935 | 20,545 | \$25.34 | \$0.00 | \$0.00 | \$8,677 |
| DM - Diversions | Both | 2039 | - | RS | 2,981 | 20,867 | \$25.34 | \$0.00 | \$0.00 | \$8,813 |
| DM - Diversions | Both | 2040 | - | RS | 3,027 | 21,189 | \$25.34 | \$0.00 | \$0.00 | \$8,949 |

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 First edition, Amendment 1
 Effective from 1 January 2016

Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

| Option (1) | Direction (2) | Period (3) | No./Year (4) | Road Category (5) | Period Volume (6) | TT (mins) (7) | TTC (\$/hr) (8) | Congest (\$/hr) (9) | Reliability (\$/hr) (10) | Annual Cost (\$) (11) |
|------------------|------------------|---------------|-----------------|----------------------|----------------------|------------------|--------------------|------------------------|-----------------------------|--------------------------|
| DM - HPMV Delays | Both | 2016 | - | RS | 101.51 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$238,421 |
| DM - HPMV Delays | Both | 2017 | - | RS | 104.56 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$245,574 |
| DM - HPMV Delays | Both | 2018 | - | RS | 107.61 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$252,727 |
| DM - HPMV Delays | Both | 2019 | - | RS | 110.65 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$259,879 |
| DM - HPMV Delays | Both | 2020 | - | RS | 113.70 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$267,032 |
| DM - HPMV Delays | Both | 2021 | - | RS | 116.74 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$274,185 |
| DM - HPMV Delays | Both | 2022 | - | RS | 119.79 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$281,337 |
| DM - HPMV Delays | Both | 2023 | - | RS | 122.83 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$288,490 |
| DM - HPMV Delays | Both | 2024 | - | RS | 125.88 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$295,642 |
| DM - HPMV Delays | Both | 2025 | - | RS | 128.92 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$302,795 |
| DM - HPMV Delays | Both | 2026 | - | RS | 131.97 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$309,948 |
| DM - HPMV Delays | Both | 2027 | - | RS | 135.01 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$317,100 |
| DM - HPMV Delays | Both | 2028 | - | RS | 138.06 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$324,253 |
| DM - HPMV Delays | Both | 2029 | - | RS | 141.11 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$331,406 |
| DM - HPMV Delays | Both | 2030 | - | RS | 144.15 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$338,558 |
| DM - HPMV Delays | Both | 2031 | - | RS | 147.20 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$345,711 |
| DM - HPMV Delays | Both | 2032 | - | RS | 150.24 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$352,864 |
| DM - HPMV Delays | Both | 2033 | - | RS | 153.29 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$360,016 |
| DM - HPMV Delays | Both | 2034 | - | RS | 156.33 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$367,169 |
| DM - HPMV Delays | Both | 2035 | - | RS | 159.38 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$374,322 |
| DM - HPMV Delays | Both | 2036 | - | RS | 162.42 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$381,474 |
| DM - HPMV Delays | Both | 2037 | - | RS | 165.47 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$388,627 |
| DM - HPMV Delays | Both | 2038 | - | RS | 168.51 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$395,779 |
| DM - HPMV Delays | Both | 2039 | - | RS | 171.56 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$402,932 |
| DM - HPMV Delays | Both | 2040 | - | RS | 174.61 | 2923.6200 | \$48.20 | \$0.00 | \$0.00 | \$410,085 |

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Additional VOC due to delays

Assumptions

- Additional VOC due to stops (Cents per speed change cycle), Table A5.41 of EEM
- Additional VOC due to waiting time (Cents per min), Table A5.23 of EEM

| Year | Total vehicle stops per day | Additional VOC | Total waiting time (min per day) | Additional VOC (c/min) | Days per year | Annual Cost |
|------|-----------------------------|----------------|----------------------------------|------------------------|---------------|-------------|
| 2016 | 245.9625 | 2.151 | 27.113 | 3 | 245 | \$ 1,495.49 |
| 2017 | 256.8875 | 2.151 | 28.539 | 3 | 245 | \$ 1,563.55 |
| 2018 | 268.765 | 2.151 | 30.145 | 3 | 245 | \$ 1,637.94 |
| 2019 | 282.611 | 2.151 | 32.123 | 3 | 245 | \$ 1,725.45 |
| 2020 | 296.457 | 2.151 | 34.101 | 3 | 245 | \$ 1,812.96 |
| 2021 | 310.303 | 2.151 | 36.079 | 3 | 245 | \$ 1,900.46 |
| 2022 | 324.149 | 2.151 | 38.057 | 3 | 245 | \$ 1,987.97 |
| 2023 | 337.995 | 2.151 | 40.035 | 3 | 245 | \$ 2,075.47 |
| 2024 | 351.841 | 2.151 | 42.013 | 3 | 245 | \$ 2,162.98 |
| 2025 | 365.687 | 2.151 | 43.991 | 3 | 245 | \$ 2,250.49 |
| 2026 | 379.533 | 2.151 | 45.969 | 3 | 245 | \$ 2,337.99 |
| 2027 | 393.379 | 2.151 | 47.947 | 3 | 245 | \$ 2,425.50 |
| 2028 | 407.225 | 2.151 | 49.925 | 3 | 245 | \$ 2,513.00 |
| 2029 | 422.4885 | 2.151 | 52.029 | 3 | 245 | \$ 2,608.91 |
| 2030 | 439.4395 | 2.151 | 54.283 | 3 | 245 | \$ 2,714.80 |
| 2031 | 456.3905 | 2.151 | 56.537 | 3 | 245 | \$ 2,820.70 |
| 2032 | 473.3415 | 2.151 | 58.791 | 3 | 245 | \$ 2,926.60 |
| 2033 | 490.2925 | 2.151 | 61.045 | 3 | 245 | \$ 3,032.50 |
| 2034 | 507.2435 | 2.151 | 63.299 | 3 | 245 | \$ 3,138.40 |
| 2035 | 524.1945 | 2.151 | 65.553 | 3 | 245 | \$ 3,244.29 |
| 2036 | 541.1455 | 2.151 | 67.807 | 3 | 245 | \$ 3,350.19 |
| 2037 | 558.0965 | 2.151 | 70.061 | 3 | 245 | \$ 3,456.09 |
| 2038 | 575.0475 | 2.151 | 72.315 | 3 | 245 | \$ 3,561.99 |
| 2039 | 591.9985 | 2.151 | 74.569 | 3 | 245 | \$ 3,667.88 |
| 2040 | 610.5695 | 2.151 | 76.958 | 3 | 245 | \$ 3,783.31 |

Additional VOC due to Detours

Assumptions

- 3 Bridge closure in last 5 years = 60% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed average detour is 89.3km, 70 min (=77km/h)
- VOC cost Table A5.9, 75km/h, 2% grade

| Year (1) | AADT (2) | % AADT affected (3) | P (Diversion) (4) | Number of Veh Diverted (5) = (2)x(3)x(4) | Additional Journey Distance (6) | VOC Cost, cents per km (7) | Annual Cost |
|-------------|-------------|------------------------|----------------------|--|---------------------------------------|----------------------------------|-------------|
| 2016 | 1,923 | 16.67% | 0.6000 | 192.30 | 89.3 | 33.3 | \$ 5,718.41 |
| 2017 | 1,969 | 16.67% | 0.6000 | 196.90 | 89.3 | 33.3 | \$ 5,855.20 |
| 2018 | 2,015 | 16.67% | 0.6000 | 201.50 | 89.3 | 33.3 | \$ 5,991.99 |
| 2019 | 2,061 | 16.67% | 0.6000 | 206.10 | 89.3 | 33.3 | \$ 6,128.78 |
| 2020 | 2,107 | 16.67% | 0.6000 | 210.70 | 89.3 | 33.3 | \$ 6,265.56 |
| 2021 | 2,153 | 16.67% | 0.6000 | 215.30 | 89.3 | 33.3 | \$ 6,402.35 |
| 2022 | 2,199 | 16.67% | 0.6000 | 219.90 | 89.3 | 33.3 | \$ 6,539.14 |
| 2023 | 2,245 | 16.67% | 0.6000 | 224.50 | 89.3 | 33.3 | \$ 6,675.93 |
| 2024 | 2,291 | 16.67% | 0.6000 | 229.10 | 89.3 | 33.3 | \$ 6,812.72 |
| 2025 | 2,337 | 16.67% | 0.6000 | 233.70 | 89.3 | 33.3 | \$ 6,949.51 |
| 2026 | 2,383 | 16.67% | 0.6000 | 238.30 | 89.3 | 33.3 | \$ 7,086.30 |
| 2027 | 2,429 | 16.67% | 0.6000 | 242.90 | 89.3 | 33.3 | \$ 7,223.09 |
| 2028 | 2,475 | 16.67% | 0.6000 | 247.50 | 89.3 | 33.3 | \$ 7,359.88 |
| 2029 | 2,521 | 16.67% | 0.6000 | 252.10 | 89.3 | 33.3 | \$ 7,496.67 |
| 2030 | 2,567 | 16.67% | 0.6000 | 256.70 | 89.3 | 33.3 | \$ 7,633.46 |
| 2031 | 2,613 | 16.67% | 0.6000 | 261.30 | 89.3 | 33.3 | \$ 7,770.25 |
| 2032 | 2,659 | 16.67% | 0.6000 | 265.90 | 89.3 | 33.3 | \$ 7,907.04 |
| 2033 | 2,705 | 16.67% | 0.6000 | 270.50 | 89.3 | 33.3 | \$ 8,043.83 |
| 2034 | 2,751 | 16.67% | 0.6000 | 275.10 | 89.3 | 33.3 | \$ 8,180.62 |
| 2035 | 2,797 | 16.67% | 0.6000 | 279.70 | 89.3 | 33.3 | \$ 8,317.41 |
| 2036 | 2,843 | 16.67% | 0.6000 | 284.30 | 89.3 | 33.3 | \$ 8,454.20 |
| 2037 | 2,889 | 16.67% | 0.6000 | 288.90 | 89.3 | 33.3 | \$ 8,590.99 |
| 2038 | 2,935 | 16.67% | 0.6000 | 293.50 | 89.3 | 33.3 | \$ 8,727.78 |
| 2039 | 2,981 | 16.67% | 0.6000 | 298.10 | 89.3 | 33.3 | \$ 8,864.57 |
| 2040 | 3,027 | 16.67% | 0.6000 | 302.70 | 89.3 | 33.3 | \$ 9,001.36 |

Worksheets A6: Accident cost savings



Worksheet A6.1 - Summary of accident costs

| | | | | | | |
|----|---|---|--------------|--------|--------------------------------|-------|
| 1 | Project name: | SH12 Matakoho Bridges RP185/10.87 to 14.31 | | | | |
| 2 | Historic accident period: | from | 2011 | to | 2015 | |
| 3 | Summary of accidents | | | | | |
| | Movement category | Number of injury accidents | | | Number of non-injury accidents | |
| | | Fatal | Serious | Minor | | |
| | Head on | - | 1 | 1 | 1 | |
| | Lost control off road | - | 2 | - | 3 | |
| | Manoeuvring | - | - | - | 2 | |
| | | - | - | - | - | |
| | | - | - | - | - | |
| | | - | - | - | - | |
| | | - | - | - | - | |
| | Total | 0 | 3 | 1 | 6 | |
| 4 | Description of likely causative factors: | Two single lane bridges, tortuous alignment | | | | |
| 5 | Description of project options & predicted accident savings | New two-lane bridges High standard realignment 975m of route shortening | | | | |
| 6 | Terrain type | Rolling | | | | |
| 7 | Traffic volume (time zero) | 1,923 | | | | |
| 8 | Traffic growth rate (time zero) | 2.4% | | | | |
| 9 | Length of project (km) | Do-minimum | 3.44 | | Option | 2.465 |
| 10 | Exposure (time zero) | 2414518.8 | | | 1730171.175 | |
| 11 | Injury accidents per year (time zero) | 0.8 | | | 0.28 | |
| 12 | Accident rate (time zero per 100M VKT) | 33.13 | | | 16.18 | |
| 13 | Typical accident rate (per 100M VKT) | 34 | | | 18 | |
| 14 | Summary of annual accident costs | | | | | |
| | Movement category | Do-minimum | | Option | | |
| | Head on | \$ | 616,533.96 | \$ | 127,359.62 | |
| | Loss of control (off road) | \$ | 620,849.11 | \$ | 308,103.81 | |
| | Crossing (turning) | \$ | 44,311.79 | \$ | 10,196.31 | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | | \$ | - | \$ | - | |
| | Total | \$ | 1,281,694.86 | \$ | 445,659.75 | |

The NZ Transport Agency's *Economic Evaluation Manual*
 First edition, Amendment 1
 Effective from 1 January 2016

Matakohe Bridges Crash History

| # | CRASH ROAD | CRASH DIST | CRASH DIRN | INTSN | SIDE ROAD | CRASH ID | CRASH DATE | CRASH DOW | CRASH TIME | MVMT | VEHICLES | CAUSES | OBJECTS STRUCK | ROAD CURVE | ROAD WET | LIGHT | WTHRa | JUNC TYPE | TRAF CTRL | ROAD MARK | SPD LIM | CRASH FATAL CNT | CRASH SEV CNT | CRASH MIN CNT | PERS AGE1 | PERS AGE2 | Proposed Crash Reduction | Reason |
|-----|---------------|------------|------------|-------|--------------------|-----------|------------|-----------|------------|------|----------|----------------|----------------|------------|----------|-------|-------|-----------|-----------|-----------|---------|-----------------|---------------|---------------|-----------|-----------|--------------------------|--------------------|
| 180 | 12/185/13.428 | 770 | E | | ARARUA ROAD | 201135826 | 17/05/2011 | Tue | 850 | BA | CE1C | 301A 341A | | R | W | ON | F | | G | N | 100 | 0 | 0 | 0 | | | 80 | 1-lane bridge gone |
| 175 | 12/185/12.158 | 270 | E | | MATAKOHE EAST ROAD | 201201872 | 8/03/2012 | Thu | 1607 | BA | VE14 | 301A | | R | D | ON | F | | G | C | 100 | 0 | 1 | 2 | | | 80 | 1-lane bridge gone |
| 176 | 12/185/12.258 | 400 | S | | ARARUA ROAD | 201416476 | 21/07/2014 | Mon | 1345 | BB | TS14 | 111A 123A 330A | | E | W | O | F | | | L | 100 | 0 | 0 | 2 | | | 80 | 1-lane bridge gone |
| 187 | 12/185/14.153 | 1000 | W | | PETLEY ROAD | 201203235 | 22/06/2012 | Fri | 1713 | DA | MW1 | 102A 131A | | M | W | DN | L | | N | C | 100 | 0 | 1 | 0 | | | 50 | Superior alignment |
| 170 | 12/185/11.458 | 1200 | S | | ARARUA ROAD | 201231254 | 2/01/2012 | Mon | 130 | DA | CN1 | 111A 131A | F | S | W | DN | L | | N | C | 100 | 0 | 0 | 0 | | | 50 | Superior alignment |
| 184 | 12/185/13.953 | 1200 | W | | PETLEY ROAD | 201234853 | 11/06/2012 | Mon | 813 | DB | TW1 | 137A 902 | V | M | W | BN | L | | N | C | 100 | 0 | 0 | 0 | | | 50 | Superior alignment |
| 183 | 12/185/13.783 | 1370 | W | | PETLEY ROAD | 201241440 | 29/11/2012 | Thu | 2130 | DB | CN1 | 135A 801 | E | M | W | DN | H | | N | C | 100 | 0 | 0 | 0 | | | 50 | Superior alignment |
| 182 | 12/185/13.748 | 1090 | E | | ARARUA ROAD | 201303353 | 3/02/2013 | Sun | 215 | DB | CW1 | 101A 131A | F | M | D | DN | F | | N | C | 100 | 0 | 1 | 0 | | | 50 | Superior alignment |
| 171 | 12/185/11.788 | 100 | W | | BARLOW LANE | 201436424 | 22/03/2014 | Sat | 1800 | MG | CN1T | 371B | | R | D | BN | F | | G | C | 100 | 0 | 0 | 0 | | | 80 | 1-lane bridge gone |
| 178 | 12/185/12.448 | 210 | W | | ARARUA ROAD | 201138138 | 18/06/2011 | Sat | 130 | MO | CW1 | 103A 129A 929 | V | E | W | DN | H | D | N | C | 100 | 0 | 0 | 0 | | | 5 | Improved Shoulders |

RELEASED UNDER THE OFFICIAL INFORMATION ACT

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Head on | Vehicle involvement | | | | Car, van, other |
|---|---------|---------------------|------------|----------|------------|-----------------|
| 1 Do-minimum mean speed | 70 | Road category | | | | RS |
| Posted speed limit | 100 | Traffic growth rate | | | | 2.4% |
| 2 Option mean speed | 100 | | | | | |
| Do-minimum | | Severity | | | | |
| | | Fatal | Serious | Minor | Non-injury | |
| 3 Number of years of typical accident rate records | | 5 | | | | |
| 4 Number of reported accidents over period | | 0 | 1 | 0 | 1 | |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.36 | 0.64 | 1.0 | 1.0 | |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0.36 | 0.64 | 0 | 1 | |
| 7 Accidents per year = (6) / (3) | | 0.072 | 0.128 | 0 | 0.2 | |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0.074592 | 0.132608 | 0 | 0.2072 | |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 | |
| 11 Total estimated accidents per year = (9) x (10) | | 0.074592 | 0.2519552 | 0 | 3.8332 | |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$5,700,000 | \$675,000 | \$37,000 | \$3,300 | |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$5,400,000 | \$650,000 | \$35,000 | \$2,700 | |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$5,520,000 | \$660,000 | \$35,800 | \$2,940 | |
| 16 Accident cost per year = (11) x (15) | | \$411,748 | \$166,290 | \$0 | \$11,270 | |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 589,307.88 | | | | |
| Option | | | | | | |
| 18 Percentage accident reduction | | 80% | | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 20% | | | | |
| 20 Predicted accidents per year (11) x (19) | | 0.0149184 | 0.05039104 | 0 | 0.76664 | |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$5,700,000 | \$675,000 | \$37,000 | \$3,300 | |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$5,400,000 | \$650,000 | \$35,000 | \$2,700 | |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$5,700,000 | \$675,000 | \$37,000 | \$3,300 | |
| 25 Accident cost per year = (20) x (24) | | \$85,035 | \$34,014 | \$0 | \$2,530 | |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 121,578.74 | | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 467,729.14 | | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Head on | Vehicle involvement | Truck | |
|---|--------------|---------------------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | |
| 2 Option mean speed | 100 | | | |
| Do-minimum | Severity | | | |
| | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | 5 | | | |
| 4 Number of reported accidents over period | 0 | 0 | 1 | 0 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | 0.36 | 0.64 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | 0 | 0 | 1 | 0 |
| 7 Accidents per year = (6) / (3) | 0 | 0 | 0.2 | 0 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | 0 | 0 | 0.2072 | 0 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | 0 | 0 | 0.9324 | 0 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | \$5,050,000 | \$550,000 | \$31,000 | \$10,300 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | \$4,150,000 | \$460,000 | \$28,000 | \$7,900 |
| 14 Mean speed adjustment - ((1) - 50)/50 | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | \$4,510,000 | \$496,000 | \$29,200 | \$8,860 |
| 16 Accident cost per year = (11) x (15) | \$0 | \$0 | \$27,226 | \$0 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | \$ 27,226.08 | | | |
| Option | | | | |
| 18 Percentage accident reduction | 80% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | 20% | | | |
| 20 Predicted accidents per year (11) x (19) | 0 | 0 | 0.18648 | 0 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | \$5,050,000 | \$550,000 | \$31,000 | \$10,300 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | \$4,150,000 | \$460,000 | \$28,000 | \$7,900 |
| 23 Mean speed adjustment - ((2) - 50)/50 | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | \$5,050,000 | \$550,000 | \$31,000 | \$10,300 |
| 25 Accident cost per year = (20) x (24) | \$0 | \$0 | \$5,781 | \$0 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | \$ 5,780.88 | | | |
| 27 Annual accident cost savings = (17) - (26) | \$ 21,445.20 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Lost control off road | Vehicle involvement | Car, van, other | | |
|---|-----------------------|---------------------|-----------------|------------|--|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | Severity | | | | |
| | Fatal | Serious | Minor | Non-injury | |
| 3 Number of years of typical accident rate records | 5 | | | | |
| 4 Number of reported accidents over period | 0 | 1 | 0 | 2 | |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | 0.13 | 0.87 | 1.0 | 1.0 | |
| 6 Number of reported accidents adjusted by severity (4) x (5) | 0.13 | 0.87 | 0 | 2 | |
| 7 Accidents per year = (6) / (3) | 0.026 | 0.174 | 0 | 0.4 | |
| 8 Adjustment factor for accident trend (table A6.1(a)) | 1.036 | | | | |
| 9 Adjusted accidents per year = (7) x (8) | 0.026936 | 0.180264 | 0 | 0.4144 | |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | 1 | 1.9 | 4.5 | 18.5 | |
| 11 Total estimated accidents per year = (9) x (10) | 0.026936 | 0.3425016 | 0 | 7.6664 | |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | \$4,700,000 | \$520,000 | \$29,000 | \$1,700 | |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | \$5,150,000 | \$525,000 | \$28,000 | \$1,700 | |
| 14 Mean speed adjustment - ((1) - 50)/50 | 0.4 | | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | \$4,970,000 | \$523,000 | \$28,400 | \$1,700 | |
| 16 Accident cost per year = (11) x (15) | \$133,872 | \$179,128 | \$0 | \$13,033 | |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | \$ | | | 326,033.14 | |
| Option | | | | | |
| 18 Percentage accident reduction | 50% | | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | 50% | | | | |
| 20 Predicted accidents per year (11) x (19) | 0.013468 | 0.1712508 | 0 | 3.8332 | |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | \$4,700,000 | \$520,000 | \$29,000 | \$1,700 | |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | \$5,150,000 | \$525,000 | \$28,000 | \$1,700 | |
| 23 Mean speed adjustment - ((2) - 50)/50 | 1 | | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | \$4,700,000 | \$520,000 | \$29,000 | \$1,700 | |
| 25 Accident cost per year = (20) x (24) | \$63,300 | \$89,050 | \$0 | \$6,516 | |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | \$ | | | 158,866.46 | |
| 27 Annual accident cost savings = (17) - (26) | \$ | | | 167,166.68 | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Lost control off road | Vehicle involvement | Motorcycle | | |
|---|-----------------------|---------------------|------------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | | Severity | | | |
| | | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | | 5 | | | |
| 4 Number of reported accidents over period | | 0 | 1 | 0 | 0 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.13 | 0.87 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0.13 | 0.87 | 0 | 0 |
| 7 Accidents per year = (6) / (3) | | 0.026 | 0.174 | 0 | 0 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0.026936 | 0.180264 | 0 | 0 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | | 0.026936 | 0.3425016 | 0 | 0 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$4,100,000 | \$455,000 | \$25,000 | \$1,800 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$4,200,000 | \$445,000 | \$24,000 | \$1,800 |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$4,160,000 | \$449,000 | \$24,400 | \$1,800 |
| 16 Accident cost per year = (11) x (15) | | \$112,054 | \$153,783 | \$0 | \$0 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 265,836.98 | | | |
| Option | | | | | |
| 18 Percentage accident reduction | | 50% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 50% | | | |
| 20 Predicted accidents per year (11) x (19) | | 0.013468 | 0.1712508 | 0 | 0 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$4,100,000 | \$455,000 | \$25,000 | \$1,800 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$4,200,000 | \$445,000 | \$24,000 | \$1,800 |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$4,100,000 | \$455,000 | \$25,000 | \$1,800 |
| 25 Accident cost per year = (20) x (24) | | \$55,219 | \$77,919 | \$0 | \$0 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 133,137.91 | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 132,699.06 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Lost control off road | Vehicle involvement | Truck | | |
|---|-----------------------|---------------------|-----------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | | Severity | | | |
| | | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | | 5 | | | |
| 4 Number of reported accidents over period | | 0 | 0 | 0 | 1 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.13 | 0.87 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0 | 0 | 0 | 1 |
| 7 Accidents per year = (6) / (3) | | 0 | 0 | 0 | 0.2 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0 | 0 | 0 | 0.2072 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | | 0 | 0 | 0 | 3.8332 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$4,300,000 | \$475,000 | \$26,000 | \$8,400 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$4,150,000 | \$505,000 | \$26,000 | \$7,000 |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$4,210,000 | \$493,000 | \$26,000 | \$7,560 |
| 16 Accident cost per year = (11) x (15) | | \$0 | \$0 | \$0 | \$28,979 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 28,978.99 | | | |
| Option | | | | | |
| 18 Percentage accident reduction | | 50% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 50% | | | |
| 20 Predicted accidents per year (11) x (19) | | 0 | 0 | 0 | 1.9166 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$4,300,000 | \$475,000 | \$26,000 | \$8,400 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$4,150,000 | \$505,000 | \$26,000 | \$7,000 |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$4,300,000 | \$475,000 | \$26,000 | \$8,400 |
| 25 Accident cost per year = (20) x (24) | | \$0 | \$0 | \$0 | \$16,099 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 16,099.44 | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 12,879.55 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Crossing, turning | Vehicle involvement | Truck | | |
|---|-------------------|---------------------|-----------|----------|------------|
| 1 Do-minimum mean speed | 70 | Road category | RS | | |
| Posted speed limit | 100 | Traffic growth rate | 2.4% | | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | | Severity | | | |
| | | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | | 5 | | | |
| 4 Number of reported accidents over period | | 0 | 0 | 0 | 1 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.16 | 0.84 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0 | 0 | 0 | 1 |
| 7 Accidents per year = (6) / (3) | | 0 | 0 | 0 | 0.2 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0 | 0 | 0 | 0.2072 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | | 0 | 0 | 0 | 3.8332 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$5,000,000 | \$485,000 | \$30,000 | \$10,000 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$4,150,000 | \$535,000 | \$27,000 | \$7,800 |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$4,490,000 | \$515,000 | \$28,200 | \$8,680 |
| 16 Accident cost per year = (11) x (15) | | \$0 | \$0 | \$0 | \$33,272 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 33,272.18 | | | |
| Option | | | | | |
| 18 Percentage accident reduction | | 80% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 20% | | | |
| 20 Predicted accidents per year (11) x (19) | | 0 | 0 | 0 | 0.76664 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$5,000,000 | \$485,000 | \$30,000 | \$10,000 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$4,150,000 | \$535,000 | \$27,000 | \$7,800 |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$5,000,000 | \$485,000 | \$30,000 | \$10,000 |
| 25 Accident cost per year = (20) x (24) | | \$0 | \$0 | \$0 | \$7,666 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 7,666.40 | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 25,605.78 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

SP3 General Road Improvements continued



Worksheet 6 - Accident cost savings

| Movement category | Crossing, turning | Vehicle involvement | | Car, van, other | |
|---|-------------------|---------------------|-----------|-----------------|------------|
| 1 Do-minimum mean speed | 70 | Road category | | RS | |
| Posted speed limit | 100 | Traffic growth rate | | 2.4% | |
| 2 Option mean speed | 100 | | | | |
| Do-minimum | | Severity | | | |
| | | Fatal | Serious | Minor | Non-injury |
| 3 Number of years of typical accident rate records | | 5 | | | |
| 4 Number of reported accidents over period | | 0 | 0 | 0 | 1 |
| 5 Fatal/serious severity ratio (tables A6.2(a) to (c)) | | 0.16 | 0.84 | 1.0 | 1.0 |
| 6 Number of reported accidents adjusted by severity (4) x (5) | | 0 | 0 | 0 | 1 |
| 7 Accidents per year = (6) / (3) | | 0 | 0 | 0 | 0.2 |
| 8 Adjustment factor for accident trend (table A6.1(a)) | | 1.036 | | | |
| 9 Adjusted accidents per year = (7) x (8) | | 0 | 0 | 0 | 0.2072 |
| 10 Under-reporting factors (tables A6.3(a) and (b)) | | 1 | 1.9 | 4.5 | 18.5 |
| 11 Total estimated accidents per year = (9) x (10) | | 0 | 0 | 0 | 3.8332 |
| 12 Accident cost, 100km/h limit (tables A6.4(e) to (h)) | | \$4,500,000 | \$575,000 | \$36,000 | \$3,300 |
| 13 Accident cost, 50km/h limit (tables A6.4(a) to (d)) | | \$4,800,000 | \$490,000 | \$30,000 | \$2,600 |
| 14 Mean speed adjustment - ((1) - 50)/50 | | 0.4 | | | |
| 15 Cost per accident = (13) + (14) x [(12) - (13)] | | \$4,680,000 | \$524,000 | \$32,400 | \$2,880 |
| 16 Accident cost per year = (11) x (15) | | \$0 | \$0 | \$0 | \$11,040 |
| 17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury) | | \$ 11,039.62 | | | |
| Option | | | | | |
| 18 Percentage accident reduction | | 80% | | | |
| 19 Percentage of accidents 'remaining' [100 - (18)] | | 20% | | | |
| 20 Predicted accidents per year (11) x (19) | | 0 | 0 | 0 | 0.76664 |
| 21 Accident cost, 100km/h limit (tables A6.21(e) to (h)) | | \$4,500,000 | \$575,000 | \$36,000 | \$3,300 |
| 22 Accident cost, 50km/h limit (tables A6.21(a) to (d)) | | \$4,800,000 | \$490,000 | \$30,000 | \$2,600 |
| 23 Mean speed adjustment - ((2) - 50)/50 | | 1 | | | |
| 24 Cost per accident = (22) + (23) x [(21) - (22)] | | \$4,500,000 | \$575,000 | \$36,000 | \$3,300 |
| 25 Accident cost per year = (20) x (24) | | \$0 | \$0 | \$0 | \$2,530 |
| 26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury) | | \$ 2,529.91 | | | |
| 27 Annual accident cost savings = (17) - (26) | | \$ 8,509.70 | | | |
| 28 PV accident cost savings = (27) x DF ^{AC} | | | | | |

Worksheets A6: Accident cost savings continued



Worksheet A6.4a - Accident rate analysis

| Option | Matakohe - Do-Min Detour Route Crashes | | |
|---|--|----------------------------|-------------|
| Posted speed limit | 100km/h near rural | Traffic growth rate | 2.4% |
| Road category | Rural Strategic | Time zero | Jul-15 |
| Accident prediction model | | | |
| 1 | Table used | | |
| 2 | Parameter b_0 | | |
| 3 | Parameter b_1 | | |
| 4 | Parameter b_2 | | |
| 5 | Lowest or side road AADT (Q_{minor}) | | |
| 6 | Highest or primary AADT (Q_{major}) | | 192.3 |
| 7 | Typical accident rate (accidents per year), A_T (formula from crash compendium) | | |
| Go to step 8 | | | |
| Exposure-based accident prediction equation | | | |
| 1a | Table used | | 3.1 |
| 2a | Coefficient b_0 ($/10^8$ veh-km or $/10^8$ vehicles) | Primary Collector, Winding | 34 |
| 3a | Cross section adjustment factor from crash compendium table 5 (1.0 for no adjustment) | | 1.12 |
| 4a | Adjusted coefficient (2a) x (3a) | | 38.08 |
| 5a | Exposure at time zero (10^8 veh-km or 10^8 vehicles) | | 0.000171724 |
| 7 | Typical accident rate (accidents per year), A_T (4a) x (5a) | | 0.006539246 |
| 8 | Accident trends factor for adjusting typical accident rate (appendix A6.5 method B) | | -0.02 |
| 9 | Adjustment factor for accident trend ($1 + (8) \times (\text{time zero year} - 2006)$) (appendix A6.5 B) | | 0.82 |
| 10 | Typical accident rate per year adjusted for accident trends, A_T (7) x (9) | | 0.005362182 |
| 11 | Cost per reported injury accident (table A6.5) | \$ | 570,000 |
| 12 | Total accident cost per year (10) x (11) | \$ | 3,056.44 |

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Network Resilience: Detour Calculations

Assumptions:-

- 3 Bridge closure in last 5 years = 60% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed Average Detour = 89.3km, 70 mins

| Year (1) | AADT (2) | % AADT affected (3) | P (Diversion) (4) | Number of Veh Diverted (5) = (2)x(3)x(4) | Additional Journey Time (6) |
|-------------|-------------|---------------------------|----------------------|--|-----------------------------------|
| 2016 | 1,923 | 16.67% | 0.6000 | 192.3000 | 70 |
| 2017 | 1,969 | 16.67% | 0.6000 | 196.9000 | 70 |
| 2018 | 2,015 | 16.67% | 0.6000 | 201.5000 | 70 |
| 2019 | 2,061 | 16.67% | 0.6000 | 206.1000 | 70 |
| 2020 | 2,107 | 16.67% | 0.6000 | 210.7000 | 70 |
| 2021 | 2,153 | 16.67% | 0.6000 | 215.3000 | 70 |
| 2022 | 2,199 | 16.67% | 0.6000 | 219.9000 | 70 |
| 2023 | 2,245 | 16.67% | 0.6000 | 224.5000 | 70 |
| 2024 | 2,291 | 16.67% | 0.6000 | 229.1000 | 70 |
| 2025 | 2,337 | 16.67% | 0.6000 | 233.7000 | 70 |
| 2026 | 2,383 | 16.67% | 0.6000 | 238.3000 | 70 |
| 2027 | 2,429 | 16.67% | 0.6000 | 242.9000 | 70 |
| 2028 | 2,475 | 16.67% | 0.6000 | 247.5000 | 70 |
| 2029 | 2,521 | 16.67% | 0.6000 | 252.1000 | 70 |
| 2030 | 2,567 | 16.67% | 0.6000 | 256.7000 | 70 |
| 2031 | 2,613 | 16.67% | 0.6000 | 261.3000 | 70 |
| 2032 | 2,659 | 16.67% | 0.6000 | 265.9000 | 70 |
| 2033 | 2,705 | 16.67% | 0.6000 | 270.5000 | 70 |
| 2034 | 2,751 | 16.67% | 0.6000 | 275.1000 | 70 |
| 2035 | 2,797 | 16.67% | 0.6000 | 279.7000 | 70 |
| 2036 | 2,843 | 16.67% | 0.6000 | 284.3000 | 70 |
| 2037 | 2,889 | 16.67% | 0.6000 | 288.9000 | 70 |
| 2038 | 2,935 | 16.67% | 0.6000 | 293.5000 | 70 |
| 2039 | 2,981 | 16.67% | 0.6000 | 298.1000 | 70 |
| 2040 | 3,027 | 16.67% | 0.6000 | 302.7000 | 70 |

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Network Resilience: HPMV Waiting Time

HPMV Waiting Time on SH1 if no HPMV route available

- Last 10 years = 40 closures (RS 261-319)
- Total Closure time = 487.27 Hours
- Average Closure time per year = 48.727 hours
- SH1 RP 292/6.23 AADT = 10928 with 10%HCV
- 1093 HCV per year, assumed 50 HPMV with 3% growth rate
- EEM TTC Costs, used \$20.1 for driver, \$28.1 for HCV2 = \$48.2

| | |
|------------------------|------------------|
| Delay p.a. | 48.727 |
| | 2.030291667 days |
| % AADT | 203.03% |
| HPMV (T ₀) | 50 |
| Tzero | 101.5145833 |
| Growth | 0.03 |

Network Resilience: Layer 2 Benefits

Figures from Network Resilience Business Case (Opus,2013)

- Layer 1 = Traditional EEM Benefits
- Layer 2 = Extended Benefits from wider economy effects
- Layer 2 Benefits were from 48 Hour Closure
- Layer 2 benefits peer reviewed by ASCARI Partners
- Recognising that link severances have wider effects, propose to use results from 2013 study

| | |
|-----------------|-----------------------------|
| Layer 1 Benefit | 63000000 |
| Layer 2 Benefit | 15800000 |
| % | 25.08% For 48 hour closures |
| Adjustment | 2.09% For 4 Hour Closure |

| | |
|---------------------|---------------|
| TTC Detour Benefits | \$ 117,638.76 |
| VOC Detour Benefits | \$ 26,087.11 |
| ACC Detour Benefits | \$ 38,291.05 |
| Layer 2 Benefits | \$ 3,804.06 |

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APPENDIX F. COST ESTIMATES

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Project Estimate - Form C

Northland One Lane Bridges Replacement - Matakahe

DBE

Detailed Business Case Estimate

| Item | Description | Base Estimate | Contingency | Funding Risk Contingency |
|---|---|---------------------|----------------------------|--------------------------|
| A | Nett Project Property Cost | 1,280,000 | 320,000 | 320,000 |
| B | Project Development Phase | | | |
| | - Consultancy Fees - NZTA Managed Costs | | | |
| | Total Project Development | Nil | Nil | Nil |
| C | Pre-implementation Phase | | | |
| | - Consultancy Fees - NZTA Managed Costs | | | |
| | Total Pre-implementation | 193,850 | 19,385 | 19,385 |
| D | Implementation Phase | | | |
| | Implementation Fees | | | |
| | - Consultancy Fees | 330,000 | | |
| | - NZTA Managed Costs | 100,000 | | |
| | - Construction Monitoring Fees | 800,000 | | |
| | Sub Total Base Implementation Fees | 1,230,000 | 246,000 | 123,000 |
| | Physical Works | | | |
| | 1 Environmental Compliance | 60,000 | 26,000 | 3,000 |
| | 2 Earthworks | 4,823,860 | 482,386 | 241,193 |
| | 3 Ground Improvements | 50,000 | 5,000 | 2,500 |
| | 4 Drainage | 80,600 | 8,060 | 4,030 |
| | 5 Pavement and Surfacing | 913,059 | 91,306 | 45,653 |
| | 6 Bridges | 12,025,000 | 1,202,500 | 601,250 |
| | 7 Retaining Walls and Fencing | 52,700 | 5,270 | 2,635 |
| 8 Traffic Services | 162,600 | 16,260 | 8,130 | |
| 9 Service Relocations | 0 | 300,000 | 45,000 | |
| 10 Landscaping | 46,400 | 4,640 | 2,320 | |
| 11 Traffic Management and Temporary Works | 25,000 | 2,500 | 1,250 | |
| 12 Preliminary and General | 2,704,338 | 270,434 | 135,217 | |
| 13 Extraordinary Construction Costs | | | 323,750 | |
| Sub Total Base Physical works | 20,943,557 | 2,414,356 | 1,415,928 | |
| Total for Implementation Phase | 22,173,557 | 2,660,356 | 1,538,928 | |
| E | Project Base Estimate (A+C+D) | 23,647,407 | | |
| F | Contingency (Assessed/Analysed) | (A+C+D) | 2,999,741 | |
| G | Project Expected Estimate (E+F) | | 26,647,147 | |
| | Nett Project Property Cost Expected Estimate | | 1,600,000 | |
| | Project Development Phase Expected Estimate | | Nil | |
| | Pre-implementation Phase Expected Estimate | | 213,235 | |
| | Implementation Phase Expected Estimate | | 24,833,912 | |
| H | Funding Risk Contingency (Assessed/Analysed) | (A+C+D) | | 1,878,313 |
| I | 95th percentile Project Estimate (G+H) | | | 28,525,460 |
| | Nett Project Property Cost 95th percentile Estimate | | | 1,920,000 |
| | Project Development Phase 95th percentile Estimate | | | Nil |
| | Pre-implementation Phase 95th percentile Estimate | | | 232,620 |
| | Implementation Phase 95th percentile Estimate | | | 28,787,196 |
| Date of Estimate | | 30/05/2016 | Cost Index (Qtr/Year) | |
| Estimate prepared by | | Naushaba Todd-Jones | Signed <i>N Todd-Jones</i> | |
| Estimate internal peer review by | | Chris Parker | Signed <i>Chris Parker</i> | |
| 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 B: Elemental Breakdown for Physical Works Form

Northland One Lane Bridges Replacement - Matakohe - Anderson's and Hardie's Bridges
Elemental Breakdown for Physical Works - Preferred Option - Option 11 (Shorter Bridges)

| Item | Description | Sub-Element Totals (\$) | Element Totals (\$) |
|------|--|-------------------------------|------------------------|
| | Project Development Phase Fees | | |
| | Project investigation fees | \$ - | \$ - |
| | Planning and consents | \$ 7,400.00 | \$ 7,400.00 |
| | Iwi consultation | \$ 7,900.00 | \$ 7,900.00 |
| | Designation and resource consent preparation and lodgement (including hearings) | \$ 4,000.00 | \$ 4,000.00 |
| | Fees (designation, environment court) | \$ - | \$ - |
| | Legal costs (including environment court) | \$ - | \$ - |
| | Mana Whenua, Waahi Tapu, Koiwi and Mauri fees and costs | \$ - | \$ - |
| | Reviews and audits | \$ - | \$ - |
| | Geotechnical elements | \$ 6,200.00 | \$ 6,200.00 |
| | Survey elements | \$ 30,100.00 | \$ 30,100.00 |
| | Public relations | \$ - | \$ - |
| | The consultant's input before contract award (D&C contracts only, include specimen design) | \$ 138,250.00 | \$ 138,250.00 |
| | Speed surveys | \$ - | \$ - |
| | Council costs/expenses | \$ - | \$ - |
| | Heritage costs | \$ - | \$ - |
| | Mitigation costs | \$ - | \$ - |
| | Supplementary investigation during the investigation phase | \$ - | \$ - |
| | | | \$ 193,850.00 |
| | Pre-implementation Phase Fees | | |
| | Design fees | \$ - | \$ - |
| | Mana Whenua, Waahi Tapu, Koiwi and Mauri fees and costs | \$ - | \$ - |
| | Professional fees (project management, risk management, value management, peer reviews) | \$ 159,000.00 | \$ 159,000.00 |
| | Geotechnical - Initial investigation | \$ 138,800.00 | \$ 138,800.00 |
| | Geotechnical - Supplementary investigation during the detailed design | \$ - | \$ - |
| | Legal fees | \$ - | \$ - |
| | Resource consent costs (including fees) | \$ - | \$ - |
| | Building consent costs | \$ - | \$ - |
| | Reviews and audits | \$ - | \$ - |
| | Public relations | \$ - | \$ - |
| | Contractor's detailed design (D&C contracts only) | \$ 800,000.00 | \$ 800,000.00 |
| | Advertising (radio, newspapers) | \$ - | \$ - |
| | Economic assessments | \$ - | \$ - |
| | Heritage costs | \$ - | \$ - |
| | Mitigation costs | \$ 60,000.00 | \$ 60,000.00 |
| | Land requirement plans | \$ 4,000.00 | \$ 4,000.00 |
| | | | \$ 1,161,800.00 |
| | Implementation Phase fees | | |
| | Consultant construction monitoring and contract administration fees | \$ 250,000.00 | \$ 250,000.00 |
| | Legal fees | \$ - | \$ - |
| | Iwi liaison (during construction) | \$ 50,000.00 | \$ 50,000.00 |
| | Regional council monitoring | \$ - | \$ - |
| | Archaeological fees | \$ - | \$ - |
| | Reviews and audits | \$ 7,500.00 | \$ 30,000.00 |
| | Public relations | \$ - | \$ - |
| | The consultant's input following contract award (D&C contracts only) | \$ 800,000.00 | \$ 800,000.00 |
| | Advertising (radio, newspapers) | \$ - | \$ - |
| | Newsletters (copying and delivery) | \$ - | \$ - |
| | Noise monitoring | \$ - | \$ - |
| | Addressing complaints | \$ - | \$ - |
| | Heritage costs | \$ - | \$ - |
| | Mitigation costs | \$ - | \$ - |
| | Geotechnical - Supplementary investigation during the construction phase | \$ - | \$ - |
| | NZTA Managed Costs | \$ 100,000.00 | \$ 100,000.00 |
| | Consent monitoring fees | \$ - | \$ - |
| | | | \$ 1,230,000.00 |

Appendix B: Elemental Breakdown for Physical Works Form

Northland One Lane Bridges Replacement - Matakoho - Anderson's and Hardie's Bridges
Elemental Breakdown for Physical Works - Preferred Option - Option 11 (Shorter Bridges)

| Item | Description | Sub-Element Totals (\$) | Element Totals (\$) |
|----------|---|-------------------------------|------------------------|
| 1 | Physical Works | | |
| | Environmental Compliance | \$ 60,000.00 | \$ 60,000.00 |
| 1.1 | Management of environmental compliance requirements | \$ - | \$ - |
| 1.2 | Preparation and management of compliance managements plans | \$ - | \$ - |
| 1.3 | Construct permanent erosion and sediment control measures, maintenance and monitoring | \$ - | \$ - |
| 1.4 | Noise attenuation | \$ - | \$ - |
| 1.5 | Stormwater treatment | \$ - | \$ - |
| 1.6 | Bunds | \$ - | \$ - |
| 1 | | | \$ 60,000.00 |
| 2 | Earthworks - Anderson's (W) and Hardie's (E) Bridges | | |
| 2.1 | Site clearance - greenfield such as small trees, shrubs, hedging etc. | \$ 20,000.00 | \$ 20,000.00 |
| 2.2 | Demolition - building demolition, structures, fences, retaining walls, utility services, stormwater pipe, manholes, cesspits, surfacing, kerbs, lights, signs, temporary works etc. | \$ - | \$ - |
| 2.3 | Temporary fencing | \$ 8.60 | \$ 26,660.00 |
| 2.4 | Topsoil stripping | \$ 2.00 | \$ 116,000.00 |
| 2.5 | Cut to fill | \$ 8.60 | \$ 258,000.00 |
| 2.6 | Cut to waste | \$ 9.00 | \$ 2,322,000.00 |
| 2.7 | Borrow to fill | \$ - | \$ - |
| 2.8 | Imported fill | \$ - | \$ - |
| 2.9 | Undercutting soft spots | \$ - | \$ - |
| 2.10 | Excavation in rock (state types) | \$ - | \$ - |
| 2.11 | Conditioning of cut and/or fill materials | \$ - | \$ - |
| 2.12 | Preloading, additional preload materials, settlement monitoring and removal of preload materials | \$ - | \$ - |
| 2.13 | Respreading topsoil | \$ 1.40 | \$ 81,200.00 |
| 2.14 | Imported topsoil | \$ 5.00 | \$ - |
| 2.15 | Reclamation works | \$ - | \$ - |
| 2.16 | Foreshore works | \$ - | \$ - |
| 2.17 | Temporary earthworks | \$ - | \$ - |
| 2.18 | Temporary haul roads | \$ - | \$ - |
| 2.19 | Construct, maintain & remove temporary sediment control measures, temporary sediment control ponds, including temporary hydroseeding, rock check dams, silt fencing | \$ 50.00 | \$ - |
| 2.20 | Dust control | \$ - | \$ - |
| 2.21 | Archaeological treatment/mitigation works | \$ - | \$ - |
| | Lifting bridge soffit level due to climate change from 3.1m to 3.3m | \$ - | \$ - |
| 2.22 | Embankments | \$ 2,000,000.00 | \$ 2,000,000.00 |
| 2 | | | \$ 4,823,860.00 |
| 3 | Ground Improvements | \$ 50,000.00 | \$ 50,000.00 |
| 3.1 | Site decontamination (removal/treatment of managed, contaminated, hazardous materials etc.) | \$ - | \$ - |
| 3.2 | Ground improvement (e.g. drainage blankets, wick drains geotextiles, stone columns, deep soil mixing) | \$ 15.00 | \$ - |
| 3.3 | Geotechnical monitoring (inclinometers, piezometers) | \$ - | \$ - |
| 3.4 | Dewatering bores, buttress drains | \$ - | \$ - |
| 3.5 | Temporary works associated with ground improvements | \$ - | \$ - |
| 3 | | | \$ 50,000.00 |

Appendix B: Elemental Breakdown for Physical Works Form

Northland One Lane Bridges Replacement - Matakohe - Anderson's and Hardie's Bridges
Elemental Breakdown for Physical Works - Preferred Option - Option 11 (Shorter Bridges)

| Item | Description | Sub-Element Totals (\$) | Element Totals (\$) |
|----------|--|-------------------------------|-------------------------|
| 4 | Drainage | | |
| 4.1 | Stormwater drainage, temporary stream diversion and culverts including headwalls, chambers and rip-rap | \$ - | \$ - |
| 4.2 | Kerb blocks, incl. subsoil | \$ 93.26 | \$ - |
| 4.3 | Single sump catchpit | \$ 1,618.64 | \$ - |
| 4.4 | Surface water channel | \$ - | \$ - |
| 4.5 | Erosion control | \$ 31.00 | \$ 80,600.00 |
| 4.6 | Flumes | \$ - | \$ - |
| 4.7 | Rain gardens | \$ - | \$ - |
| 4.8 | Permanent ponds | \$ - | \$ - |
| 4.9 | Wetlands | \$ - | \$ - |
| 4.10 | Grassed swales | \$ - | \$ - |
| 4.11 | Treatment devices | \$ - | \$ - |
| 4 | | | \$ 80,600.00 |
| 5 | Pavement and Surfacing | | |
| 5.1 | Subgrade stabilisation/improvement (aggregate, lime or cement) | \$ - | \$ - |
| 5.2 | Subgrade preparation and testing | \$ - | \$ - |
| 5.3 | Sub-basecourse including improvement (lime, cement) | \$ - | \$ - |
| 5.4 | Base course including improvement (lime, cement) | \$ 3.98 | \$ 107,460.00 |
| 5.5 | Base course | \$ 59.68 | \$ 644,544.00 |
| 5.6 | Surfacing (chip seal, asphaltic concrete, Stone Mastic Asphalt, deep lift asphalt, OGPA) | \$ 5.97 | \$ 161,055.00 |
| 5.7 | Upgrade existing carriageway(s) | \$ - | \$ - |
| 5.8 | Sawcutting | \$ - | \$ - |
| 5.9 | Joints | \$ - | \$ - |
| 5.10 | Conc. Footpath | \$ 49.55 | \$ - |
| 5 | | | \$ 913,059.00 |
| 6 | Bridges | | |
| 6.1 | Anderson's Bridge (55m) | \$ 65,000.00 | \$ 3,575,000.00 |
| 6.2 | Hardie's Bridge (130m) | \$ 65,000.00 | \$ 8,450,000.00 |
| 6.3 | Demolish existing structures | \$ - | \$ - |
| 6.4 | Temporary works in association with bridge construction (launching gantry, access platform) | \$ - | \$ - |
| 6.7 | Underpasses | \$ - | \$ - |
| 6.8 | Rip-rap scour protection to abutments | \$ - | \$ - |
| 6 | | | \$ 12,025,000.00 |
| 7 | Retaining Walls and Fencing | | |
| 7.1 | Timber-piled walling | \$ - | \$ - |
| 7.2 | Concrete-piled walling including ground anchors | \$ - | \$ - |
| 7.3 | Gabion walling | \$ - | \$ - |
| 7.4 | Crib walling | \$ - | \$ - |
| 7.5 | Mechanically stabilised earth (MSE) walling | \$ - | \$ - |
| 7.6 | Backfill behind retaining walls where the estimator is to consider the provisions included in the earthworks element and allow extra for special materials and/or placement requirements behind retaining walls) | \$ - | \$ - |
| 7.7 | Stone strong walling | \$ - | \$ - |
| 7.8 | Diaphragm walling | \$ - | \$ - |
| 7.9 | Precast concrete facing panels | \$ - | \$ - |
| 7.10 | Drainage in association with retaining walls | \$ - | \$ - |
| 7.11 | Temporary works associated with retaining walls | \$ - | \$ - |
| 7.12 | Fencing | \$ 17.00 | \$ 52,700.00 |
| 7.13 | Fencing gates | \$ - | \$ - |
| 7 | | | \$ 52,700.00 |

Appendix B: Elemental Breakdown for Physical Works Form

Northland One Lane Bridges Replacement - Matakohe - Anderson's and Hardie's Bridges
Elemental Breakdown for Physical Works - Preferred Option - Option 11 (Shorter Bridges)

| Item | Description | Sub-Element Totals (\$) | Element Totals (\$) |
|-----------|---|-------------------------------|------------------------|
| 8 | Traffic Services | | |
| 8.1 | Barrier (wire/concrete median barrier and verge barrier) | \$ 500.00 | \$ 20,000.00 |
| 8.2 | Pavement markings, pavement markers | \$ - | - |
| 8.3 | Road signs, gantries | \$ 800.00 | - |
| 8.4 | Traffic signals | \$ 800.00 | - |
| 8.5 | Marker posts | \$ 800.00 | - |
| 8.6 | Lighting | \$ 7,000.00 | \$ 49,000.00 |
| 8.7 | Emergency cross-overs and phones | \$ - | - |
| 8.8 | Variable Message Signs | \$ - | - |
| 8.9 | Intelligent Traffic Signals/ATMS | \$ - | - |
| 8.10 | Bus/cycleway green paint marking | \$ - | - |
| 8.11 | Guardrails | \$ 90.00 | \$ 79,200.00 |
| 8.12 | Leading and trailing end terminals | \$ 900.00 | \$ 14,400.00 |
| 8.13 | Crash cushions | \$ - | - |
| 8 | | | \$ 162,600.00 |
| 9 | Service Relocations | | |
| 9.1 | NZTA cost of all local authority and utility companies (after cost share) and contractor's on-costs | \$ - | - |
| 9.2 | Civil works associated with utility services such as trenching | \$ - | - |
| 9.3 | Temporary works associated with utility services | \$ - | - |
| 9 | | | \$ - |
| 10 | Landscaping & Urban Design | | |
| 10.1 | Landscaping (aesthetic and environmental) | \$ - | - |
| 10.2 | Grassing, hydroseeding, planting, revegetation, mulch | \$ 0.80 | \$ 46,400.00 |
| 10.3 | Architecture | \$ - | - |
| 10.4 | Fencing | \$ - | - |
| 10.5 | Streetscaping | \$ - | - |
| 10.6 | Land accommodation costs (also refer to project property cost funding) | \$ - | - |
| 10.7 | Footpaths and cycleway | \$ - | - |
| 10.8 | Building relocations | \$ - | - |
| 10.9 | Traffic islands | \$ - | - |
| 10.10 | Pram crossings with kerb and tactile pavers | \$ - | - |
| 10.11 | Urban design features to bridges, structures, barriers, retaining walls etc. | \$ - | - |
| 10 | | | \$ 46,400.00 |
| 11 | Traffic Management and Temporary Works | | |
| 11.1 | Temporary traffic diversions | \$ - | - |
| 11.2 | Traffic management physical works costs | \$ - | - |
| 11.3 | Temporary roads | \$ 25,000.00 | \$ 25,000.00 |
| 11 | | | \$ 25,000.00 |

Appendix B: Elemental Breakdown for Physical Works Form

Northland One Lane Bridges Replacement - Matakohe - Anderson's and Hardie's Bridges
Elemental Breakdown for Physical Works - Preferred Option - Option 11 (Shorter Bridges)

| Item | Description | Sub-Element Totals (\$) | Element Totals (\$) |
|----------------------|--|-------------------------------|-------------------------|
| 12 | Preliminary and General | | |
| 12.1 | Establishment, temporary accommodation, clean up, disestablishment and other site operating costs | \$ 250,000.00 | \$ 250,000.00 |
| 12.2 | Contractor's supervision, on site staffing, prescribed specialists and other time related costs | \$ 800,000.00 | \$ 800,000.00 |
| 12.3 | Insurances, bonds, warranties/guarantees, as-built requirement plans and other non time-related costs | \$ 150,000.00 | \$ 150,000.00 |
| 12.4 | Temporary works design and traffic management planning | \$ 50,000.00 | \$ 50,000.00 |
| 12.5 | Project plans, quality assurance, traffic management plans, environmental management plans, programming and reporting, consent fees, stakeholder management, health and safety, security management, contractor's escrow tender documents | \$ 727,168.76 | \$ 727,168.76 |
| 12.6 | Network maintenance | \$ - | \$ - |
| 12.7 | QA systems | \$ 727,168.76 | \$ 727,168.76 |
| 12.8 | Testing | \$ - | \$ - |
| 12 | | | \$ 2,704,337.52 |
| 13 | Extraordinary Construction Costs | | |
| 13.1 | Extraordinary costs may include special items such as rock avalanche cover, tunnels, rail bridges, rail level crossings, mine hazard mitigation i.e. this item is for significant non- roadway expenses. Note: This is not for miscellaneous items | | \$ - |
| 13 | | \$ 18,179,219.00 | \$ - |
| Base Estimate | | | \$ 23,529,206.52 |

| | | |
|---|---------------------|-----------------------------------|
| Date of Estimate | 30/05/2016 | Cost Index |
| Estimate prepared by | Naushaba Todd-Jones | Signed <i>Naushaba Todd-Jones</i> |
| Estimate internal peer review by | Chris Parker | Signed <i>Chris Parker</i> |
| Estimate external peer review by | | Signed |
| Estimate accepted by NZTA project manager | | Signed |

Note: These estimates are exclusive of Contingency, Funding Risk Contingency, Escalation and GST.

Risk Register

| Rank | RID | Risk Title | Description/ Cause/ Consequence | Risk Owner | Risk Owning Org | Date Raised (xx/xx/xxxx) | Risk Status | Phase | Established Controls | Current Exposure | | | Treatment Strategy | Residual (Target) Exposure | | | Commentary & Closure Statement | DO NOT USE IN RISK REGISTER ADDED TO CALCULATE FUNDING RISK (95% PERCENTILE) | | |
|------|-----|---|--|--------------------------------|-----------------|--------------------------|--------------|--------------------|----------------------|------------------|------------|------------|---|----------------------------|------------|------------|--------------------------------|---|-----------------------|------------------------------------|
| | | | | | | | | | | Conseq. | Likelihood | Risk Score | | Conseq. | Likelihood | Risk Score | | Percentage weight based on likelihood | OPTION RISK COST (\$) | OPTION Likelihood x Risk Cost (\$) |
| 3 | 1 | Matakohe: Preferred alignment | Description: There is an opportunity that the successful contractor identifies an alignment that is more beneficial financially and/or otherwise during / following RFT. Cause: The cause of the opportunity is not having a specified preferred alignment. Consequence: The consequence of the opportunity is that financial savings can be made. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Implementation | | Medium | Very High | 18 | Individual actions to be recorded in the Actions Register (Tab 4) | Medium | Very High | 18 | | 0.50 | -\$ 3,000,000 | -\$ 1,500,000 |
| 1 | 2 | Matakohe: Culverts | Description: There is an opportunity that the cut surplus can be reduced considerably. Cause: The cause of the opportunity is the introduction of culverts. Consequence: The consequence of the opportunity is that financial savings can be made. | Vivianne Tadros / Chris Parker | NZTA / Opus | 27/05/2016 | Live - Treat | Pre Implementation | | Very High | Very High | 25 | Liaise with the relevant authorities and confirm that culverts can be incorporated into the design. | Very High | Very High | 25 | | 0.75 | -\$ 3,000,000 | -\$ 2,250,000 |
| 2 | 3 | Matakohe: Limestone from cut to waste | Description: There is an opportunity that the cut to waste, which is expected to be limestone, can be sold. Cause: The cause of the opportunity is that the Limestone can be used as a fertilizer to local farming businesses. Consequence: The consequence of the opportunity is that a saving can be made on disposing of this material and a profit can be made from selling it. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Operation | | Very High | High | 24 | To be considered during the operation phase of the project. | Very High | High | 24 | | 0.50 | -\$ 1,500,000 | -\$ 750,000 |
| 8 | 4 | Matakohe: Preferred alignment | Description: There is a threat that the preferred alignment has not been confirmed. Cause: The cause of the threat is lack of timeframes to develop and select a well developed preferred option. Consequence: The consequence of the threat is that the principal's requirements are insufficiently defined and the contract is vulnerable to variation during construction phase. | Vivianne Tadros / Dave Heine | NZTA / Opus | 26/04/2016 | Live - Treat | Pre Implementation | | High | High | 21 | Prioritise design development activities. Employ highly experienced personnel to write and manage risk within the contract. | High | High | 21 | | 0.25 | \$ 200,000 | \$ 50,000 |
| 18 | 5 | Matakohe: Consents | Description: There is a threat that the necessary consents are not applied for and obtained in the necessary timeframes to start works in March 2017. Cause: The cause of the threat is that NRC & FNDC have not been engaged to date to check their understanding. Consequence: The consequence of the threat is programme extensions. | Vivianne Tadros | NZTA | 26/04/2016 | Live - Treat | Pre Implementation | | Medium | Medium | 15 | Consult with Regional and District Council as soon as possible. | Low | Low | 6 | | 0.25 | \$ 350,000 | \$ 87,500 |
| 2 | 6 | Matakohe: Geotechnical uncertainties | Description: There is a threat that the geotechnical engineering investigations to date have not uncovered all the issues on site. Cause: The cause of the threat is that the geotechnical investigation was not comprehensive enough to cover the site. Consequence: The consequence of the threat is that additional issues are uncovered at later stages of the project and incur additional costs in ground improvement/engineering solutions and cause delays in the project programme. | Vivianne Tadros | NZTA | 29/04/2016 | Draft | Implementation | | Very High | High | 24 | Organise a review additional geotechnical investigation to highlight any gaps and trying to bridge those gaps. | High | High | 21 | | 0.75 | \$ 700,000 | \$ 525,000 |
| 1 | 7 | Matakohe: Vertical Alignment | Description: There is a threat that the vertical alignment will result in very large cut and fill quantities. Cause: The cause of the threat is the terrain and ground conditions. Consequence: The consequence of the threat is that the volume of fill will increase. | Vivianne Tadros / Chris Parker | NZTA / Opus | 29/04/2016 | Live - Treat | Implementation | | Very High | Very High | 25 | Consider retaining options, (alternatively consider alternative alignment) | High | High | 21 | | 0.25 | \$ 100,000 | \$ 25,000 |
| 8 | 8 | Matakohe: Moving from longer vs. shorter lengths in Bridge Design | Description: There is a threat that the bridge(s) length(s) shortening will lead to further requirements for obtaining the Resource Consent (RC). Cause: The cause of the threat is that there will be additional engineering requirements and these will further encroach into the alluvial/marine environment (embankments). Consequence: The consequence of the threat is that additional requirements for RC and increased consultation times will lead to time risks and delays in the project start date of Mar 2017. | Vivianne Tadros / Chris Parker | NZTA / Opus | 29/04/2016 | Live - Treat | Pre Implementation | | High | High | 21 | Identify the requirements for the RC and begin the application process as early as possible. | Medium | High | 17 | | 0.50 | \$ 250,000 | \$ 125,000 |
| 14 | 9 | Matakohe: Moving from longer vs. shorter lengths in Bridge Design | Description: There is a threat that the bridge(s) length(s) shortening will be denied at the consenting stage. Cause: The cause of the threat is that there will be arguments against encroaching into the alluvial/marine environment (embankments). Consequence: The consequence of the threat is that the design will revert to the longer bridge design. | Vivianne Tadros / Chris Parker | NZTA / Opus | 29/04/2016 | Draft | Pre Implementation | | Very High | Low | 20 | Identify the requirements for the RC and begin the application process as early as possible. | Very High | Very Low | 13 | | 0.25 | \$ 9,000,000 | \$ 2,250,000 |

Risk Register

| Rank | RID | Risk Title | Description/ Cause/ Consequence | Risk Owner | Risk Owning Org | Date Raised (xx/xx/xxxx) | Risk Status | Phase | Established Controls | Current Exposure | | | Treatment Strategy | Residual (Target) Exposure | | | Commentary & Closure Statement | DO NOT USE IN RISK REGISTER ADDED TO CALCULATE FUNDING RISK (95% PERCENTILE) | | |
|------|-----|--|--|--------------------------------|-----------------|--------------------------|--------------|--------------------|----------------------|------------------|------------|------------|--|----------------------------|------------|------------|--------------------------------|---|-----------------------|------------------------------------|
| | | | | | | | | | | Consq. | Likelihood | Risk Score | | Consq. | Likelihood | Risk Score | | Percentage weight based on likelihood | OPTION RISK COST (\$) | OPTION Likelihood x Risk Cost (\$) |
| 8 | 10 | Matakohe: Archaeological concerns | Description: There is a threat that not enough work has been done in terms of addressing the archaeological concerns for the Matakohe (Archaeological Field Survey and liaising with Heritage NZ). Cause: The cause of the threat is that the Archaeological Records from Matakohe are not well documented. Consequence: The consequence of the threat is that Heritage NZ may require an Archaeological Authority to be in place prior work commencement leading to time risks and delays. | Vivianne Tadros / Chris Parker | NZTA / Opus | 29/04/2016 | Draft | Implementation | | High | High | 21 | Begin consultation with Heritage NZ and begin process of obtaining an Archaeological Authority | Medium | Medium | 15 | | 0.50 | \$ 400,000 | \$ 200,000 |
| 8 | 11 | Matakohe: Surplus land disposal | Description: There is a threat that there will be difficulty in disposing of the surplus land. Cause: The cause of the threat is that the land has to be acquired for the construction of the new alignment. Consequence: The consequence of the threat is that the surplus land is unable to be sold at the purchase price. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Implementation | | High | High | 21 | | High | High | 21 | | 0.50 | \$ 500,000 | \$ 250,000 |
| 8 | 12 | Matakohe: Surplus material from cut to fill | Description: There is a threat that there will be a large volume of surplus material from cut to fill that is unable to be taken somewhere locally. Cause: The cause of the threat is the earthworks required for the alignment and bridges and the terrain and ground conditions. Consequence: The consequence of the threat is that there will be financial premium on the disposal cost on top of the transfer cost. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Implementation | | High | High | 21 | | High | High | 21 | | 0.25 | \$ 300,000 | \$ 75,000 |
| 2 | 13 | Matakohe: Fate of the old bridges | Description: There is a threat associated with the transference of the maintenance of the old bridges. Cause: The cause of the threat is the condition of the old bridges. Consequence: The consequence of the threat is that there maybe some cost implications with the transference / demolition / upgrading of the bridges. | Vivianne Tadros | NZTA | 27/05/2016 | Live - Treat | Pre Implementation | | Very High | High | 24 | Meeting with Kaipara District Council to negotiate the fate of the old bridges | Low | Low | 6 | | 0.25 | \$ 150,000 | \$ 37,500 |
| 2 | 14 | Matakohe: Impact on residential property | Description: There is a threat that the residential property north of the big cut for Hardie's bridge will be negatively impacted. Cause: The cause of the threat is the earthworks required for the alignment. Consequence: The consequence of the threat is that the owner may caused delays in the planning process and the property may be required to be purchased. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Pre Implementation | | Very High | High | 24 | Begin consultation with the owner as to the planned works | High | High | 21 | | 0.50 | \$ 450,000 | \$ 225,000 |
| 14 | 15 | Matakohe: Access to the Kauri Museum | Description: There is a threat that access to the Kauri Museum has not been sufficiently addressed. Cause: The cause of the threat is that the access to the museum is on the old alignment. Consequence: The consequence of the threat is that either further engineering works will be required or the old Anderson's bridge will be required to be upgraded. | Vivianne Tadros | NZTA | 27/05/2016 | Live - Treat | Pre Implementation | | Very High | Low | 20 | Meeting with Kaipara District Council to discuss the requirements to the access to the museum | High | Low | 16 | | 0.75 | \$ 970,000 | \$ 727,500 |
| 5 | 16 | Matakohe: Upgrading old roads and inetrsections | Description: There is a threat that upgrading / tying in to the new alignment has not been sufficiently addressed for the old roads and intersections. Cause: The cause of the threat is that the new alignment does not follow the old. Consequence: The consequence of the threat is that additional resources and time will be reired and can result in programme delay. | Vivianne Tadros | NZTA | 27/05/2016 | Live - Treat | Pre Implementation | | Very High | Medium | 23 | Meeting with Kaipara District Council to discuss the requirements | High | Medium | 19 | | 0.50 | \$ 200,000 | \$ 100,000 |
| 16 | 17 | Matakohe: Loss of income for Kauri Museum | Description: There is a threat that the Kauri Museum will suffer a loss of income during the construction phase of the project. Cause: The cause of the threat is the construction work and associated controls, diversions, etc. Consequence: The consequence of the threat is that the Kauri Museum may need to be compensated for the loss of income. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Operation | | High | Medium | 19 | Begin consultation with the Kauri Museum | High | Medium | 19 | | 0.75 | \$ 25,000 | \$ 18,750 |
| 5 | 18 | Matakohe: Orchards in the vicinity of the construction works | Description: There is a threat that the construction works will have a negative effect on the orchards (x3) in the vicinity of the works. Cause: The cause of the threat is the generation of dust, vehicular and machinery exhaust fumes. Consequence: The consequence of the threat is that the orchard owners may have to be compensated for the loss of income due to crop failure. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Operation | | Very High | Medium | 23 | Begin consultation with the owners and see what controls can be placed on the works | High | Medium | 19 | | 0.50 | \$ 90,000 | \$ 45,000 |

Risk Register

| Rank | RID | Risk Title | Description/ Cause/ Consequence | Risk Owner | Risk Owning Org | Date Raised (xx/xx/xxxx) | Risk Status | Phase | Established Controls | Current Exposure | | | Treatment Strategy | Residual (Target) Exposure | | | Commentary & Closure Statement | DO NOT USE IN RISK REGISTER ADDED TO CALCULATE FUNDING RISK (95% PERCENTILE) | | |
|------|-----|--|---|--------------------------------|-----------------|--------------------------|-------------|--------------------|----------------------|------------------|------------|------------|---|----------------------------|------------|------------|--------------------------------|---|-----------------------|------------------------------------|
| | | | | | | | | | | Consq. | Likelihood | Risk Score | | Consq. | Likelihood | Risk Score | | Percentage weight based on likelihood | OPTION RISK COST (\$) | OPTION Likelihood x Risk Cost (\$) |
| 8 | 19 | Matakohe: Accidental contamination of the estuary | Description: There is a threat that there could be some accidental contamination of the estuary during the construction works despite of the environmental controls in place. Cause: The cause of the threat is the nature of the construction activities and human error. Consequence: The consequence of the threat is that the possibility of fines and costs for clean up. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Operation | | High | High | 21 | Ensure that sufficient controls are in place, all the staff are fully competent and trained in their respective fields and Environmental, Health & Safety aspects, including Behaviour Based Safety to minimise human error | Medium | Medium | 15 | | 0.50 | \$ 50,000 | \$ 25,000 |
| 16 | 20 | Matakohe: Endangered flora and fauna in the vicinity of the works | Description: There is a threat that the Ecological Desktop Assessment has not picked up some of the flora and fauna that may be found on this site. Cause: The cause of the threat is the presence of protected and / or endangered flora and fauna in the habitats across the project site. Consequence: The consequence of the threat is that there may be time delays and cost implications in dealing with these aspects leading to Project Programme delays. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Pre Implementation | | High | Medium | 19 | Organise Ecological Site Survey as soon as possible | High | Medium | 19 | | 0.50 | \$ 35,000 | \$ 17,500 |
| 5 | 21 | Matakohe: Stormwater treatment | Description: There is a threat that stormwater treatment has not been considered sufficiently at this stage of the project. Cause: The cause of the threat is the requirement of stormwater treatment prior entry into the estuary. Consequence: The consequence of the threat is that further time resources may be needed to be deployed to sufficiently address this issue and lead to time and cost implications. | Vivianne Tadros | NZTA | 27/05/2016 | Draft | Implementation | | Very High | Medium | 23 | Engage the design team to address this issue | Very High | Medium | 23 | | 1.00 | \$ 40,000 | \$ 40,000 |
| | 22 | Matakohe: Option 12 | Description: There is a threat that Option 12 becomes an option to be seriously considered. Cause: The cause of the threat is that Option 12 has been raised and therefore been asked to be considered again in the light of the new options (of shorter bridges). Consequence: The consequence of the threat is that considering it will lead to time and resource delays when it is an inferior alignment due to the unavailability of a functional diversion to the SH during the construction phase. | Vivianne Tadros / Chris Parker | NZTA / Opus | 2/05/2016 | Rejected | Pre Implementation | | High | Low | 16 | Compared with the other options and is found to be an inferior alignment | Very Low | Very Low | 1 | | 0.00 | \$ - | \$ - |
| | 22 | Matakohe: Option 10 | Description: There is a threat that the Southern option becomes an option to be seriously considered. Cause: The cause of the threat is that the Southern Option has been raised and therefore been asked to be considered again in the light of the new options (of shorter bridges). Consequence: The consequence of the threat is that it may be rejected by the Consenting Authority as a non-viable option due to the availability of other options and the bridge's proximity to the estuary within this option, leading to time risks and delays. | Vivianne Tadros / Chris Parker | NZTA / Opus | 02/05/2016 | Rejected | Pre Implementation | | Medium | Low | 11 | Compared with the other options and is found to be an inferior alignment | Very Low | Very Low | 1 | | 0.00 | \$ - | \$ - |
| | | | | | | | | | | | | | | | | | | | \$ 6,310,000 | \$ 323,750 |

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