NOTE ON THE MELLING TRANSPORT IMPROVEMENTS SINGLE STAGE BUSINESS CASE

November 2020

The Single Stage Business Case (SSBC) for the Melling Transport Improvements in Lower Hutt was prepared during 2018/19 and finalised in November 2019.

A SSBC combines a project's Indicative Business Case and Detailed Business Case. It confirms the preferred option and includes a more detailed analysis of the project and its risks, benefits and opportunities.

The SSBC for the Melling Transport Improvements was prepared on the basis that the project would be funded through the National Land Transport Programme, with construction expected to begin after 2028.

In January 2020, after completion of this SSBC, the government announced the NZ Upgrade Programme which included funding to deliver the Melling Transport Improvements. This alters the funding and timing considerations within the SSBC.

Funding

The NZ Upgrade Programme provides $258m to fully fund delivery of the Melling Transport Improvements; including:

- A new grade-separated SH2 Melling interchange,
- A new Melling Bridge over Te Awakairangi Hutt River
- Relocating the Melling train station and its park and ride facilities,
- Improved walking and cycling paths.

The NZ Upgrade Programme funding replaces the funding and cost-sharing arrangements that were documented in the SSBC.

The SSBC signalled joint funding for parts of the project (including the Hutt River Bridge), with costs to be shared by Hutt City Council and Greater Wellington Regional Council. These components will instead be fully funded through the NZ Upgrade Programme.

Timing

Funding through the NZ Upgrade Programme also means construction can start in late 2022.

The SSBC noted that construction was expected to begin after 2028, once other components of RiverLink had been completed. This expectation has now been superseded, as the NZ Upgrade Programme funding provides for construction to begin in late 2022.

Next steps

The project expects to jointly seek consents and approvals within a package of applications for the RiverLink group of projects. We expect to lodge these applications in early 2021.

As part of the consenting stage, updated designs for all the RiverLink projects, including the Melling Transport Improvements, will be shared with the community in late 2020. These designs will reflect further development of the preferred option signalled in the SSBC.

RiverLink is a partnership between Waka Kotahi NZ Transport Agency, Greater Wellington Regional Council and Hutt City Council, working together with mana whenua Taranaki Whānui ki te Upoko o te Ika and Ngāti Toa Rangatira.

More information on RiverLink can be found at riverlink.co.nz

More information on the NZ Upgrade Programme can be found at nzta.govt.nz/nzupgrade

MELLING TRANSPORT IMPROVEMENTS SSBC

PREPARED FOR NZ TRANSPORT AGENCY

September 2019

Stantec

QUALITY STATEMENT

PROJECT MANAGER

Section 9(2)(a) [redacted]

PROJECT TECHNICAL LEAD

Section 9(2)(a) [redacted]

PREPARED BY

Section 9(2)(a) [redacted] ..../...../.....

CHECKED BY

Section 9(2)(a) [redacted] ..../...../.....

REVIEWED BY

Section 9(2)(a) [redacted] ..../...../.....

APPROVED FOR ISSUE BY

Section 9(2)(a) [redacted] ..../...../.....

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REVISION SCHEDULE

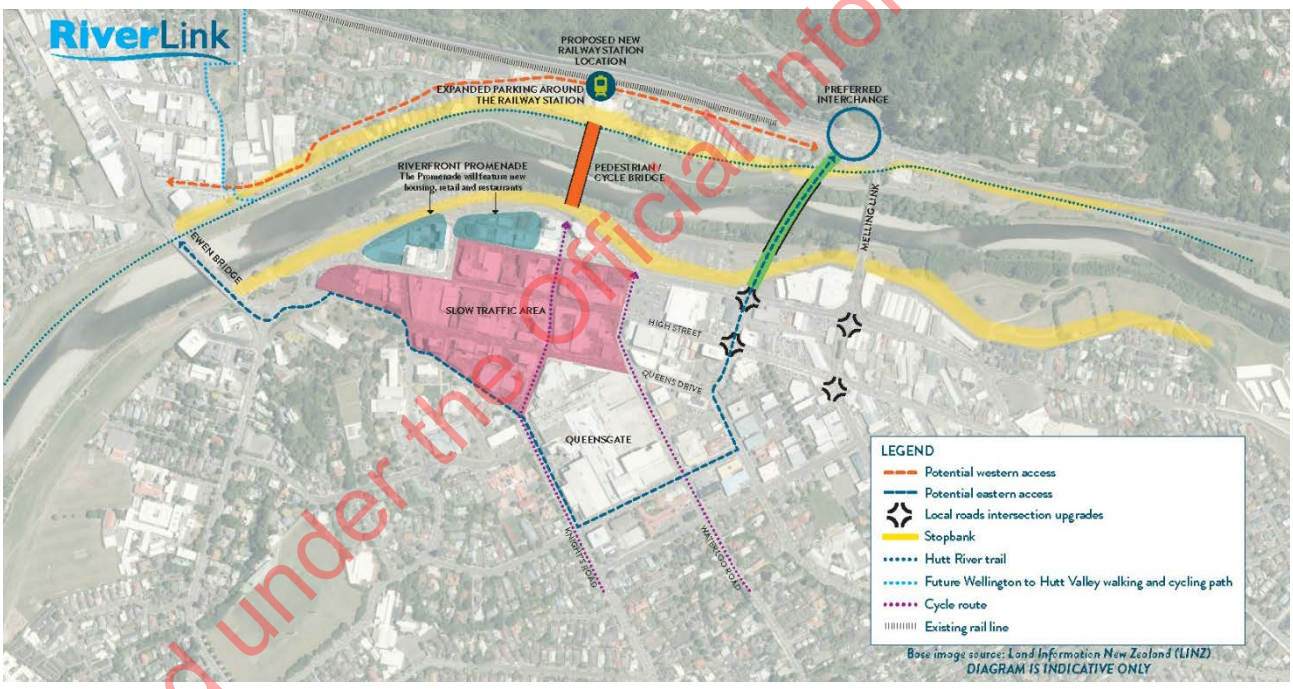
Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
1	28/6/18	Draft front end for internal review	Section 9(2)(a) [redacted]	Section 9(2)(a) [redacted]		
2	29/6/18	Draft front end for client review				
3	16/8/19	Draft Part A and B for client review				
4	06/9/19	Draft Part A, B and C			Section 9(2)(a) [redacted]	
5	13/9/19	Cost Estimate updated & Exec Sum included				
6	27/11/19	After NZ Transport Agency and Partner feedback				Section 9(2)(a) [redacted]

Executive Summary

Context

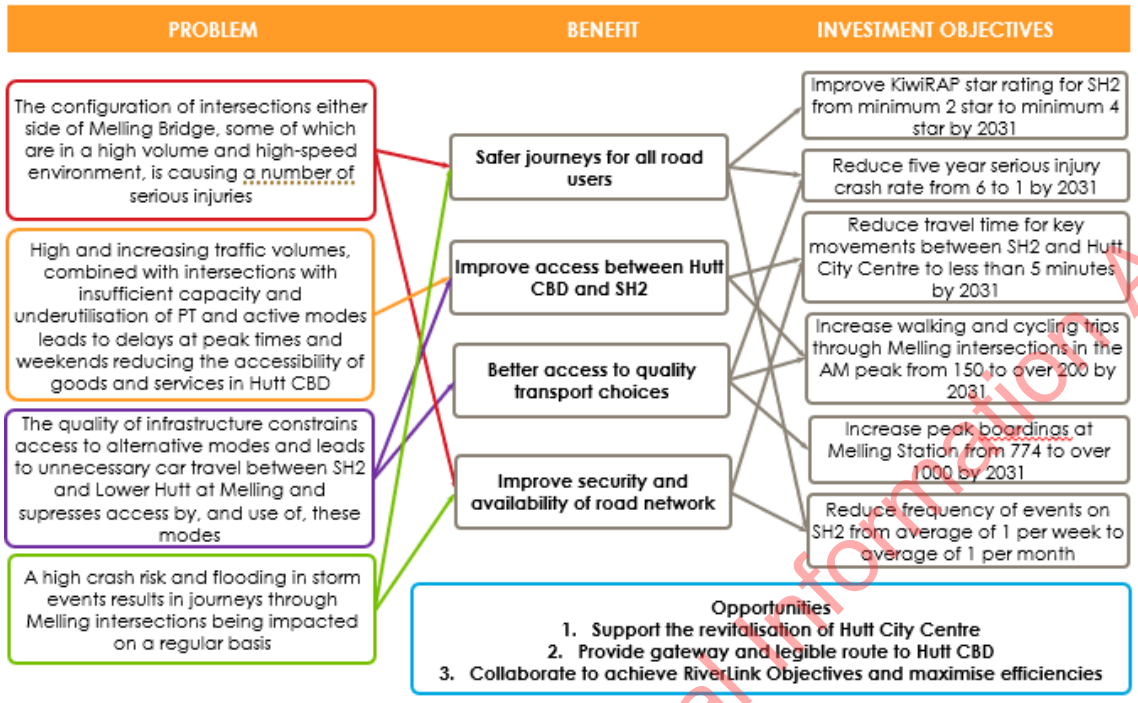
The Melling Transport Improvements project is a fundamental element of two overarching Programme Business Cases (PBC), SH2: Ngauranga to Te Marua (2016) and Melling Gateway (RiverLink) (2015). The SH2 PBC recommended programme aimed to increase rail patronage and reduce commuter traffic on SH2, with Melling Intersection Improvements identified as necessary in the early/short term phases of programme delivery to address safety and access to Hutt City Centre. The RiverLink PBC aimed to deliver on three areas: improved protection from Hutt River flood events; better access to Hutt City Centre and the railway station by all modes; and, improved liveability and quality of life for people working and living in Hutt City Centre. The grade separation of the SH2 Melling intersection was recommended as a short-term activity to complement the flood protection works, improve safety and reliability, and to provide the catalyst for revitalisation of Hutt City Centre through HCC's Making Places plan.

The NZ Transport Agency has been working closely with their two RiverLink partners, Greater Wellington Regional Council (GWRC) and Hutt City Council (HCC), both of which are working on turning the RiverLink programme into reality. GWRC is proposing to spend $125m improving Hutt River flood protection, while HCC is proposing to spend $59m to implement the 'Making Places' regeneration and growth plan for Lower Hutt (now encompassed by the City Centre Transformation Plan 2019).



Problems, Benefits, Opportunities and Investment Objectives

The problem statements and benefits for this business case were derived from stakeholder workshops and the two preceeding PBCs.

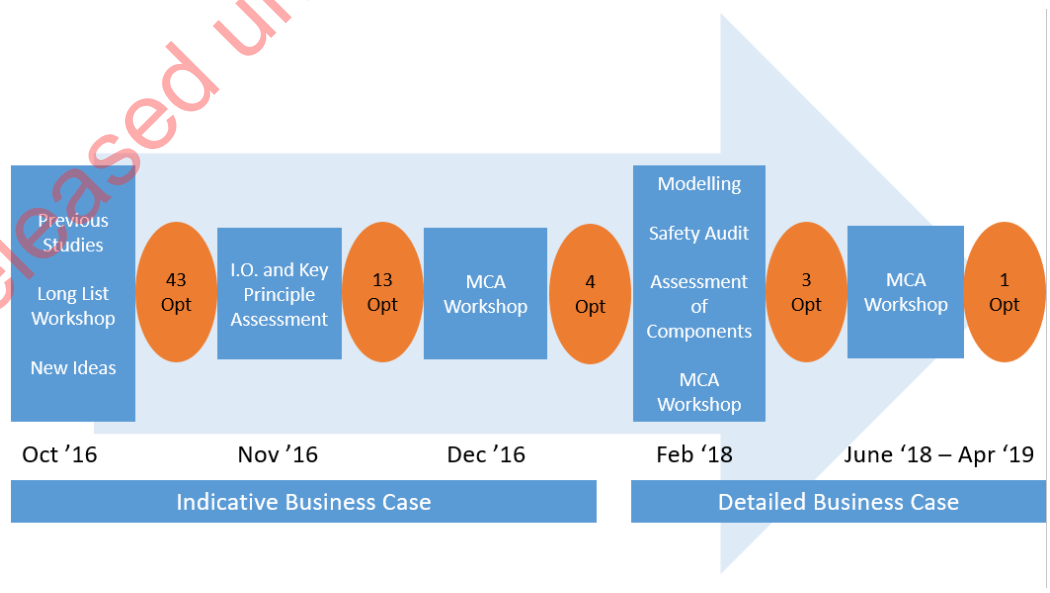


Option Development and Assessment

In addition to the problems and investment objectives, the following key principles were developed with key stakeholders to ensure any investment was appropriately focussed on wider outcomes:

- Traffic to connect into edge of Hutt City Centre
- All routes for all modes should be legible and all existing connectivity retained
- Full pedestrian and cycle connectivity
- Retain the ability to extend the Melling rail line further north
- Permit the flood protection works for a 2800 cumec flood (1-in-440 year return period) including the predicted effects of climate change to 2120.
- Clearly define Melling as the Gateway to the Hutt City Centre

The figure below shows the progression of option development and refinement throughout this project

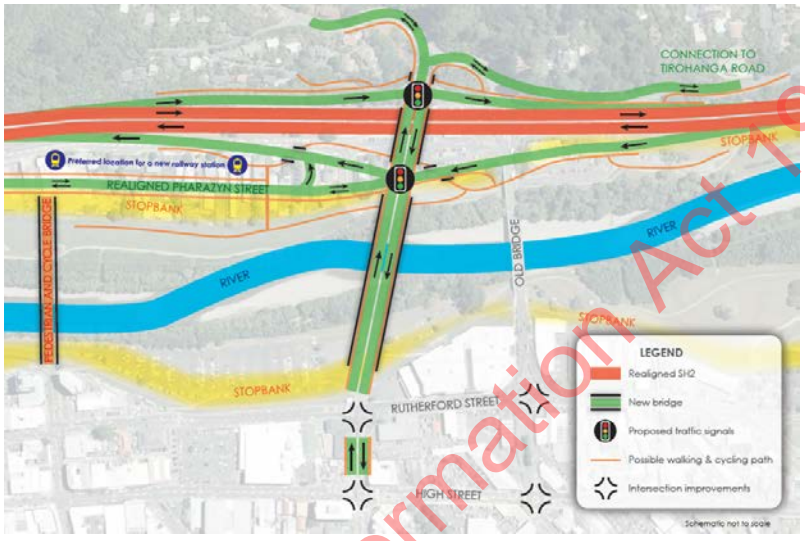


Option Shortlist

The final MCA workshop debated three shortlisted options for a grade separated SH2 diamond interchange with a new bridge connecting to Hutt City Centre. These options were:

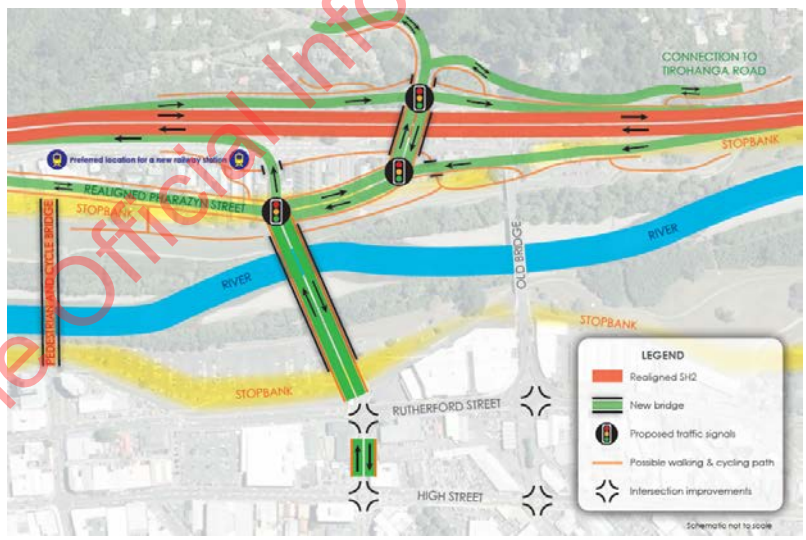
QUEENS DIRECT:

- Direct gateway entrance to Hutt City Centre with a new bridge connecting at Queens Drive.
- Requires only two signalised intersections at the interchange.



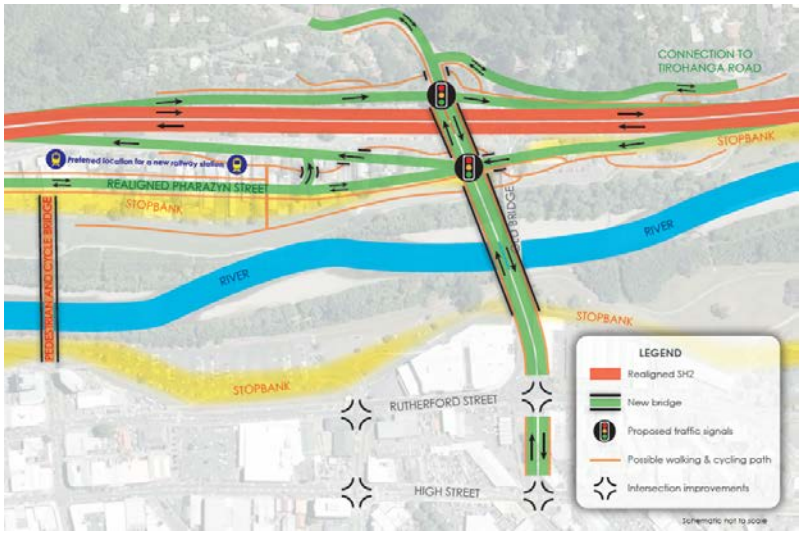
QUEENS INDIRECT:

- Indirect gateway entrance to Hutt City Centre with a new bridge connecting at Queens Drive.
- Has three signalised intersections at the interchange.
- Separates SH2 southbound on-ramp from the interchange.



MELLING DIRECT:

- A new bridge connects to Melling Link
- Requires only two signalised intersections at the interchange



The three options were publicly consulted on during May and June 2018, with Queens Direct the most popular option of the three. Following the public consultation, a third and final multi criteria analysis (MCA) workshop was held with the key stakeholders, which through considering around a dozen different criteria, also determined that Queens Direct was the recommended option. There were many key positive attributes for this option, including;

- An opportunity to improve flooding resilience by reducing the floodway constriction created by the existing Melling Link Bridge location.
- A direct gateway entrance to Hutt City which better defined the desired edge of the city centre.
- Better gateway alignment than existing situation with the desired edge of the city centre, the proposed Eastern Accessway route around the city centre[1] and other local roads.
- Better access than existing situation to a relocated Melling Station and therefore better public transport mode integration.
- Provides good walking and cycling connections into Hutt City Centre.

Recommended Option Assessment

The Queens Direct option performs well against all five investment objectives and provides numerous multi-modal benefits across all transport user modes. When assessed against One Network Road Classification criteria, again Queens Direct performs well and achieves the desired levels of service.

The total expected cost is $237M yielding a BCR of 1.7.

The Melling Transport Improvements achieves a VERY HIGH alignment under the State Highway Improvements Activity Class. Safety achieved a VERY HIGH rating due to the expected reduction in death and serious injury crashes with the recommended option. Access (Thriving Regions) achieved a HIGH rating as the SH2 corridor (and hence the local roads that feed onto it) would be impeded less often by crashes and localised flooding events, whilst also reducing travel times for commuters and freight. Access (Liveable Cities) achieved a HIGH rating as the project supports high priority elements in agreed integrated land use and multi-modal plans: HCC Making Places Plan, Urban Growth Strategy and Central City Transformation Plan as well as the RiverLink PBC and SH2 PBC.

The recommended option also enables the RiverLink programme to deliver resilience to natural hazard outcomes that are not part of the Melling assessment framework. Specifically, this is protecting against a predicted $1.1B of direct damages (and an equivalent amount in intangible damages) resulting from a flood hazard failure event at the constriction point within the floodway created by the under capacity of the existing Melling Bridge.

Readiness and Assurance

Funding

In recognition of the inter-relationships between the different elements of the RiverLink programme and the fact that many of the elements contribute to different organisational goals, cost sharing principles have been developed. These state that if the benefits of delivering a component of RiverLink align to only one organisation then the costs would fall to that organisation, and where benefits of a component align to more than one party the costs are shared between those parties. This model provides flexibility and fairness for the allocation of costs across the three agencies involved.

The table below outlines how the cost of the different RiverLink elements, including the Melling Transport Improvements could be distributed according to these funding principles. It is noted that this funding split has not been endorsed by the project partners and it is just one of several scenarios that have been considered.

Further discussion on cost sharing is currently underway.

[1] The existing western access route along Daly Street is removed due to the location of the new stop banks, placing greater importance on the function of the eastern accessway route

Section 9(2)(j)

[redacted]

It is noted that there is currently only very limited funding available within the State Highway Improvement activity class. Early in 2019, the Transport Agency announced their decision that implementation of the Melling Transport Improvement projects would be considered after 2028.

Next Phase

The NZ Transport Agency have recently announced that they are funding the consenting of the Melling transport improvement project alongside RiverLink.

Once the designation of the project is confirmed, it opens up the Agency to having to purchase properties under the designation. Section 9(2)(j) [redacted]

Other pre-implementation activities, such as detailed design, should be considered once funding for the implementation is programmed.

[2] Includes an allowance for cost recovery of selling unneeded property

[3] It is noted that funding a new bridge is not within GWRC's statutory responsibilities. However, GWRC may contribute to enable the bridge to proceed via, for example, gifting property.

NZ Transport Agency

Melling Transport Improvements Melling Transport Improvements SSBCase

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PART A – THE CASE FOR THE PROJECT

1. Introduction

The Melling Transport Improvements is a package of work that emerged from two overarching programmes:

- SH2: Ngauranga to Te Marua Programme Business Case (2016) – this programme was focussed on multi-modal inter-regional connections. The recommended programme includes projects to increase rail patronage and reduce commuter traffic on State Highway 2 (SH2) by improving rail services on the Hutt Valley and Wairarapa lines and enhancing park and ride opportunities at stations in the Hutt Valley. Melling Intersection Improvements was identified as being required in the early/short term phases of programme delivery to address safety and access to Hutt City Centre.
- Melling Gateway (RiverLink) Programme Business Case (2015) – this multi-agency programme involving the NZ Transport Agency (herein referred to as the Transport Agency), Greater Wellington Regional Council (GWRC) and Hutt City Council (HCC), seeks to deliver:
    - Improved protection from Hutt River flood events;
    - Better access to Hutt City Centre and the railway station by all modes;
    - Improved liveability and quality of life for people working and living in Hutt City Centre.

In both programmes, the grade separation of Melling intersection was recommended as a short-term activity to complement the flood protection works, improve safety and reliability, and to provide the catalyst for revitalisation of Hutt City Centre through HCC's Making Places plan.

The Transport Agency has been working closely with their two RiverLink partners, both of which are working on significant projects in the same area. GWRC is proposing to spend $125m improving Hutt River flood protection, while HCC is proposing to spend $59m[4] to implement the 'Making Places' regeneration and growth plan for Lower Hutt. These are significant, game-changing projects for Lower Hutt and beyond, and the partners have been collaborating since 2015 to develop a shared plan for the area which ensures that all elements are complementary and work together to achieve the overall community outcomes. The business case process has involved all three parties working together.

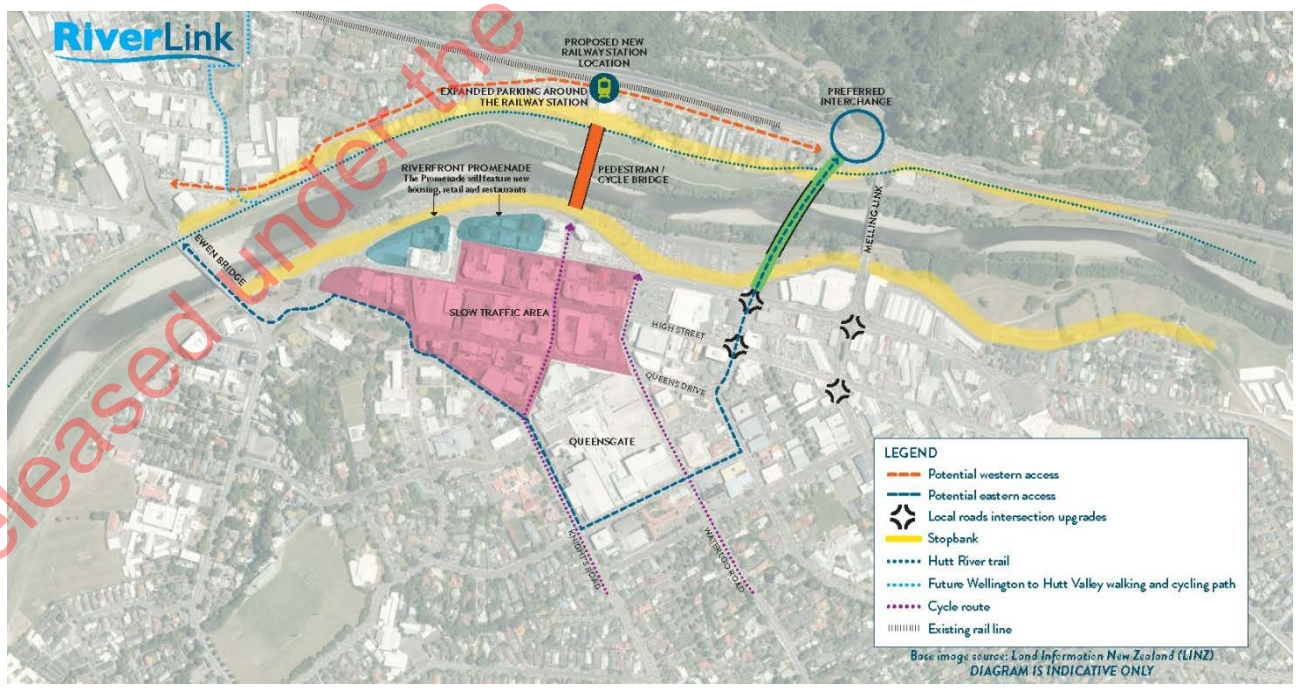


Figure 1-1: Potential RiverLink Scheme

[4] 38m budgeted in LTP, but underspend from previous years is available

GWRC is proceeding with the flood protection works, with consenting and detailed design being undertaken in 2019/20 and construction start scheduled for 2021/22. Improvements include construction of new, higher level, stopbanks adjacent to Hutt River. These enhanced stopbanks require land which is currently used for other purposes, such as residential properties, local roads and car parks. More information on the RiverLink programme is in Section 2.6.

The existing Melling Bridge contributes to the flood risk, because the area underneath it is insufficient to pass a 2,800 cumec design flood (the flood standard for the Hutt River). The bridge is too low to allow free passage of flood waters, and is in the most constrained part of the Hutt River due to encroaching urban and state highway development on the floodway. When the new stopbanks are constructed, it will be the only significant flood constraint on this river. When the bridge reaches the end of its life, the replacement would be required to meet the standard for the river floodway capacity. With RiverLink and the stopbank upgrade, there is an opportunity to meet the design standard now. Replacing the bridge would presents opportunities to address other deficiencies with the bridge and surrounding transport infrastructure, such as a lack of provision for active modes. Because of the proximity of the bridge to SH2 and local road intersections, it is not possible to raise the bridge alone, without significant changes and impacts to nearby intersections.

There are benefits of progressing these transport improvements alongside the RiverLink Programme, or at least developing and consenting an integrated design for the area which identifies those improvements now, even if the non-urgent ones are not scheduled to be completed in the short-medium term.

This Business Case revisits the case for change, explains the process that was used to progress from a long list to a recommended option including the results of technical assessments and consultation/engagement activities, and confirms the scope, design and risks of the recommended option. It explores possible staging and arrangements for ongoing collaboration with the RiverLink partners to co-ordinate and optimise investment. Confirming a recommended option for Melling Transport Improvements will allow the Transport Agency to meaningfully engage with GWRC and HCC's flood protection and city centre revitalisation projects to provide cost efficiencies, integrate design and reduce consenting risk for all RiverLink partners.

There is a high level of community interest in this potential project, and this is reflected by the articles in the media and the interest shown by local and central government politicians. The vast majority of opinion is wanting the improvements delivered as soon as possible.

2. Background and Context

2.1 Study Area

SH2 is an interregional route linking Wellington with the Wairarapa. The study area is located within the Lower Hutt metropolitan area which is 16km from Wellington City Centre. The area encompasses two at-grade crossroad intersections of SH2 with local roads (Harbour View Road/Melling Link and Tirohanga Road/Block Road). Melling Link is one of the main ways to access the city centre if travelling from elsewhere in the region. As well as the city centre, it allows people to get to the hospital, residential areas and Melling Railway Station including the park and ride facility. The study area is shown in Figure 2-1.

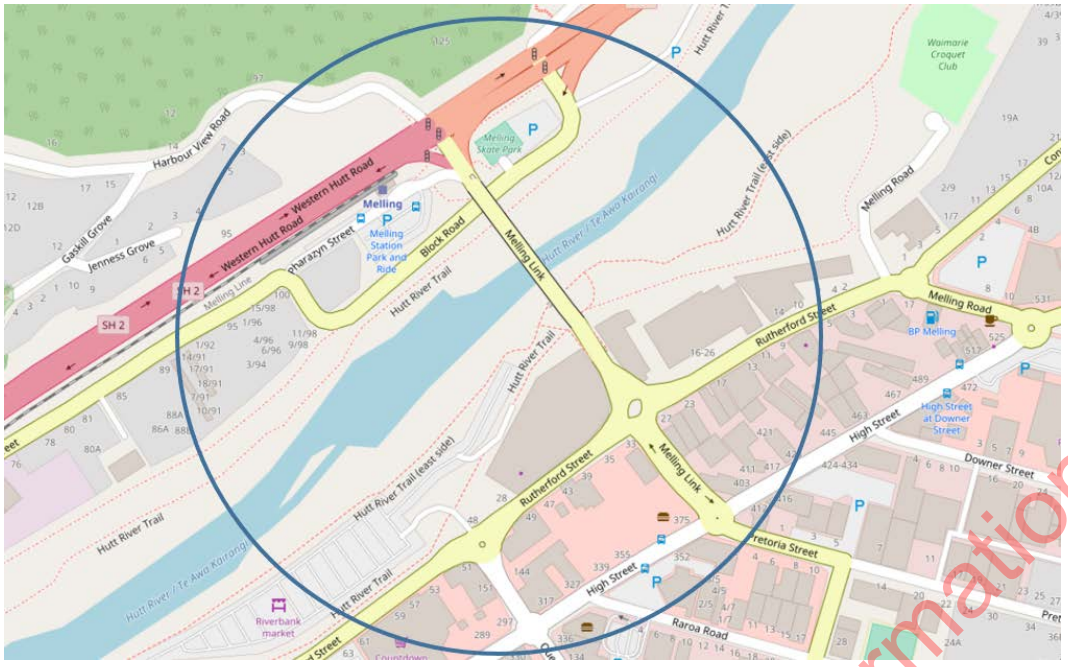


Figure 2-1: Melling Transport Improvements Study Area

2.2 Transport Context

The Melling Transport Improvements must cater for multi-modal transport improvements.

- **SH2 National (High Volume) Highway:** SH2 is an interregional route linking Wellington with the Hutt Valley and Wairarapa. The corridor connects the cities of Upper Hutt, Lower Hutt and provides access to and from Wellington City. SH2 is a National (High Volume) highway south of Melling intersection and a National highway to the north. It carries approximately 40,000 vehicles per day (both north and south of Melling Link), of which around 4% are heavy vehicles.

- **Melling Intersections:** The two Melling intersections provide access to Hutt City Centre and residential suburbs of Lower Hutt. Both are signalised crossroads. These are two of four signal controlled at-grade intersections between the grade separated Dowse interchange and grade separated SH2/SH58 interchange. The primary highway intersection is with Harbour View Road and Melling Link. Melling Link provides access over the Hutt River via the Melling Bridge, to Hutt City Centre, Hutt Hospital and Lower Hutt residential communities, and performs an important multi-modal access function for people travelling within the Lower Hutt area and to destinations north and south of Melling, including Wellington City. Many people living in the area work in either Lower Hutt or Wellington City Centre, resulting in strong commuter flows. Figure 2-2 shows the main travel movements in the morning peak for all modes.

- **Melling Railway Station and free Park and Ride Facility:** The Melling Railway Line is adjacent to SH2, providing a weekday daytime service to Wellington City Centre. Adjacent to the intersection is Melling Railway Station, which is at the end of the Melling line. Supporting the station is a 187 space Park and Ride facility which is popular with commuters. Growth in patronage in 2019 is 33% higher than in 2014 at peak times, and 26% higher overall (based on figures for Hutt line which includes Melling Station). GWRC is currently developing a Park and Ride Strategy. All stations were assessed using an Investment Prioritisation Framework to understand which locations were most feasible for Park and Ride[5]. Melling fell into band 1 of 5 – indicating it is one of the most feasible locations, based on considerations such as potential customer base (indicated by residential density and access), commercial zoning around the station as well as the ability to intercept car commuters early to avoid congestion bottlenecks. Parking was assessed and indicates that for Melling surface level parking is likely to be more viable than multi-storey due to lower land values. This work indicates Melling is a strategic location for Park and Ride and any planned changes should protect the facility. It is assumed that as a minimum the current footprint of the station and car park will be

[5] Technical Note 3 – Where Should Park & Ride Investment Occur (MRCagney for GWRC, 2018)

retained in any future plans, and that they should be futureproofed to allow for possible expansion when required[6].

- **Bus Services:** The Lower Hutt Queensgate Bus Interchange is located at the Queensgate Shopping Centre at the Queens Drive/Bunny Street intersection (12 min walk from Melling Railway Station). Buses go to Upper Hutt, Waterloo Interchange, Petone and Wellington City. There are three high frequency services (every 10-15 minutes) and two standard services (every 30-60 minutes).
- **Walking and Cycling**: The pedestrian and cycling environment between Hutt City Centre, Melling Station and the Western Hill suburbs need improvement, with provision for these modes restricted to a narrow pedestrian walkway on Melling Bridge and pedestrian phases at the traffic signals. The intersections on both sides of the river are traffic dominated and add to community severance created by SH2, with its high volumes and speeds. On SH2 there is a sealed shoulder that cyclists (except for northbound cyclists north of the intersection) can use but no dedicated cycling facilities. On Melling Bridge there are no cycling facilities. Running alongside the west banks for the Hutt River from Petone to Upper Hutt, the 29km Hutt River Trail is a scenic walk and cycle path. The trail runs the entire length of the eastern riverbank is located on the western banks of Hutt River, and provides a connection to the Wellington to Hutt Valley walking and cycling path currently under investigation.

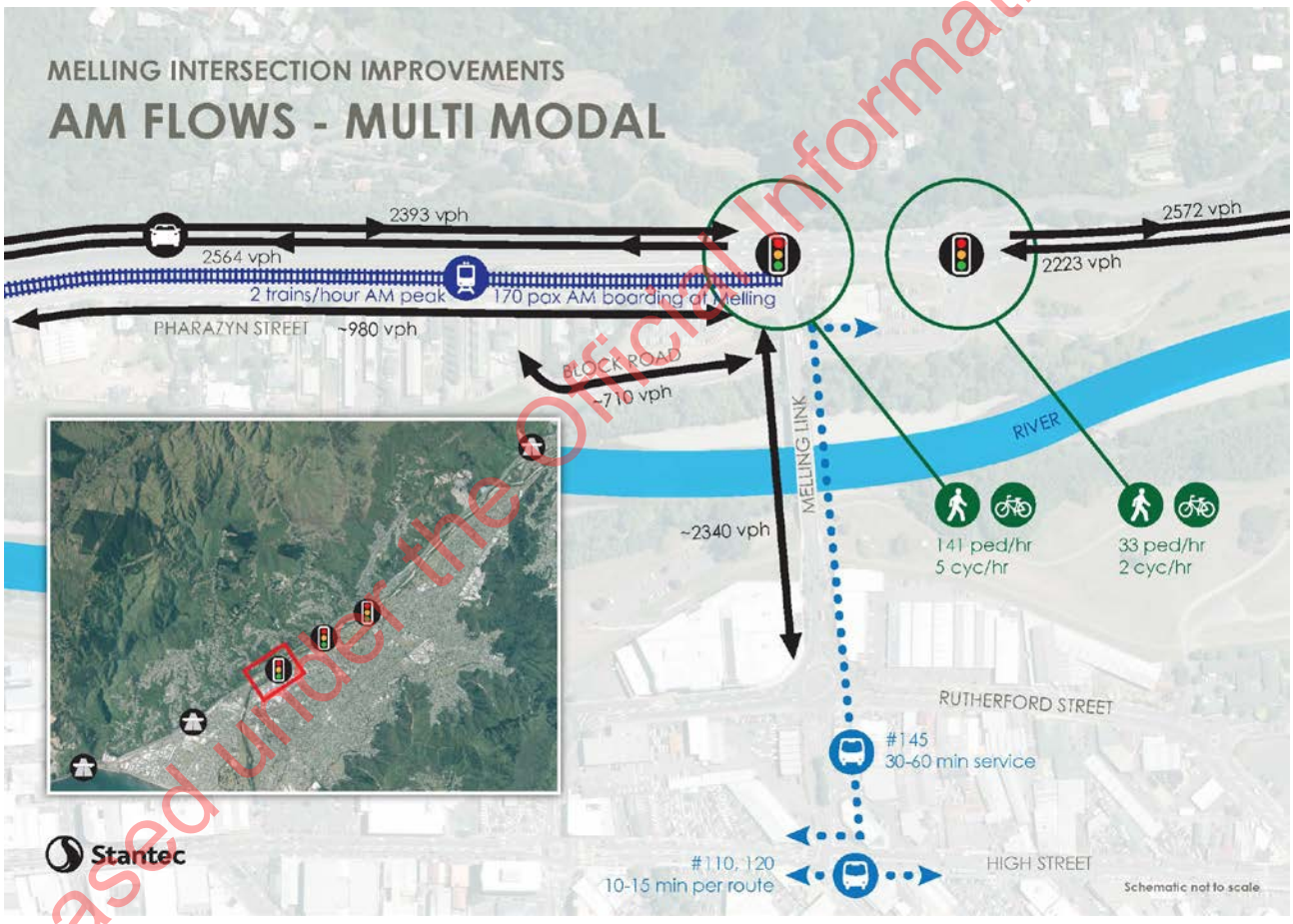


Figure 2-2: AM peak movements (all modes)(Source: SH2 data [NZTA website]; local road volumes [Mobile Road]; public transport data [GWRC])

Note the local road hourly volumes are based on a 10% assumption from AADT volumes.

[6] Melling Station Relocation Assessment (Stantec for NZTA, 2017)

2.3 Wellington and Lower Hutt Growth Context

2.3.1 Greater Wellington Region

The Greater Wellington region has the third largest regional economy, the largest knowledge based sector in NZ, the political hub of the country and the third largest regional population. As a result, the region's transport network is subject to the growing and diverse needs of national, regional and local customers.

The region performs a critical connecting role. It links North and South Island freight and tourism customers and connects Palmerston North distribution hubs and inland ports in the North Island to CentrePort and industrial areas in Seaview. SH1 and SH2 are important tourism routes connecting Auckland, Rotorua and Napier with Cook Strait ferries and the South Island. More than one million passengers cross the Cook Strait annually. More than seven million tonnes of long-distance freight pass through Wellington via road and rail each year. Approximately five million people use Wellington Airport every year.

At a regional level, the dominance of Wellington City as the main employment hub and home of key regional facilities means there is a strong demand from customers to access the City. The City produces 73% of the regional GDP, and 60% of the region's jobs are located here. Unlike other parts of the region, Wellington City is the only area to have more jobs than employed people, which means people need to commute between Wellington City and other urban centres (in the region and beyond).

In the next 30 years 85% of employment growth in the region is forecast to occur in Wellington City. Wellington City and Hutt will remain the largest urban centres, with secondary centres in Porirua, Kapiti and Upper Hutt. Growth projections indicate that strong demand from customers to commute will continue.

At a local level, customers are increasingly seeking accessible, liveable urban centres that offer transport choices. The dominance of Wellington City as a regional destination means these different functions – connecting freight and tourism flows, enabling flows to and from Wellington City, and creating a sense of place – often play out in the same location, creating competing demands and requiring trade-offs.

2.3.2 Lower Hutt Growth Story

Hutt City is the second largest city and employment centre in the Wellington region. There is easy access to Wellington City Centre, which is the largest employment centre in the region. Lower Hutt has a mixture of rural, rural-residential and urban areas. Part of the district is composed of steep hills and there is a limited amount of flat land on the valley floor, some of which is within the Hutt River floodplain. HCC's Urban Growth Strategy aims to encourage population growth in the Lower Hutt area, and provide residential development opportunities at a range of densities, with 80% of development within existing urban areas, including in the city centre. The Council's vision is for Lower Hutt to be 'a great place to live, work and play'. This is supported by the Council's Central City Transformation Plan which includes a variety of initiatives aimed at urban regeneration of Hutt City Centre (refer to Section 5.4 for more information) and population growth. Further detail is available in the Hutt Story 2018[2].

There are over 105,000 residents in Lower Hutt Council area. Hutt City Centre is the primary commercial and retail centre within the sub-region, providing services and amenities for the greater Wellington community. Hutt Hospital, located to the east of the study area and accessed from SH2 and western suburbs via the Melling Bridge, is regionally significant, with 322 beds. There are several schools in the vicinity, such as Hutt Valley High School in Lower Hutt (1600 students), and Wellington Institute of Technology in Petone (8500 students). Some students in Hutt Valley travel to schools or tertiary institutions in Wellington. The manufacturing industry is the largest employer in the Hutt Valley, followed by construction, retail, education and health sectors.

Lower Hutt faces several challenges including an ageing population, low population growth, modest economic growth and areas of social deprivation. HCC's Central City Transformation Plan (2019)(updated from the 2009 Making Places plan), aims to transform Hutt City Centre by 2030 through creating the foundations for a sustainable, vibrant, and buoyant future for Lower Hutt, with a key focus on improving people's lifestyles by making Lower Hutt an attractive place to live, visit and invest (refer to Figure 2-3). One of the aims is for Lower Hutt to become a 'River City', to strengthen the community's sense of identity and ensure a strong link between the city centre and the river corridor. Other aspects of the initiative include strengthening the gateway into the city provided by the replacement of Melling Bridge, a pedestrian/cycle bridge connecting the city centre to the railway station, and amenity improvements and development of multiple recreation opportunities in the vicinity of the river corridor, such as the creation of a Riverside Promenade which will be a high quality public space with opportunities for a high quality built edge to the eastern stopbank. A further aim is to make the city a more attractive place to invest.

Figure 2-3: City Centre 'Making Places': Artists Impression

Historically, Hutt City has historically experienced low population growth compared to the Wellington Region, with an average growth rate of 0.55% (2006-2013). Stats NZ Medium population projections anticipated decline in population from 2028. However, over the last two years the Hutt City population has grown more rapidly, at a rate of 1.3% (2015-2017)[2]. Various population forecasts are available from both Stats NZ and HCC, however regardless of different forecast ranges, HCC is mandated under the National Policy Statement – Urban Development Capacity to provide sufficient development capacity in its District Plan for housing and business growth to meet demand.

The Council's aim is to achieve an additional 11,000 people and 6,000 homes by 2032 (from a 2012 baseline). This is likely to be exceeded as the 2019 estimated population is already 105,900 (which was the Stats NZ population forecast for post 2030).

The desire to focus residential growth in the city centre is reinforced in the Central City Transformation Plan[7] (CCTP) which is a strategic framework to guide future development. The plan aims to create a vibrant 24-hour city focused firmly on the river and contributes to the growth of Lower Hutt beyond the central city.

The CCTP has a focus on housing. Careful residential development is considered the most effective way to reinvigorate the central city by turning it from "a place to get stuff to a place to do stuff". Its authors note that the city centre has the "potential to dramatically reposition itself as a vibrant location for inner city living".

The Lower Hutt Urban Growth Strategy 2012 plans to provide for more intensification opportunities to encourage a greater level of population growth, provide for a broader range of housing types and support the economic prosperity of commercial centres. The specific targets for population are:

- A total population of at least 110,000 people (additional 10,000) by 2032
- An increase of 6,000 additional homes by 2032

Within Lower Hutt approximately 20% of new dwellings will be provided through greenfield development (Wainuiomata, Kelson and Stokes Valley) and 80% through residential intensification in Lower Hutt Central City (including RiverLink), Petone, and key centres along the public transport corridor, as illustrated in Figure 2-4. This growth will lead to increased travel demand within the study area Intensification in the Lower Hutt Central City is supported by the Hutt City Making Places Strategy which focuses on revitalising the central city, creating a riverside promenade and reconfiguring the central city.

[7] http://www.huttcity.govt.nz/Your-Council/Projects/central-city-transformation-plan/

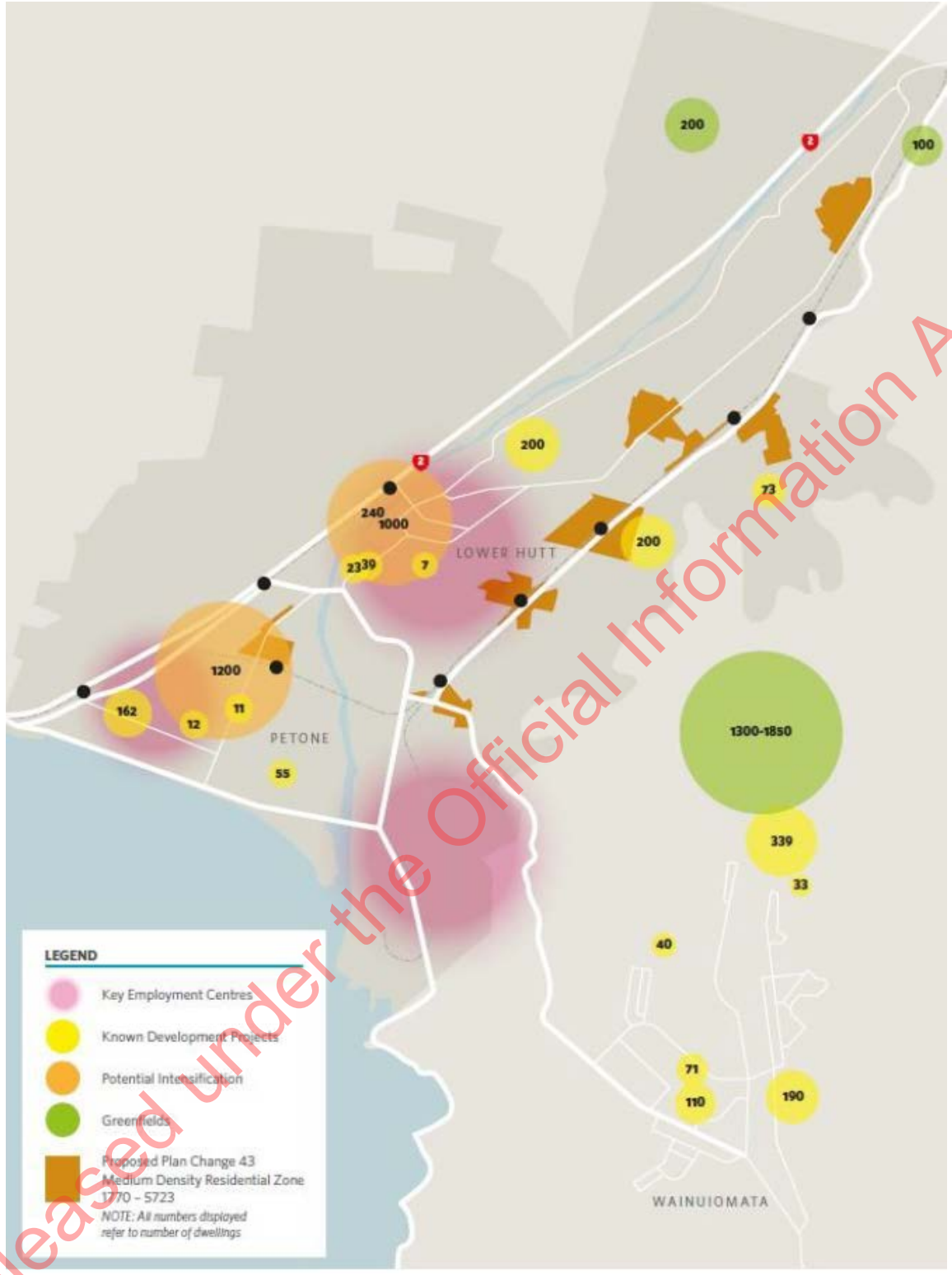


Figure 2-4: Location of growth/new developments across Lower Hutt (Source: HCC March 2018 cited in Lower Hutt Growth Story 2018)

The Lower Hutt Growth Story[8] summarises the urban growth, transport, land use and resilience goals and activities for Lower Hutt. Figure 2-5 summarises the transport issues facing Hutt City, which are a combination of unacceptably high flood risk with significant consequences, and poor transport network performance.

[8] Lower Hutt Growth Story (2018, Hutt City Council, Greater Wellington Regional Council and NZ Transport Agency)

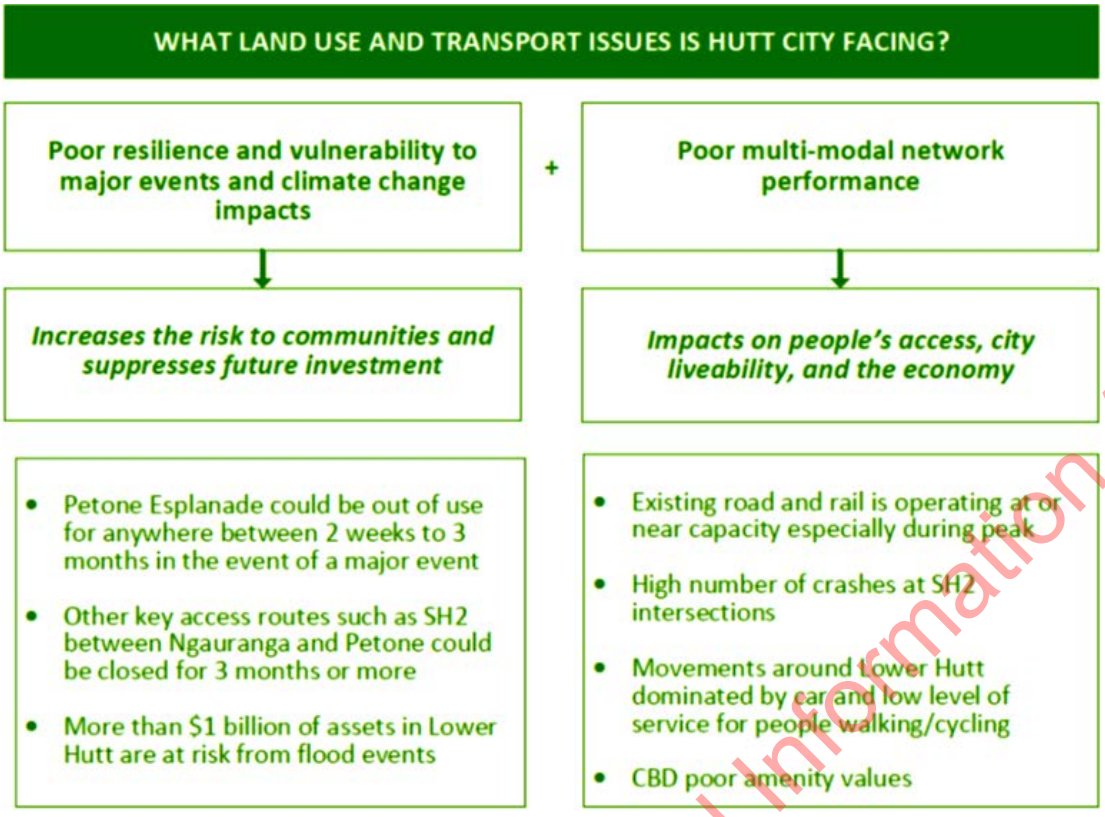


Figure 2-5: Developed from information in Lower Hutt Growth Story 2018

2.4 Geographic and Environmental

The Wellington Regional Transport Plan identifies that the study area is susceptible to surface and river flooding, landslides, tsunamis and liquefaction. The Melling intersection is located between the Hutt River to the east and a steep escarpment to the west. The SH2 corridor in this location runs alongside the Wellington Fault.

Flooding of the Hutt River is a recurring problem. There have been twelve major flood events from 1855 to 2005. The consequences of future catastrophic design flooding event was estimated in 2014 at **$1.1b** physical damage to Hutt City Centre plus additional social, economic and environmental effects. Such a flood potentially results in loss of life and impact property and commercial activities of thousands of people. These potential social, economic and environmental costs may double that cost estimate[9]. Recent experience with other natural disasters nationally indicates that the consequential losses and reconstruction costs could be much greater than this estimate, and have a wider impact on the region in terms of the migration of people from Hutt Valley to other parts of the region or country.

Table 2-1 shows predicted property damage, which varies depending on whether the west or east stopbank fails first. Note once one stopbank has failed, the other will not, so damage will be approximately $1.1b (plus indirect damages that tend towards an equivalent additional amount), rather than both.

[9] Melling Gateway Strategic Case (2014) for NZTA, GWRC, HCC

Table 2-1: Predicted properties affected and damage to tangible items should either Melling stopbank breach during a 1 in 440 year flood event[10]]

Corridor breach	Property types affected				Estimated tangible damages[9]
	Commercial	Residential	Schools	Industrial	
West bank at Melling Bridge (Pharazyn St)	462	2,111	4	91	$1.1 billion
Breach of east stopbank at Melling Bridge (left stopbank)	126	3,115	5	596	$1.06 billion

Concern about the community, economic and social impacts of significant flood events led GWRC to develop the Hutt River Flood Management Plan. Following extensive consultation, it is proposed to build to a 1 in 440 year return period flood protection level that includes an allowance for climate change by enlarging and moving stopbanks further west of the river, requiring significant property removal. This is the highest level of flood protection in the country, and reflects the value of public and private assets located within the flood plain and the importance of Hutt City Centre within the wider region.

There are two existing constraints to providing protection for a 1 in 440 year flood event. These are:

- Pharazyn Street, Block Road and Melling Park and Ride – the preferred flood protection works require stopbanks to be constructed in locations that are currently occupied by transport infrastructure and housing;
- Melling Link Bridge – the bridge restricts the flow of water in a flood event, and at its current capacity can only pass floodwaters from a 1 in 65 year event. This could be extended to a 1 in 200 year event with additional stop banks and waterway improvements around the bridge.

The impact of a 2800 cumec flood (1 in 440 year event) is illustrated in Figure 2-6 and would be catastrophic for the population of Lower Hutt. In terms of the transport network, areas in this map shaded yellow, orange and red would cause vehicles to float. Areas adjacent to stopbank breaches would be inundated with sediment and debris closing those local roads until clean up could be mobilised. Buildings adjacent to breach locations are likely to have been pushed off foundations and may have been forced into the local road network causing impacts for weeks or even months.

SH2 could remain available for use (subject to surface flooding), but Block Road would be flooded and unpassable as would affected areas of the local roading network which at some locations would have been damaged/affected by debris and sediment accumulations, all of which would affect the operation of SH2 and how the wider transport network would operate.

The Melling intersection and Block Road are also susceptible to flooding due to stormwater runoff during high intensity storm events. Anecdotally, the Wellington Traffic Operations Centre note Block Road is closed due to flooding approximately eight times a year. This affects the operation of through traffic on SH2 if the southbound traffic queues to leave SH2 extend beyond the turn bay into the SH2 through traffic lane.

[10] Source: Melling Gateway Strategic Case 2014. Note tangible damages include direct costs e.g. damage to property and other assets and indirect costs such as loss of production.

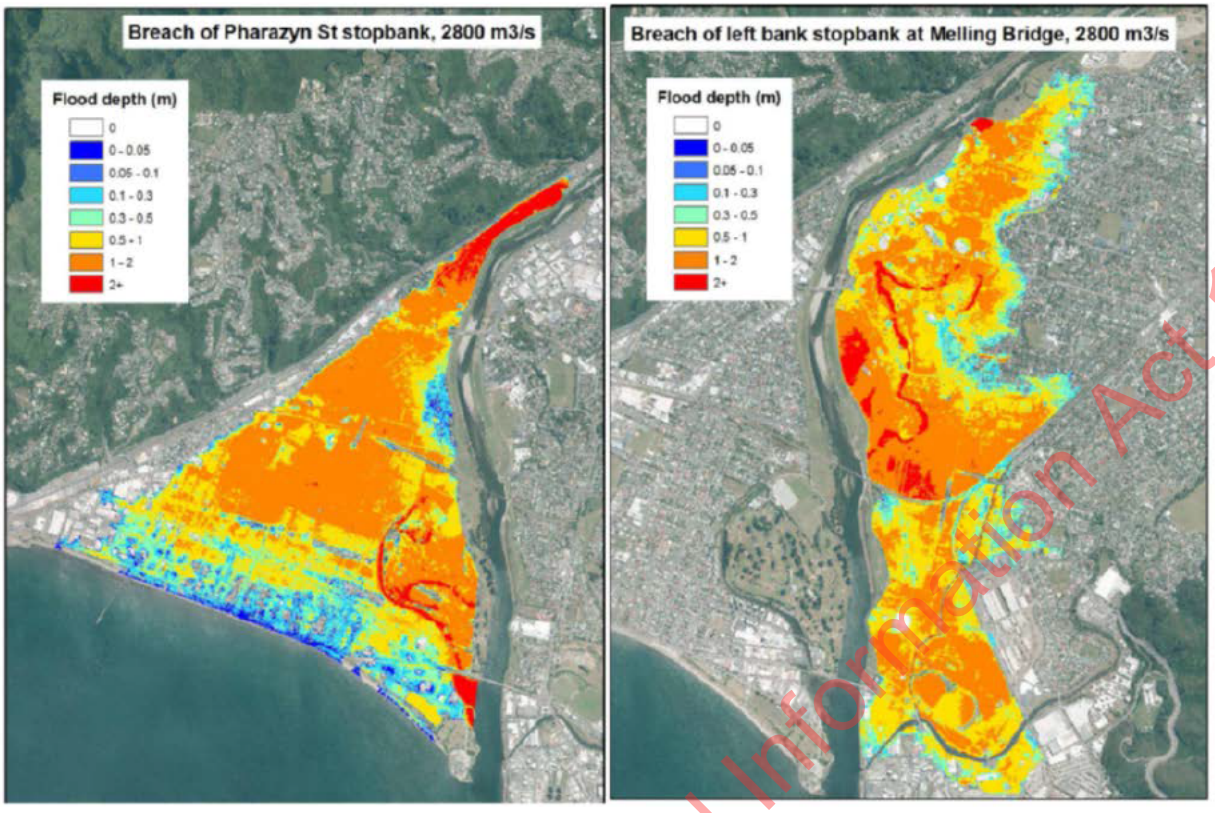


Figure 2-6: Hydraulic model of stopbank breach either side of Melling during a 1 in 440 year flood event (Source: Melling Gateway Strategic Case 2014)

2.5 Overarching Programme Business Cases

The outcomes that were sought from the two overarching Programme Business Cases (PBC) are shown in Table 2-2. The transport outcomes are aligned. The main differences are the primary driver for the Melling Transport Improvements, RiverLink aims to improve protection of public and private assets in the event of a major flood, as well as availability/resilience of the transport network, by upgrading the existing flood defence system. RiverLink also includes aspects of the Making Places urban revitalisation plan of HCC which capitalise on opportunities presented by the flood works and transport improvements. The SSBC outcomes align closely with these overarching PBC objectives.

Table 2-2: Outcomes Sought from the two overarching Programme Business Cases

Programme Business Case	Outcomes Sought (Investment Objectives)
Melling Gateway Programme Business Case (RiverLink) (2015)	• Increase flood plain resilience of the Hutt River Valley to reduce the economic and social impacts of a catastrophic flood event valued at $1.1B of direct damages (and an equivalent amount of intangible damages • Improve connectivity between the Hutt City centre and its adjacent transport corridors and the Hutt River • Improve SH2 and local road network safety, reliability and multi-modal transport choices • Provide the opportunity for urban regeneration in the Hutt City Centre
SH2: Ngauranga to Te Marua Programme Business Case (2016)	• Improve travel time reliability on SH2 between Ngauranga and Te Marua • Improve public transport in the Hutt Valley • Improve the safety of the transport corridor by reducing the number of deaths and serious injuries • Improve the quality of infrastructure by increasing the KiwiRAP Star Rating • Increase availability along the transport corridor by reducing the number of journeys impacted by natural closures and delays

The status and indicative timing of each programme is outlined in Table 2-3.

Table 2-3: Programme Status

Programme Business Case	Status
Melling Gateway Programme Business Case (RiverLink)	• GWRC has consulted on the flood protection works and approved the design and implementation of works to provide protection for a 2800 cumec flood (1 in 440 year event). This will require extensive stopbank works and raising the height of Melling Bridge. Funding of $125m for RiverLink is included over the ten years of the 2018-28 Long Term Plan (LTP). • HCC have consulted on financing options to fund the city centre Making Places: RiverLink plan through the Annual Plan process, and have included in the 2018-28 LTP (noting that they are budgeting greater expenditure): o Promenade and Urban Improvements: $25.5m ($12m between 2019/20 and 2022/23; $13.5m between 2023/24 and 2033/34) o Footbridge: $6.5m 2023/24 to 2025/26 o $5.6m for strategic property purchase • In 2019 GWRC and HCC signed a contract to develop an Assessment of Environmental Effects and Notice of Requirement application before end of 2020.
SH2: Ngauranga to Te Marua Programme Business Case	• Grade separation of Melling Intersection was recommended for short-term implementation. The Transport Agency Board supported the PBC and its HH (0.9-2.0) assessment profile, up to (but not including) the implementation of the recommended programme within the next decade[11]. The Board advised in 2016 that their implementation would not be before 2026, and subsequently confirmed in 2019 that implementation would not be before 2028.

2.6 RiverLink

2.6.1 RiverLink – Scope

RiverLink involves three separate but interdependent projects: flood protection (GWRC), Making Places urban development plan (HCC) and Melling Intersection Improvements (NZTA). In a transport context, the programme aims to improve the resilience, accessibility, efficiency, and safety of the Melling intersections and the wider transport network.

The overall outcomes sought are:

- a connected, resilient and secure floodplain;
- an integrated, resilient, safe and efficient transport network;
- a more liveable Hutt City and enhanced economic growth.

To achieve these, the programme of works includes:

- Making Places City Revitalisation
- Pedestrian/Cycle Bridge between the CBD and the relocated railway station
- Eastern Access Route
- Western Access Route
- Riverfront Promenade
- Bulk Car Parking Facility
- Stopbanks and River Works
- Walking and Cycling Paths

[11] The decision can be found here: http://www.nzta.govt.nz/planning-and-investment/our-investments/investment-decisions/board-decisions/portfolio-of-inter-regional-business-cases-north-island/

- Relocated Railway Station and new Park & Ride
- New Melling Interchange
- New Melling Bridge over the Hutt River
- River Park Corridor Amenity Improvements
- Ecological and Environmental Enhancements
- Stormwater quality and quantity improvements
- Improvements to four intersections within Hutt City centre

Figure 2-7: Central City Transformation Plan incorporating RiverLink and Melling intersection improvements

2.6.2 RiverLink – SSBC integration

In addition to the ongoing RiverLink management co-ordination, the RiverLink partners were involved in each of the key steps through the Melling SSBC. In addition, there are several key project interactions for which ongoing dialogue has been occurring:

- Development of Problems, Benefits, Investment Objectives and Key Principles
- Development of Long List Options
- All MCA processes, including using RiverLink personnel as criteria specialists
- Financial split discussions
- Interaction between the bridge abutment and the eastern stopbanks
- Interaction between the on and offramps and the western stopbanks
- Structural options and impact on the floodway and urban design framework
- Railway station and Park & Ride optioneering
- Promenade options and interaction with Melling Intersection Improvements
- Property impacts across all options
- Impacts on local roads at tie in points
- Intersection configuration and layouts

2.6.3 RiverLink – Timelines

Figure 2-8 shows the historic and indicative forward timeline for RiverLink as at 2018.

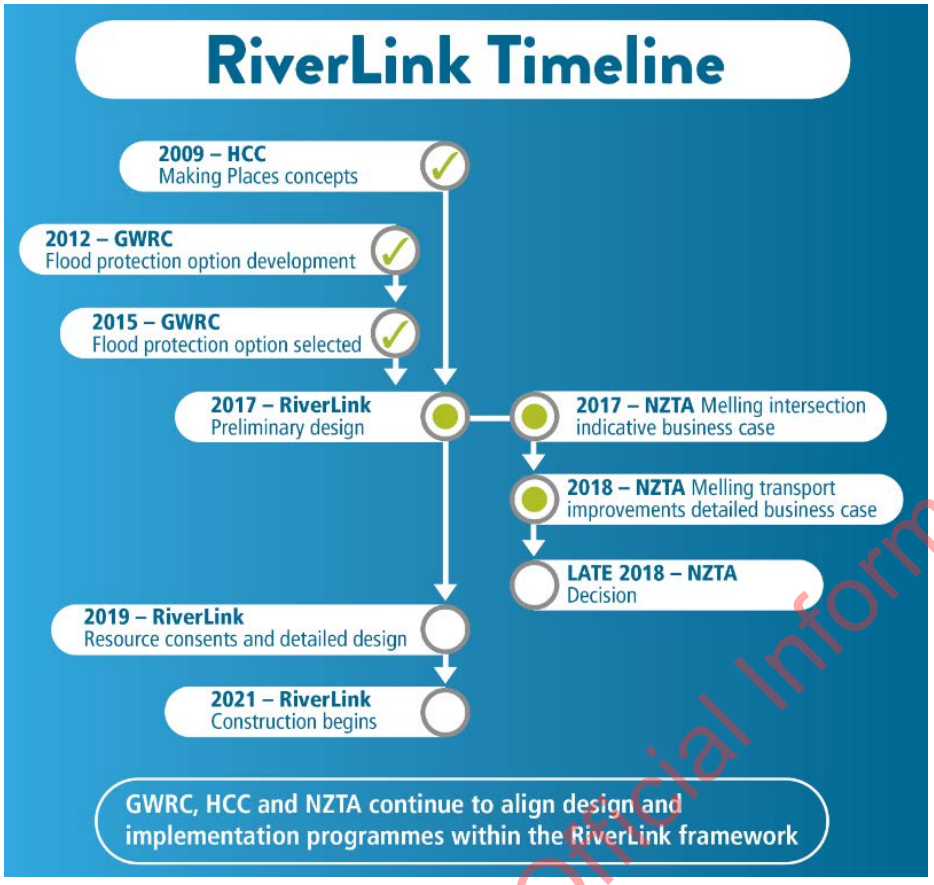


Figure 2-8: Key Programmes of Work and Timelines

2.6.4 Transport Project Re-Evaluation and Impact on RiverLink Timeline

The decision to undertake a re-evaluation of this project to confirm its alignment with Government objectives resulted in the timeframes presented above being delayed. Work stopped on the SSBC in July 2018. The re-evaluation outcomes were communicated in April 2019 and work then recommenced on the SSBC.

The delay caused by the Project Re-evaluation has delayed the overall RiverLink timeline, but to a lesser extent. The flood protection and urban re-vitalisation elements progressed by commissioning a consulting team to commence preparation of consenting and Notice of Requirement applications.

The revised RiverLink timeline is shown in Figure 2-9. This shows that a decision on the next phases of the Melling project will be made early 2020. However, in September 2019, the NZ Transport Agency announced that funding was available for the consenting phase and work is now underway on that element. However, this is likely to again delay the RiverLink consent lodgement date.

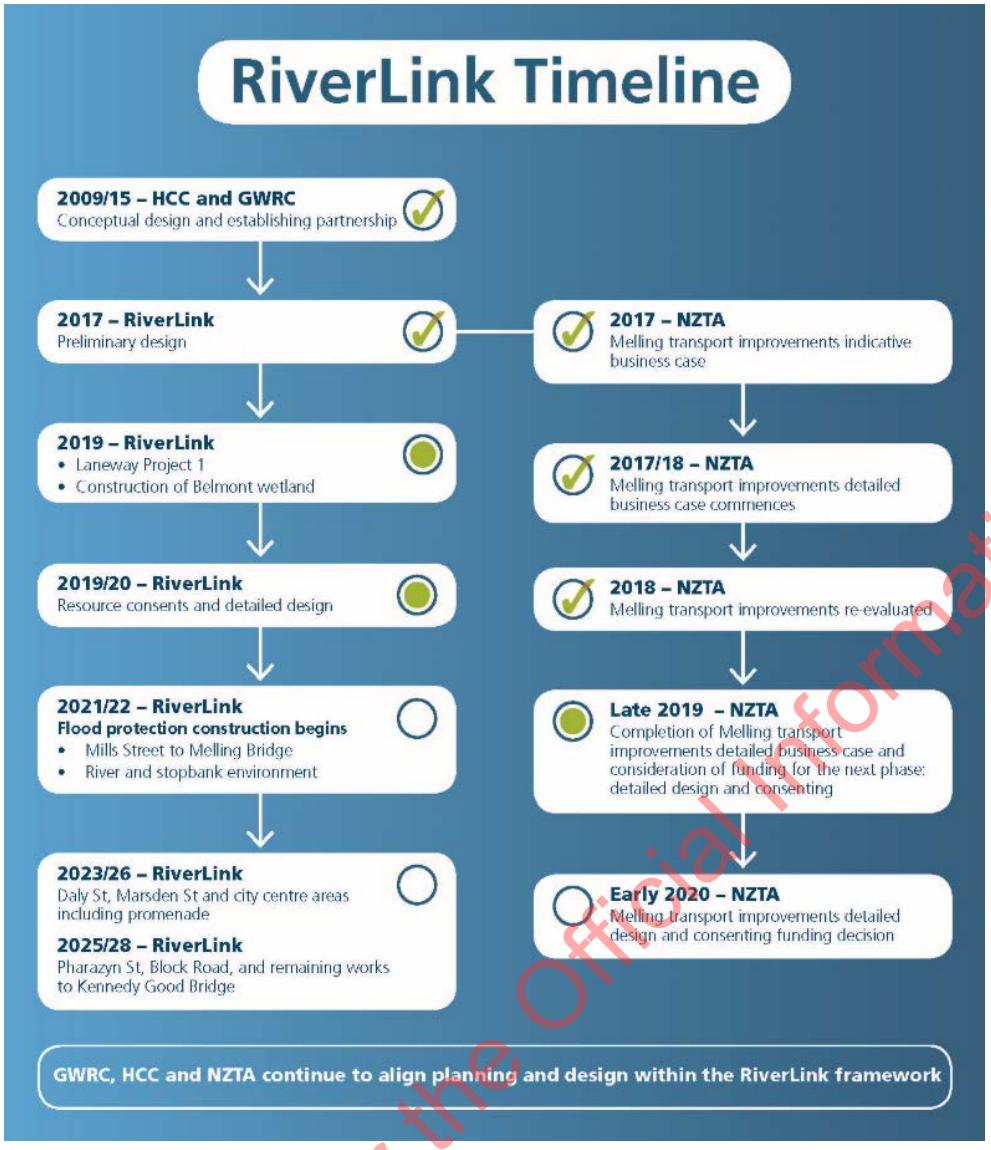


Figure 2-9: Revised RiverLink Timeline

2.7 Project Inter-Dependencies

There is a critical interdependency between the flood plain resilience activities and the Melling Transport Improvements. The interdependencies for the wider RiverLink programme is outlined in Figure 2-10. The diagram illustrates that improving flood plain resilience means that other activities must happen, such as reconstructing stopbanks and altering the Melling Link Bridge so that more flood water can pass under during an event. These changes drive other essential activities, such as relocating Melling Station because the intersection improvements require the land, and offer opportunities to address deficiencies with other transport elements, such as considering the best configuration for a new Melling Bridge.

As shown, the Melling Bridge replacement presents an opportunity to improve access and connectivity to Hutt City Centre by all modes, optimise the transport network, improve safety and provide a gateway to the city centre. It is expected that these improvements would support the revitalisation and redevelopment of Hutt City Centre. The Melling Transport Improvements encroach on the Melling Station car park, meaning this needs relocating. This presents an opportunity to consider increasing park and ride capacity, as well as improving pedestrian connectivity between Hutt City Centre and Melling Station, while facilitating land use changes around the city centre.

The Melling Transport improvements are a key component to providing better access and connectivity for the Lower Hutt communities and provides better conditions for people and freight travelling along SH2. The project outcomes are wider than just transport, as improving multi-modal access would unlock social and economic opportunities.

It is expected that traffic volumes through the study area will be influenced by the opening of Transmission Gully in 2020 and the timing of the potential Petone to Grenada link. Both projects are expected to increase traffic volumes through the Melling intersections.

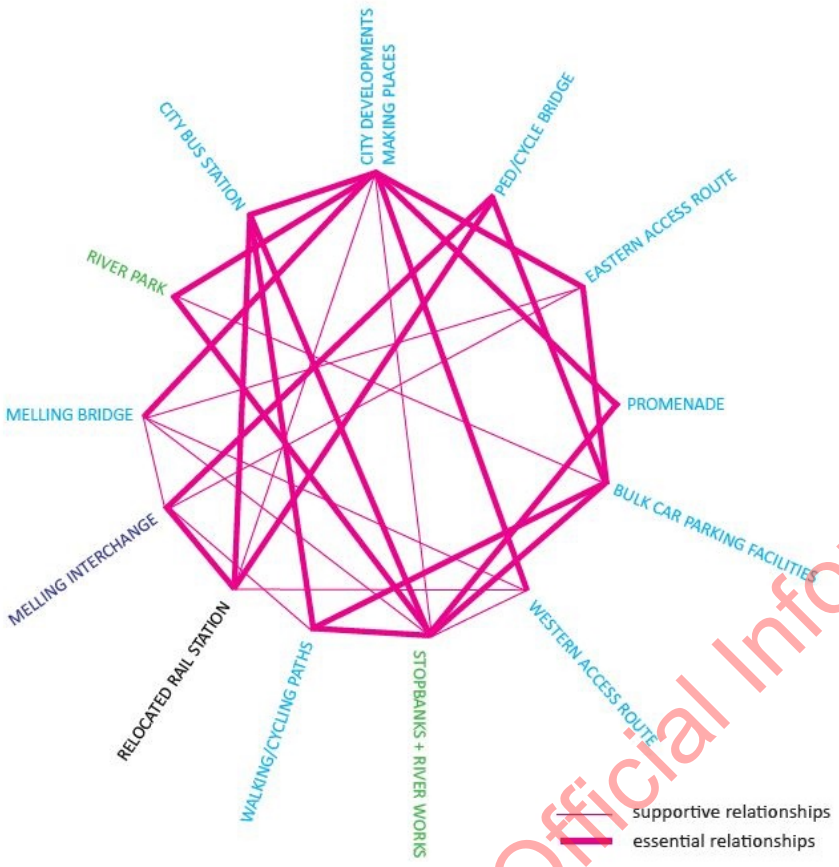


Figure 2-10: Interdependent Activities

The overlapping project and interrelationships can be used to advantage the efficiency and effectiveness of the outcomes for the mutual benefit of all. By considering the whole system of overlaps and relationships in the form of Riverlink the case for investment here is strong.

2.8 Work Completed to Date

There have been many studies looking at transport improvements at Melling over the last few decades. None, except the more recent, have considered the integration of improvements with resilience and re-vitalisation outcomes. This was the focus of the first stage of this study, the Melling Gateway (RiverLink) Programme Business Case and the subsequent Melling Intersection Improvements Indicative Business Case (IBC).

A draft of the IBC was completed and presented to the Transport Agency's Value Assurance Committee in June 2017. Rather than approve the report for issue, the Committee directed the team to progress and develop a Single Stage Detailed Business Case (SSBC) for approval.

Work completed during the development of the draft IBC demonstrated that lack of integrated planning for the flood protection and transport infrastructure would increase delivery costs, result in sub-optimal outcomes and could limit future options for transport improvements.

3. Engagement

3.1 RiverLink

3.1.1 Partners

The RiverLink partners for this Business Case are shown in Table 3-1. These parties have worked very closely together under the RiverLink banner and are constantly communicating with each other to ensure the best outcomes for all parties.

Table 3-1: RiverLink Partners

Partner	Focus Area of Relevance to this SSBC
NZ Transport Agency	The Transport Agency's primary purpose is to provide transport solutions for a thriving New Zealand. The Transport Agency invest in land transport activities, regulate access and use of the land transport system, and maintain, operate, plan for and improve the state highways. The Transport Agency are responsible for the state highway. For RiverLink the Transport Agency are responsible for investigating the transport improvements at and around the Melling intersection including the railway station, Melling Bridge and adjacent local road intersections.
Hutt City Council	HCC is responsible for managing local roads, including the walking and cycling network. The Council's focus is on realising the revitalisation and transformation of Hutt City Centre through the initiatives identified in the Central City Transformation Plan (previously 'Making Places') and the LTP. For RiverLink the HCC are responsible for investigating the urban redevelopment opportunities, local road alterations away from the Melling intersection area and the new pedestrian/cycle bridge over the Hutt River.
Greater Wellington Regional Council	Relevant Regional Council responsibilities are flood protection for major river and major stream flooding, public transport and regional transport planning. The proposed flood protection works present an opportunity to improve landscaping and community access to the river, in partnership with HCC, to facilitate the Making Places plan. There are also opportunities for investment in public transport, such as ensuring the relocated train station meets future needs, and better connecting the rail network with bus and pedestrian networks. GWRC are primarily focussed on the flood protection aspects of the RiverLink programme.

3.1.2 Governance

The RiverLink Governance structure is outlined in Part C.

The Transport Agency are a key partner in RiverLink and are represented in working groups and management groups. The SSBC has been developed in consultation with RiverLink partners and integrated with the partners' components of RiverLink.

3.2 Stakeholder and Community Engagement

There has been many community engagement activities undertaken on this project throughout the project development with most of it, if not all, undertaken under the RiverLink umbrella in partnership with the Councils. The project has established an ongoing dialogue with the community and key stakeholders. Community engagement has included one on one meetings, customer insights, RiverLink open days, station relocation engagement, SH2 interchange options engagement, participation in Festival of Lights and RiverLink markets, as well as regular newsletters and use of the RiverLink website. The three larger community engagement activities for the Melling transport improvements were as follows:

- Late 2016: Customer Insights
- Early 2017: Feedback on design work so far, Melling bridge location and Melling station relocation
- Early 2018: Consultation on shortlisted options.

The summary reports for these phases are in Appendix A and Appendix G.

4. Strategic Alignment

Melling Transport Improvements align closely with national, regional and local strategies, policies and plans, as demonstrated in Table 4-1. Further information is provided in the Hutt Story 2018[12].

Table 4-1: Alignment with national, regional and local strategies, policies and plans.

Document	Alignment
Ministry of Transport - Transport Outcomes Framework	Board endorsed alignment with Transport Outcomes Framework through re-evaluation noting: • Implementing the transport improvements has **High** alignment with: Inclusive access; economic prosperity; and resilience & security outcomes, and **Medium** alignment with: healthy & safe people; and Environmental Sustainability Outcomes. This is because they will: • Increase resilience to events such as flooding • Provide certainty of investment, enabling adjacent works to proceed • Increase travel choices to public transport via walking and cycling improvements • Improve safety • Improve journey times. Proceeding with RiverLink partners to finalise the co-investment plan, and carry out designation/consenting is expected to bring added benefits of: • Clarity on intended outcomes and quantity and return on investment • Assurance that the long-term proposed option can be implemented.
NZTA Statement of Intent (2018-22)	**Strong** alignment with three of the five long-term outcomes: • Inclusive access: Improves access to Hutt City Centre by all modes and to Wellington City and the wider region by rail and road. Increases mode choice for people in green and brownfields developments. • Economic prosperity: Supports economic revitalisation of Hutt City Centre by providing effective access for freight and enabling HCC's placemaking plans • Healthy and safe people: addresses known safety issues on SH2 and at Melling intersection
Safer Journeys Action Plan 2016-20 (soon to be superseded by the Road to Zero Strategy)	The focus of the plan is on reducing risk on the country's highest risk roads. The project aligns with the objective to ensure roads and roadsides reduce the likelihood of crashes and minimise trauma when crashes occur, particularly those: • on urban arterial roads, • related to head on, run off-road crashes and intersection crashes, • related to vulnerable road users • involving motorcyclists There is **strong** alignment with this objective, as the primary intersection and the corridor have a high collective risk. Also four of the seven serious injury crashes in the last five years involved motorcyclists.
NZTA Hutt Corridor Plan	The vision for the Hutt Corridor is to provide a high level of access and reliability for both passengers and freight. The strategic responses envisioned include improvements to SH2 intersections to provide better east-west connectivity, safety upgrade works including safe and attractive walking and cycling routes, and a reliable and modern rail corridor supported by feeder bus services. In the future, a 'High quality rail and bus services will accommodate a majority of commuters along this corridor during the peak period.' Melling Intersection Improvements are identified. There is **strong** alignment with the strategy.

[12] Hutt Story Strategic Context, May 2018, NZ Transport Agency

Document	Alignment
GWRC Wellington Region Land Transport Plan 2015: 2018 Mid-Term Update	The RLTP **includes** 'Melling Safety and Efficiency Improvements' and notes this project is now linked more closely to the wider RiverLink programme of work through collaboration between partners. The RLTP includes funding for cycleways on SH2 Hutt – Wellington, and frequency/capacity enhancements for Hutt Valley Railway line. These projects support Let's Get Wellington Moving, which has a focus on mode shift for journeys to Wellington City Centre.
GWRC Regional Public Transport Plan	The PT Plan has a goal of continually improving the network. This **includes** the rail network through the study area as well as park and ride facilities.
GWRC LTP 2018-28	Identifies key projects and programmes for the next ten years. RiverLink is **highlighted** as a priority programme delivering on regional Resilience outcomes for GWRC to widen the river and construct larger stopbanks, contribute to the regeneration of Hutt City Centre and improve transport options between SH2 and Lower Hutt. A figure of $125m is included in the GWRC consultation document.
HCC Urban Growth Strategy 2012-2032	Targets population growth to at least 110,000 people living in Hutt City by 2032; a 10% increase from 2013. In Lower Hutt, 80% of new dwellings will be provided though residential intensification, including in Hutt City Centre. Presents growth areas.
HCC LTP 2018-28	Identifies RiverLink as a priority project worth $200m. States HCC are leading the development of the 'Riverside Promenade' and that the project includes a new pedestrian footbridge between Hutt City Centre and a relocated Melling Station, as well as new walking and cycling facilities on the promenade.
HCC 'Making Places' Report (2009) updated as Central City Transformation Plan (2019)	Vision for revitalisation and growth of Hutt City Centre. Recognises that improving connectivity and access for all modes is critical to revitalisation, and identifies improved connections between SH2, Hutt City Centre and Melling Station/Park and Ride including a new city centre to Melling Station footbridge.
Hutt River Floodplain Management Plan	Programme of works for improvement of flood security for the Hutt Valley Floodplain to the design standard for the Hutt River

5. Case for Change

The case for change for the overall RiverLink project is based on three separate but inter-related problems – the flood risk; severance between Hutt City, the river and the strategic transport network; and localised transport issues around Melling Bridge.

The Melling Gateway Strategic Case was jointly developed by the RiverLink partners in 2014. The Strategic Case outlines the context and case for a co-ordinated investment programme to improve resilience, accessibility and safety.

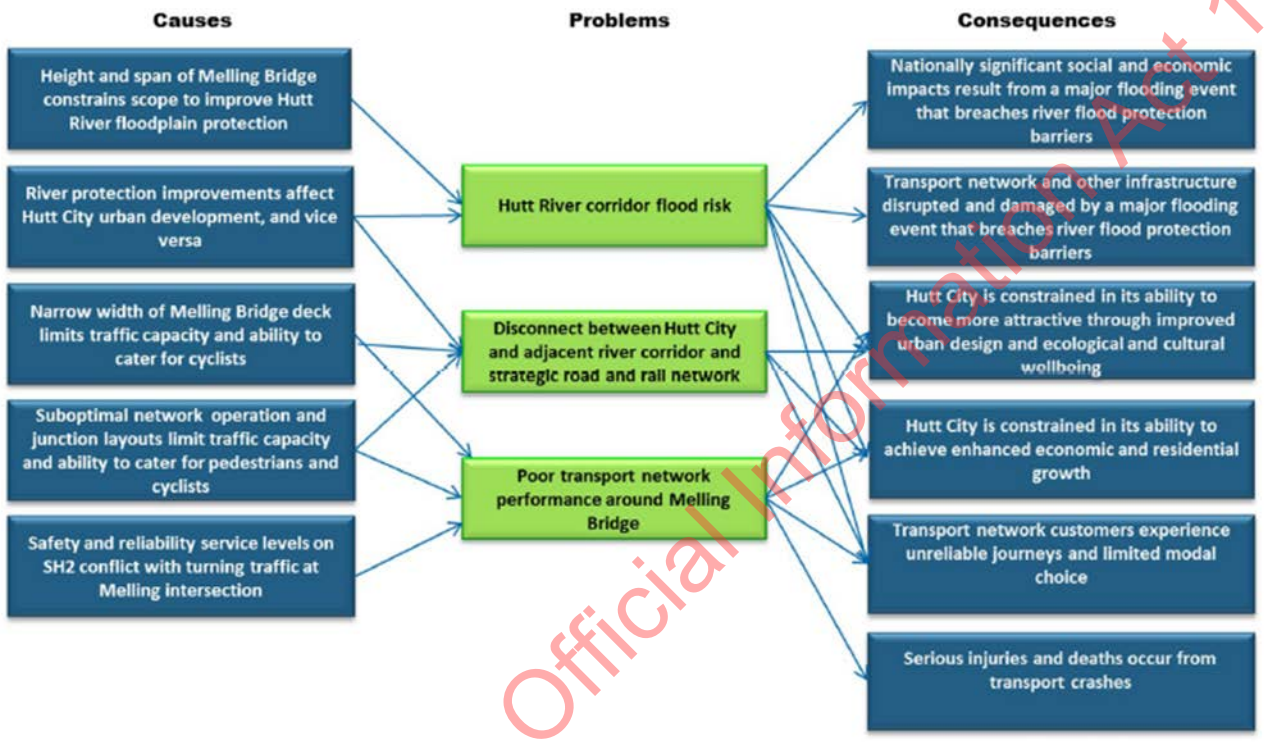


Figure 5-1: Summary of case for investment (Source: Melling Gateway Strategic Case 2014)

This business case relates to transport improvements specifically. However due to the inter-related nature of the RiverLink projects, the Transport Agency has been working very closely with HCC and GWRC to identify the transport solution that will deliver the best outcomes for the community and offer value for money.

In the next section the problems that relate specifically to severance between Hutt City Centre, the river, railway and SH2, as well as localised transport network performance around Melling Bridge and SH2 Melling intersections is assessed and evidence provided.

6. Problems, Opportunities and Benefits

6.1 Problems

The problem statements for this transport improvements business case are derived from the two sets of overarching Programme Business Case problems, as shown in Table 6-1. The problems, benefits and investment objectives were reviewed as part of the Transport Agency's Re-evaluation Project. The Findings Report suggested that the evidence was strong in support of access and resilience, but less so for safety because the intersection did not feature on the High Risk Intersections List. It stated that problem 2 should be amended to be mode neutral. This amendment is shown in **bold red**. Other changes were introduced to make the statement more specific (problem 1) or show the consequence clearly (problems 2 and 3). The updated problem statements and evidence is presented below and in the remainder of this chapter.

Table 6-1: Evolution of Problem Statements

Melling Gateway Programme Business Case	SH2: Ngauranga to Te Marua Programme Business Case	Melling Transport Improvements Problem Statements
Capacity constraints at Melling Bridge and the immediate vicinity result in exacerbated flood risk and inefficient multi modal network performance. The disconnect between the city, river corridor and transport has undermined the status of the access from State Highway 2 as the main gateway to the city centre.	High traffic volume and insufficient network capacity results in peak delay and unreliable journey times that adversely affect regional productivity. Poor configuration and operational environment of SH2 and associated local network results in poor multi-modal network performance.	**1.** The configuration of intersections either side of Melling Bridge, some of which are in a high volume and high speed environment, is causing a **number of serious injuries**
		2. High and increasing traffic volumes, combined with intersections with insufficient capacity and **underutilisation of PT and active modes** leads to delays at peak times and weekends **reducing the accessibility of goods and services in Hutt City**
		3. The quality of infrastructure constrains access to alternative modes and leads to unnecessary car travel between SH2 and Lower Hutt at Melling **and suppresses access by, and use of, these modes**
A constrained river corridor is increasing the flood risk and the potential economic and social impacts.	Constrained topography, the geology and lack of alternative routes results in poor network resilience.	**4.** A high crash risk and flooding in storm events results in journeys through the Melling intersections being impacted on a regular basis

6.1.1 Problem 1: Safety

The configuration of intersections either side of Melling Bridge, some of which are in a high volume and high speed environment, is causing a number of serious injuries (35%).

Table 6-2: Safety Problem Overview

Cause	• Below standard infrastructure on SH2 in the vicinity of Melling intersections, with KiwiRAP star rating of 3 around the Melling Link intersection, and 2 star northbound at the Tirohanga Road intersection, compared to expected standard of 4 star south of the intersection, and high 3 or 4 star to the north. • High speed environment (100 km/h speed limit) and high traffic volumes on SH2 • Long queues at peak times on SH2 from right turn bay into Melling increases safety risk • Complex intersection configuration at SH2 • Poor intersection geometry of the roundabouts on the eastern side of the river
Effect	• High collective risk at SH2/Melling Link intersection • Medium collective risk at SH2/Block Road intersection
Consequence	• Six serious injury crashes in five year period (2014-2018), three of which were in 2017. Four of these were on SH2, and one each at Melling Link/Rutherford Street and Melling Link/High Street intersection. • All four serious injury crashes on SH2 involved motorcycles travelling southbound. Three of the crash reports mentioned cars breaking suddenly due to traffic lights/queues. • Delay to other traffic whilst emergency services attend the crash scene.

6.1.1.1 SH2 Infrastructure Rating

KiwiRAP star ratings for SH2 are shown in Figure 6-1. This reflects the road's engineering features assessed by inspection of several road and roadside design elements such as land and shoulder width, power poles and ditches, intersection frequency, and the presence of safety barriers. Between 1 and 5 stars are awarded to road segments (typically 100m in length) depending on the level of safety which is 'built in' to the road. A 5 star rating represents the safest road infrastructure design for the speed environment, and 1 star rating represents a road with poor infrastructure design for the speed environment. The target for a National High Volume Road (SH2 southwest of Melling Link) is 4 star. The target for a National Road (SH2 northeast of Melling Link) is high 3 star or 4 star. Of particular concern is the 2 star section which passes Tirohanga Road, and the 3 star sections adjacent to the Melling Link intersection.

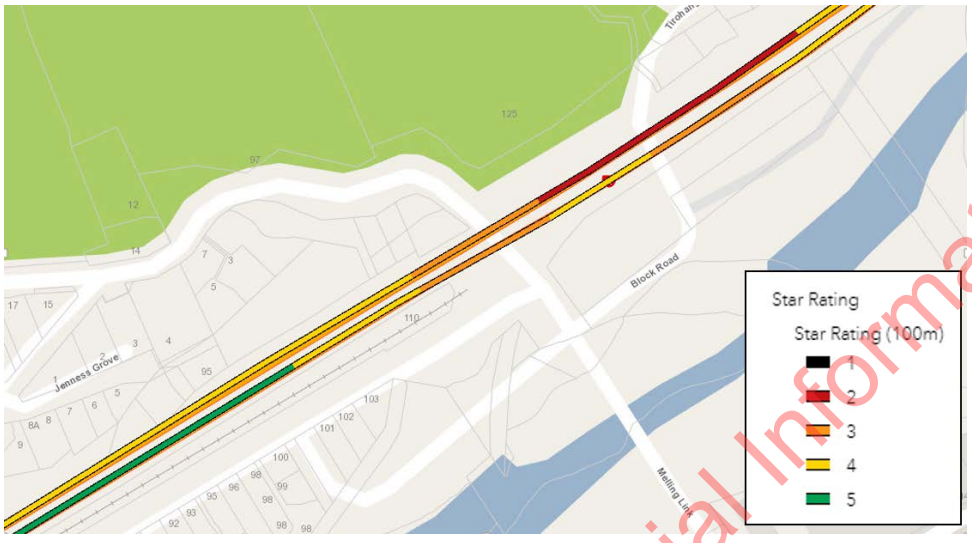


Figure 6-1: KiwiRAP Infrastructure Star Rating Map for SH2 at Melling

The star ratings for SH2 reflect that traffic signals are located within a high speed environment which is highly undesirable and does not fit within the Safe System philosophy. These traffic signals are the first impediment to the free flow of vehicles on the expressway environment travelling north from Wellington and are out of context with the form and function of this route. The presence of traffic signals combined with capacity constraints at this intersection result in significant queuing during peak hours. Rear-end crashes are therefore a common occurrence, accounting for 40% of the crashes at this intersection. The two serious injury crashes on the southbound approach both involved motorcyclists in queuing traffic – one was a rear end crash and the other a lane change to avoid stationary traffic. However, the two serious injury crashes at the Melling Link intersection were a result of vehicles running the red light and colliding with other traffic.

6.1.1.2 Crash Totals

Within the study area[13] there were 181 reported crashes of all types and injuries between 2014 and 2018. Figure 6-2 shows the breakdown by severity and year.

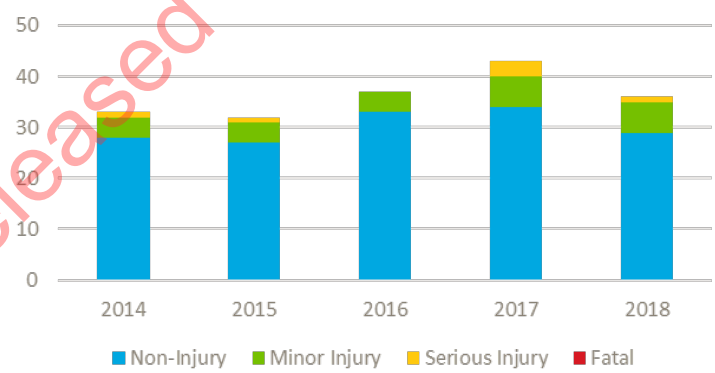


Figure 6-2: Annual distribution of crashes by severity (2014-2018)

[13] SH2 and intersections with Melling Link and Block Road; Rutherford Street and intersections with Melling Link and Queens Drive; High Street and intersections with Melling Link and Queens Drive, Melling Link

The total number of crashes fluctuates, with no clear trends emerging over the five year period. The number of reported crashes peaked in 2017, but this was not sustained in 2018. More serious injury crashes occurred in 2017 (three), which equals the total for all other years combined. Minor injury crash numbers were higher during both 2017 and 2018 compared to the previous three years.

6.1.1.3 Crash Type and Location

The heat map in Figure 6-3 shows where the main crash clusters[14] are located, and the stars indicate the location and year of the serious injury crashes. The crashes analysed on SH2 extend approximately 200m south of the Melling Link intersection and approximately 150m north of the Block Road intersection.

The majority of crashes within the study area are intersection related, with the SH2/Melling Link and High Street/Melling Link recording 34 and 33 crashes respectively (2014-2018). The two intersections are quite different with the former being a multi-lane traffic signal controlled crossroads and the latter being a small radius roundabout with two lane approaches on each of the four legs.

Of the serious injury crashes, four were on SH2 (two at the intersection and two on the northern approach to the intersection), and 1 each at Melling Link/Rutherford Street and Melling Link/High Street intersection.

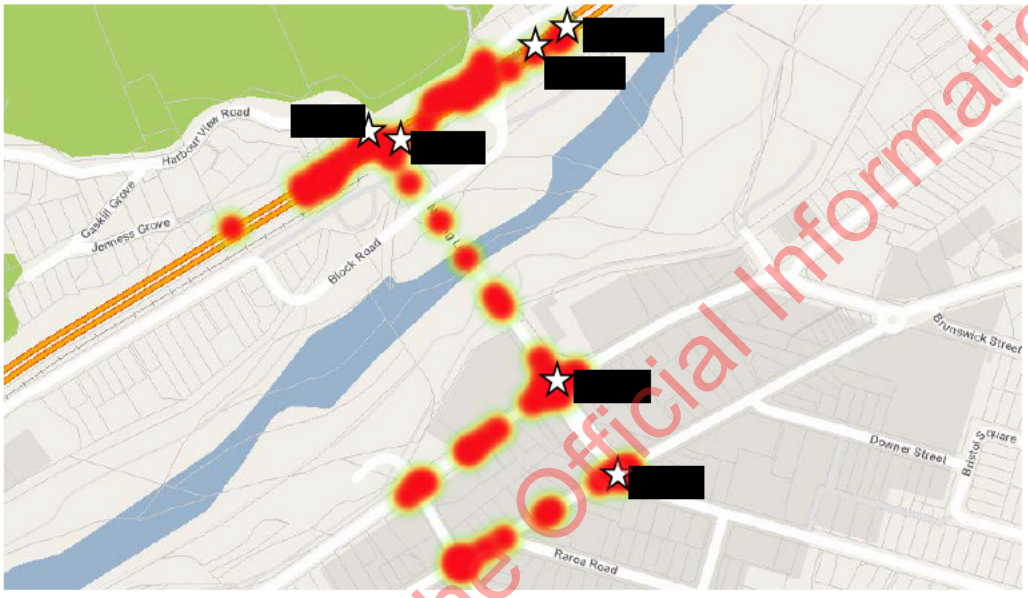


Figure 6-3: Crash Clusters and Location/Dates of Serious Injury Crashes, 2014-2018 (Source: CAS)

The most common type of crash in the study area is a rear end crash, making up 40% of all crashes. Crashes at the six main intersections are summarised in Table 6-3.

Table 6-3: Intesection Crashes and Intersection Collective Risk

Intersection	Main Crash Types	Injury crashes	Intersection Collective Risk
Melling Link/High Street	Failure to give way Rear end crashes	1 serious 4 minor	Medium collective risk[15]
SH2/Melling Link	Rear end crashes	4 serious 4 minor	High collective risk[16]
SH2/Block Road	Rear end crashes	2 minor	Medium collective risk[4]
Melling Link/Rutherford Street	Wide range of types	1 serious 3 minor	Medium collective risk[3]
Rutherford Street/ Queens Drive	Range of types	None	
Queens Drive/ High Street	Crossing movements Rear end crashes	3 minor	

[14] The clusters shown on the map include all reported crashes
[15] Calculated using estimated DSI equivalents from High Risk Intersection Guide (NZTA, 2013)
[16] Information from SafetyNET (2018)

6.1.1.4 Risk

The High Risk Intersection Guide defines an intersection as high collective risk if it has three or more serious injury crashes or fatalities in a five year period. Considering the SH2/Melling Link/Block Road intersections have had four serious injury crashes in the five year period 2014-2018, it therefore classifies it as a high risk intersection that should be addressed. In addition, all four serious crashes involved motorcycles, which is an identified area of focus in the Safer Journeys strategy.

Figure 6-4 shows the Corridor Collective Risk for SH2 within the study area. Collective Risk is based on the total number of crashes within a section of road. The corridor Collective Risk is High on SH2 for both directions to the north of the Melling Link and Block Road intersections. The SH2/Melling Link intersection itself is classified as High risk. South of the Melling Link intersection, the northbound lanes are classified as High risk, while the southbound lanes are Medium-High risk. The overall high level of risk is expected given SH2 has two signalised intersections in close proximity in a 100km/h speed environment.

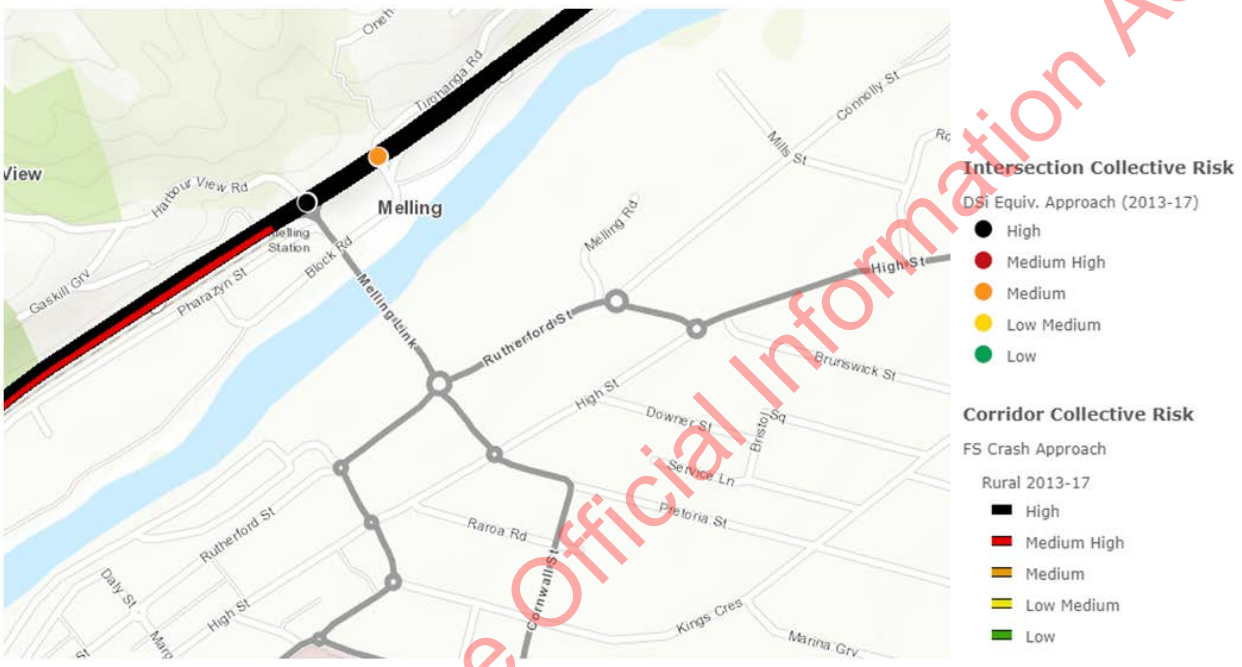


Figure 6-4: SH2 Collective Risk 2013-17 (MegaMaps, 2019)

6.1.1.5 Consequences

The lower than desirable infrastructure star rating for a National High Volume and National Highway is manifesting in a high collective risk at the SH2/Melling Link intersection. It is notable that vulnerable users (motorcycles) are represented in all four serious injury crashes on SH2. The stretch of SH2 is also noted on the High Benefit Speed Management – top 10% DSI saving that would benefit from a lower speed limit.

The two predominant consequences of crashes are injuries and delays. There have been six crashes that resulted in six serious injuries in this period. Three of these crashes were reported in 2017 which was a significant increase on previous years. Four of the serious injury crashes were on SH2 at the Melling Link intersection, involving motorcyclists approaching the intersection travelling southbound. Injury crashes have an overall cost to society estimated in 2018 at $458,000 for a serious injury and $27,700 for a minor injury.

The other effect of crashes is the ensuing delay created for other road users when a crash closes a lane or a link. When a serious or fatal crash occurs it can cause delays over many hours while emergency services attend the crash site. Due to the fragility of the wider transport network during peak periods, non-injury rear-end crashes may also result in significant delays. This effect is part of Problem 4 (section 7.4).

6.1.2 Problem 2: Access

High and increasing traffic volumes, combined with intersections with insufficient capacity and underutilisation of PT and active modes, leads to delays at peak times and weekends reducing the accessibility of goods and services in Hutt City (30%)

Table 6-4: Access Problem Overview

Cause	Current demand exceeds the capacity of the intersections: • In the morning peak, for southbound travel from Melling Link and from further north on SH2 • In the evening peak the volumes turning out of Melling Link and Block Road conflict with the right turn on to Melling Link • The single lane eastbound across the Melling Link Bridge precludes providing a double right turn to improve accessibility because of the need to retain two lanes westbound in all periods • The intersections on the eastern side of the river limit the amount of traffic that can be serviced by the Melling Bridge. • Hutt River, rail and highway corridor divide some parts of the Lower Hutt community and make it difficult to easily and safely get to essential goods and services in and near Hutt City Centre • Underutilisation of rail service due to constrained car park for Park & Ride and poor access for active mode users (refer Problem 3 evidence). THe 145 bus services the Park & Ride facility. • Underutilisation of active modes due to poor level of service (refer problem 3 evidence)
Effect	• Creates delays and means travel times are increasingly variable during peak hours and weekends. • Customer insights data shows people in private vehicles avoid the SH2 Melling intersections, using local roads instead.
Consequence	• Longer travel times and reduced accessibility to Hutt City Centre goods and services including Hutt Hospital • Longer travel times and trip distances for those taking alternative routes to avoid the Melling intersections, which is inefficient and increases traffic on routes that may be unsuitable • More traffic on local roads rather than on SH2, which has negative effects on safety and amenity • Bus travel becomes unreliable and the service is unattractive.

This section of SH2 and the local roads carry high volumes of traffic, as shown in Figure 6-5. The highest volumes are experienced on SH2. There are three possible connections[17] between SH2 and Hutt City Centre, with the Melling Link providing the most direct connection, and therefore the busiest, at 23,400 vehicles per day.

Figure 6-5: Daily traffic flows in the study area

The high traffic volumes and inadequate intersection capacity results in delays. Figure 6-6 shows southbound vehicle speeds at different times of day, from 2km upstream of the Melling Link intersection to 2km downstream. A similar pattern is evident for northbound traffic. At all times of day speeds are significantly slower at the Melling intersection as a result of the traffic signals. Average traffic speeds are reducing to 10km/h in some instances, whereas the speed limit is 100km/h.

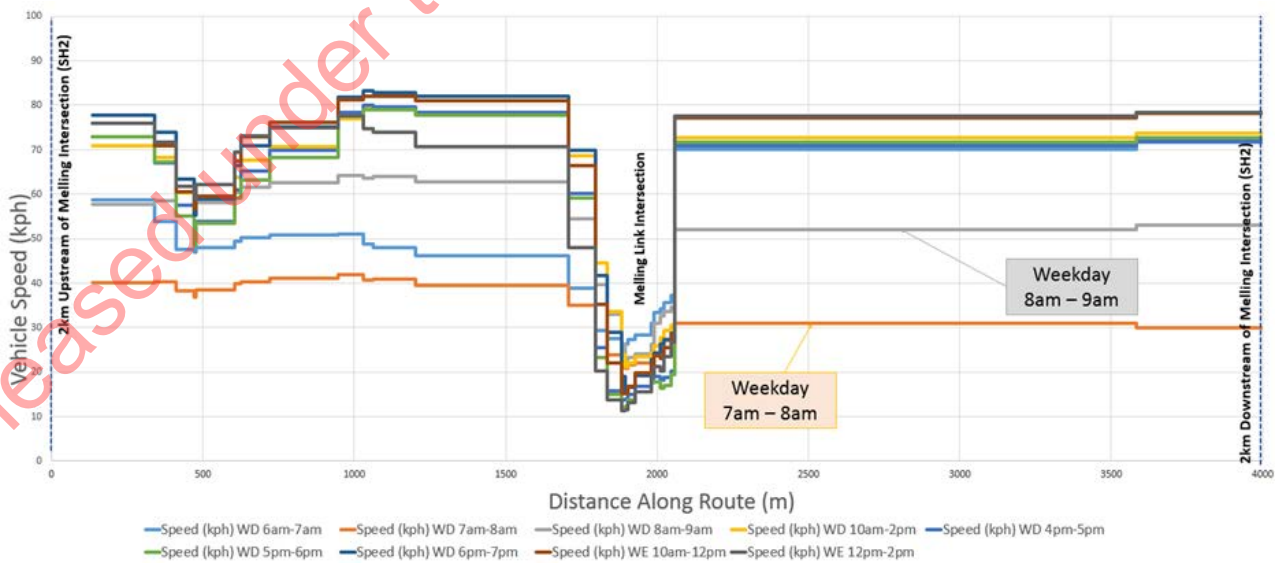


Figure 6-6: Travel speeds on SH2 southbound 2km either side of Melling Intersection (Source: TomTom data)

[17] Melling Link, Dowse interchange and Kennedy Good Bridge.

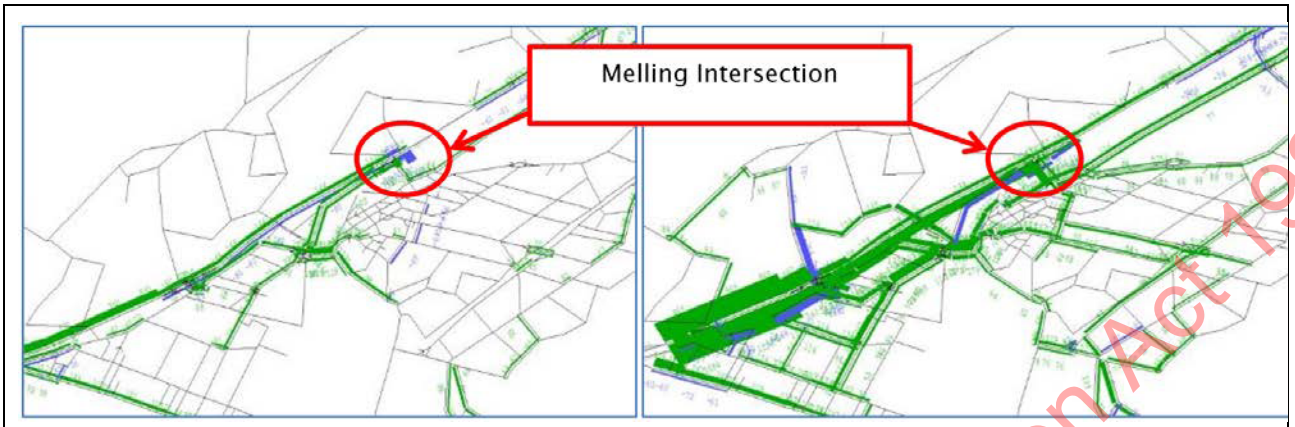
The queues at the Melling intersections can become very long at peak times. Queues also extend at the other intersections in the vicinity as shown in Figure 6-7 and Figure 6-8. In the morning peak the longest queue is 1.5km on the southbound approach of SH2, and in the evening peak the longest queue is over 250m on the Melling Link approach for traffic turning both left and right onto SH2. Traffic queues cause travel time delays and create safety issues. Three of the four serious injury crashes on SH2 in the vicinity of the Melling intersections were caused by queues.

Figure 6-7: Queuing Morning Peak Period

Figure 6-8: Queuing Evening Peak Period

The opening of Transmission Gully in 2020 is expected to bring 4-5,000 more vehicles per day to SH58 and SH2. This will increase the volumes using the Melling Intersections. HCC's Urban Growth Strategy is also expected to increase the population in Lower Hutt, as well as those living in the city centre. This will compound existing issues. Traffic modelling for 2011, 2021 and 2031 is shown in Table 6-5. This shows the locations where traffic flows are predicted to increase (green) and decrease (blue). The image on the left shows some traffic growth on the network to 2021, whereas the image on the right shows significant traffic growth between 2021 and 2031, once the Transmission Gully and Petone to Grenada upgrades are completed. This image shows there is little or no growth on SH2 north of Melling, which may be because the intersection is at capacity and presents a constraint to growth.

Table 6-5: Comparison of growth on network with and without other network upgrades (Source: SATURN Traffic Model)



Daily flow comparison between 2011 base and 2021 Do Minimum model – shows growth in traffic	Daily flow comparison between 2021 and 2031 Do Minimum Model – shows impact of Transmission Gully and Petone to Grenada upgrades

For a National High Volume highway, which is defined as a 'state highway that makes a significant contribution to the social and economic wellbeing of the country by connecting major population centres, international ports or major airports', delays have wide reaching economic effects on prosperity regionally and nationally. Anticipated traffic increases will exacerbate these delays.

Data on underutilisation of public transport and active modes is presented in Problem 3. It shows that those living on the hills (Tirohanga Drive/Harbour View) have a much higher percentage of people using a motor vehicle to travel to work (80% compared to 64% for those living on the flat), a much lower percentage of people walking to work (12% compared to 3%) and a lower percentage using public transport (both bus and train).

The consequences of this constrained capacity, travel delays and unreliable travel times are that accessibility to Hutt City Centre goods and services, including the hospital, is reduced. The reliability of bus services passing through the area is affected, reducing the attractiveness of the service. Business profit margins are eroded as goods take longer to get to market, and business travel is affected. The poor operation of the intersection may erode the attractiveness of Hutt City Centre as a destination for visitors and shoppers. The parallel river, rail and highway corridor cuts the Lower Hutt community in two and forms a barrier, which reduces the accessibility of Hutt City Centre and hospital. The route to Hutt City Centre is not direct or legible for new users.

One of the key findings from the Customer Insights survey was that many people who avoid using the Melling intersections, using a variety of alternative routes instead. This is because of safety concerns, congestion, navigation issues and traffic delays. Figure 6-9 shows the change in traffic flow with an interchange option at Melling from the Saturn traffic model. Traffic decreases on local roads (shown in blue) and increases on SH2 (shown in green). It is far better for this traffic to be accommodated on SH2 which provides for through movements, rather than on local roads where it has a negative amenity and safety impact and can add to distance travelled.

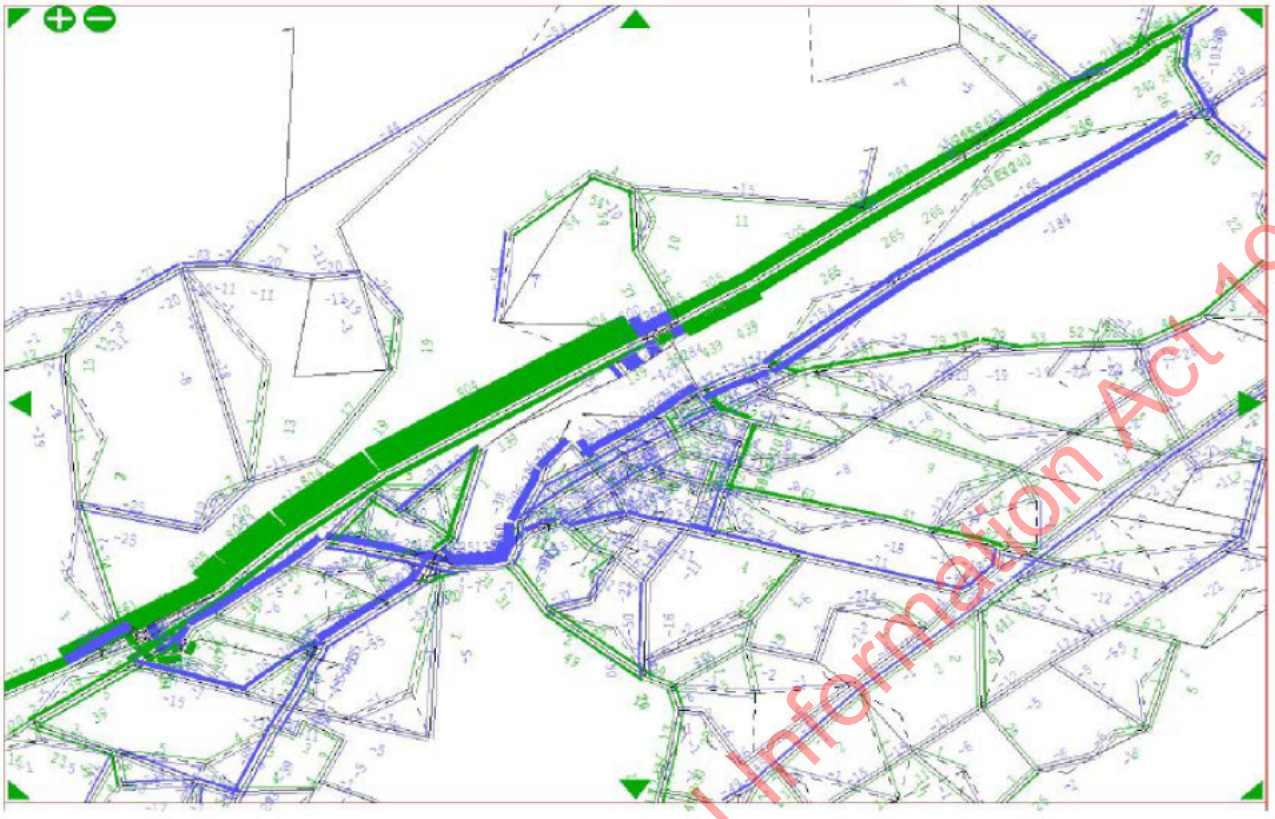


Figure 6-9: Change in traffic flow with an interchange at Melling (evening peak). Green shows increase in traffic, blue decrease

6.1.3 Problem 3: Transport Choice

The quality of infrastructure constrains access to alternative modes and leads to unnecessary car travel between SH2 and Lower Hutt at Melling and suppresses access by, and use of, these modes (15%)

Table 6-6: Transport Choice Problem Overview

Cause	• The lack of safe, connected and efficient pedestrian and cycle connection/facilities between Hutt City Centre, Melling Station and the Western Hills • Hutt River, rail and highway corridor separate some Lower Hutt communities from essential goods and services in and near to Hutt City Centre • Demand for parking at Melling Park and Ride exceeding capacity • Traffic dominated environment reduces amenity for active modes • Buses delayed by traffic at the Melling Intersections
Effect	• Active mode and public transport facilities do not meet customer expectations • Community severance due to location of river, rail and highway corridor
Consequence	• Greater car use than is necessary or desirable for the network • Reduced reliability of travel by car and bus • Supressed demand for active travel • Social exclusion • Negative environmental impacts (air pollution, fossil fuel use) • Increased safety risk for active modes.

Melling Link is the only route between Hutt City Centre, Melling Station and the hillside communities. SH2, the railway line and Hutt River act as barriers. The Melling Link itself also presents a barrier to uptake of walking and cycling due to the poor quality or absent infrastructure for these modes. For example, there are:

- No on-road or off-road cycling facilities on the Melling Link Bridge, on SH2 (which is a high speed road with no shoulders in some locations) or on the local road network
- Narrow footpaths on Melling Link over the Hutt River

- Car dominated environment
- Narrow, steep and disconnected footpaths on Harbour View Road
- No controlled or protected facilities at the roundabouts on the eastern side of the river
- No street lighting on some of the pedestrian connections e.g. the stopbank footpath that runs behind Harvey Norman, which is currently narrow and unlit, and is the shortest route for people walking between the city centre and Melling Station.

Access by active modes to Melling Station, Hutt City Centre and the surrounding suburbs is poor. The route between the station and the city centre is indirect and circuitous, being about 500m longer than a direct route. It also involves using the substandard walking and cycling infrastructure on the Melling Link. The lack of quality walking and cycling facilities will act as a deterrent to use and reduce the number of people walking and cycling across SH2 and the river to the station and the city centre.

Census data from 2013 was used to understand the modes which people use to travel to work. Figure 6-10 compares mode choice for those living on the 'Hill' (Tirohanga Area Unit and ten other meshblocks representing properties accessed from Harbour View) and those living on the 'Flat' (Hutt Central Area Unit) with figures for Lower Hutt and Wellington City Council areas, and national figures.

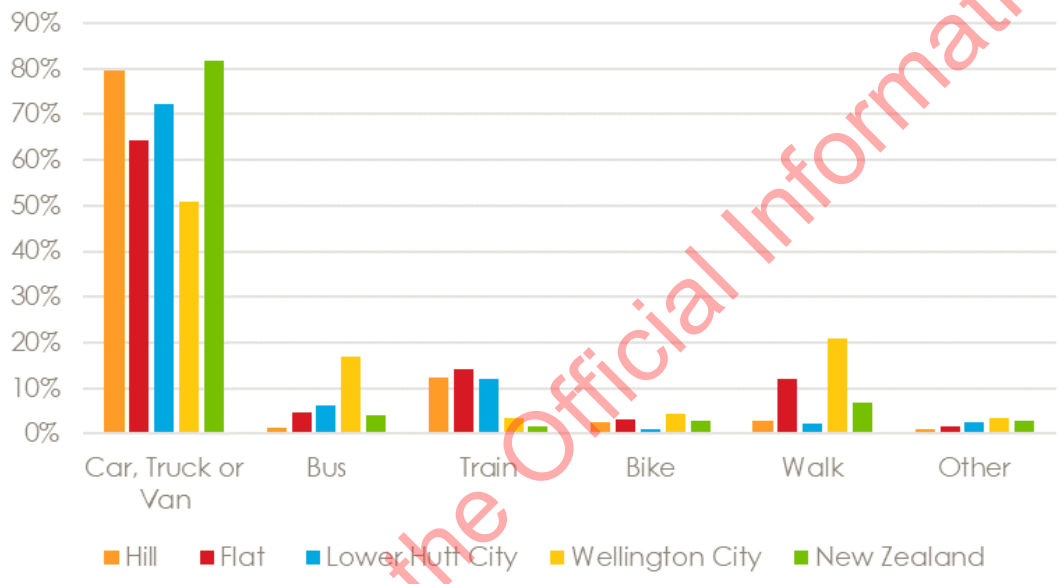


Figure 6-10: Mode Splits Comparison (Source: Census 2013)

The data shows the preferred modes are quite different between those living on this hills and those living on the flat. For those living on the hill, 80% use a motor vehicle, compared to 64% of those on the flat. Only 3% of those living on the hill walk compared to 12% of those living on the flat. Bus use is higher for those living on the flat, and train use is also slightly higher. This data suggests that the severance of effect of SH2 and Melling Link has a significant effect on mode of travel to work, with walking and public transport less attractive. Cycling rates are the same for both locations.

There are trains throughout the weekday from Melling Station, and a Park and Ride facility is provided. However in 2010, a survey showed that the parking facilities do not meet demand, with the main car park (155 spaces) fully occupied by 8am, and the secondary car park (45 spaces) full by 9.15am (Figure 6-11). It is likely demand has increased since 2010 however no more recent data is available.

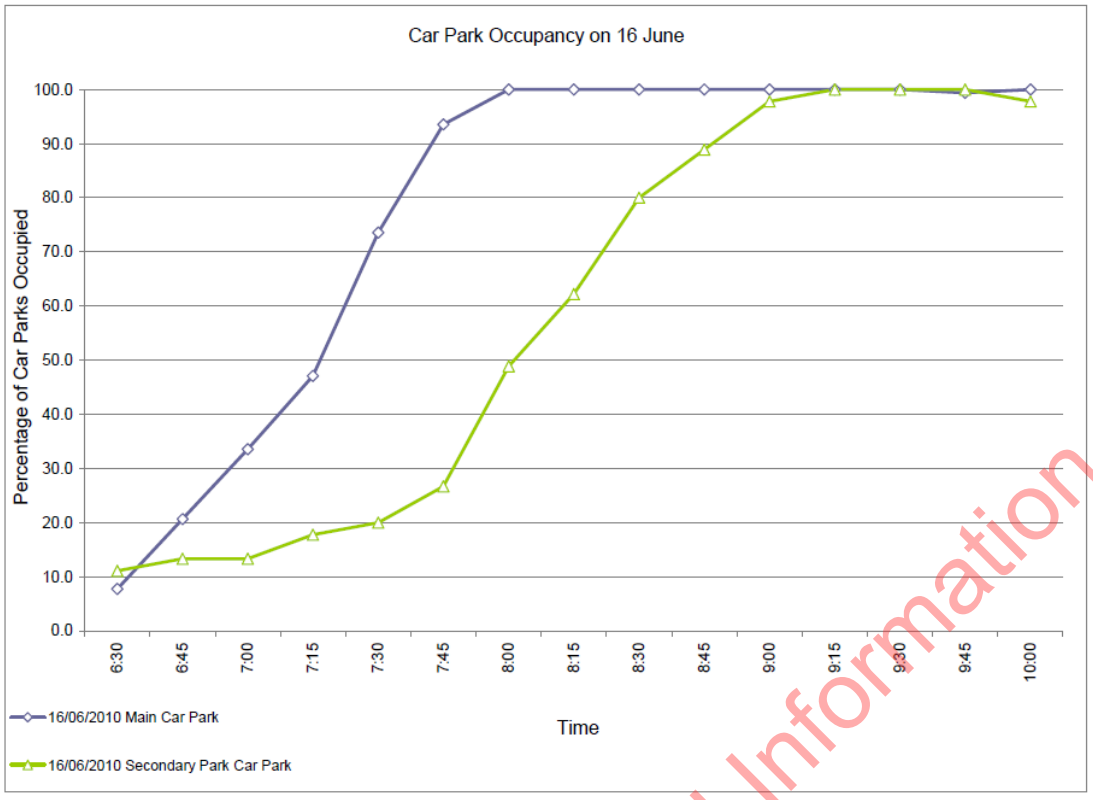


Figure 6-11: Melling Park and Ride Car Parking Survey (Source: Melling Railway Line Survey, 16/6/10)

Six bus services travel through the study area. Only one stops at Melling Station (Route 145 which operates 14 times per day, refer Figure 2-2). There are no services in the suburbs of Harbour View and Tirohanga, and it is noted that the steep topology of these suburbs could be a hindrance to people making the decision to walk or cycle to Melling Station or Hutt City Centre.

The combined effect of the barriers presented by the river and the current infrastructure, the poor quality of the walking and cycling facilities, the limited Park and Ride capacity and limited public transport feeder services is that:

- Active and public transport mode use is suppressed, and the opportunity to capture more of this travel market to reduce congestion and realise health/environmental benefits is missed.
- There is underutilisation of the seated train capacity on the Melling line.

Figure 2-2 displays the flows by each mode in the morning peak, and public transport routes and frequencies.

The 2010 survey asked how people got to the station, with 70% driving and 30% using active or public transport. It was noted that only half of those living within walking distance of the station actually walked there. This suggests there is scope to increase the active mode share.

The survey also noted that there between 170 and 240 people boarded at Melling Station between 6.30am and 9.30am, and that the trains are only about half full when they leave Melling Station, which demonstrates underutilisation of public transport. There is additional capacity for rail trips on the network, which would also help to reduce congestion.

Poor provision and network design for public and active transport leads to low uptake and higher personal vehicle use. In turn, the higher vehicle use leads to a greater exposure to vehicle related safety issues associated with travel in this area, and contributes to deteriorating network reliability (as described in the previous problems). Low uptake of active modes also means health and environmental benefits are lower than they could be, for individuals and the community. Increased use of active modes has been linked to more social and liveable communities, with potential flow on to economic activity in Hutt City Centre.

The 2013 census data shows the mode share for walking and using public transport to get to work, is supressed for those living on the hills west of SH2 Melling intersections compared to those living on the flat in the Hutt Central Census Area Unit. Cycling rates are the same.

6.1.4 Problem 4: Resilience

A high crash risk and flooding in storm events results in journeys through the Melling intersections being impacted on a regular basis.

Table 6-7: Resilience Problem Overview

Cause	• High crash risk and surface flooding during storm events. • Proximity of the transport corridor to natural hazards, with limited alternative routes. • Inadequate stormwater drainage capacity.
Effect	• Reduction in capacity or forcing traffic to use an alternate route via the Dowse Interchange and local roads. • Lane or road closure. • City network congestion. • Delays on SH2.
Consequence	• Increased travel time and reduction in reliability for affected users and those subject to diversions.

Crashes and weather events can cause delays and diversions for people travelling through the Melling intersections. Table 6-8 summarises the frequency of events on SH2 in the study area during the five year period to June 2018. Flooding was the most common natural event affecting SH2. Using the TREIS commentary it can be assumed that during the period, the Block Road intersection was closed thirteen times, with six of those in the 2016/17 year. Breakdowns were the most common non-natural event recorded, followed by crashes.

Table 6-8: Summary of events that occured on SH2 within study area (Source: TREIS five years to June 2018)

Event Type	Approximate Frequency (2013-18)	Average Occurrence
Crashes	48 events	10 per year
Breakdown	68 events	14 per year
Obstruction	29 events	6 per year
Surface flooding	39 events	8 per year
Slips or fallen trees	2 events	1 every 2.5 years
Traffic signal fault	36 events	7 per year
Total events[18]	**216 events**	**45 per year**

All flood events recorded in TREIS for SH2 since June 2013 are caused by surface water due to insufficient capacity or blockage of the stormwater network. Block Road flooding is a result of the Hutt River breaching its banks during high intensity events. The likely flood effects from a 1 in 440 year return period event is shown in Figure 6-12. In this scenario Block Road floods first (refer Figure 6-13), followed by the Melling Link Bridge. SH2 would follow but this would be very unlikely as it is above the level of the proposed new stopbanks.

[18] If all occurred in isolation

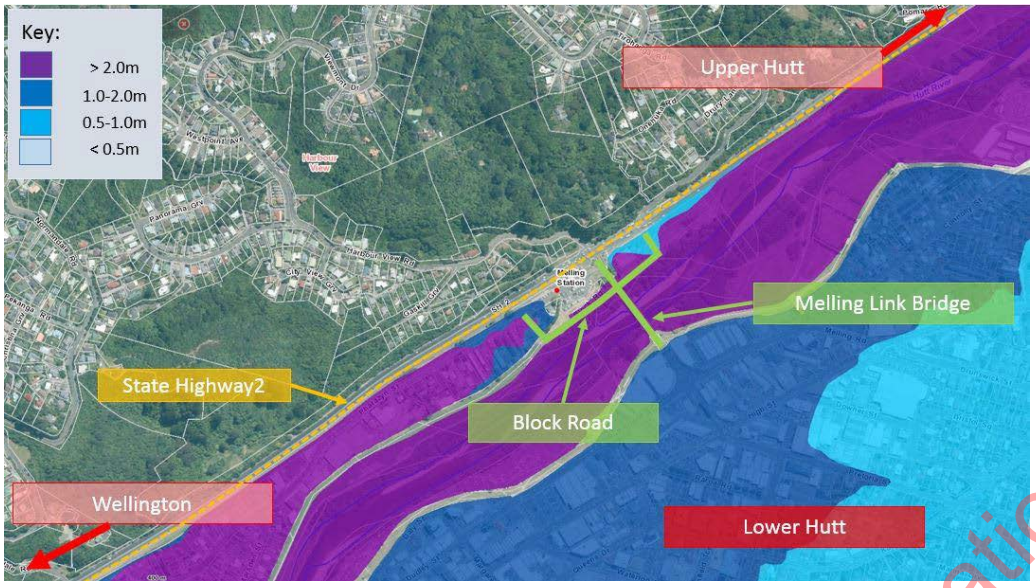


Figure 6-12: Flooding in 1 in 440 year event without stopbank upgrade

Figure 6-13: Block Road Flooding

Unplanned events reduce the capacity of the transport network by making lanes or links unavailable for an unforeseeable length of time, which depends on the severity of the incident, or forcing traffic to use an alternate route. The evidence from TREIS shows that events affect the intersection area every 1-2 weeks on average. Resilience is also about how well the network can cope with such disruptions. For SH2, there are few suitable alternative routes for parts of the network. Detours cause redistribution of traffic on to parts of the local road network that are not designed to function as highly trafficked streets, such as streets in the Hutt City Centre (refer Figure 6-14).

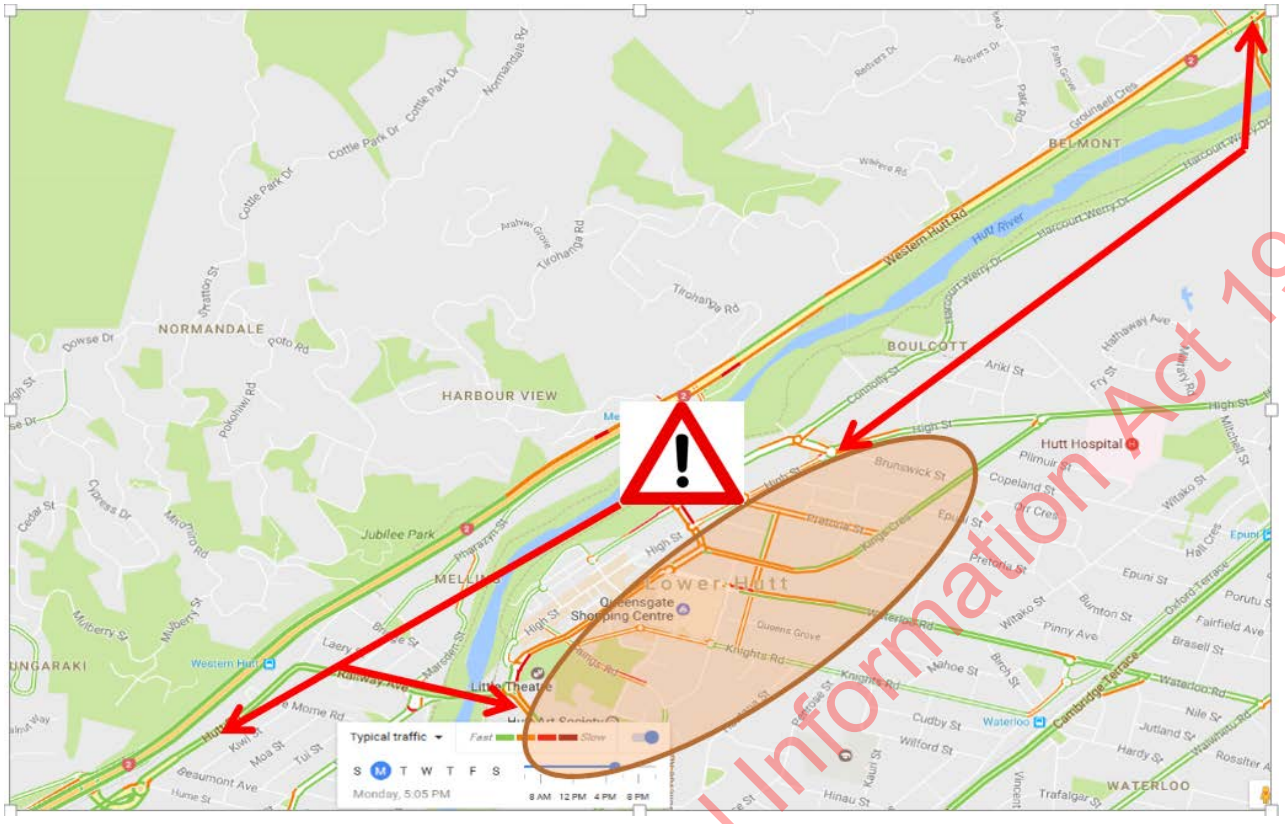


Figure 6-14: Localised Detour/Alternative Routes

If there is a closure of SH2 at the Melling intersections it is likely that highway traffic will be diverted onto the local road network as shown in Figure 6-14. However, if a more significant section of SH2 is unavailable, the alternative inter-regional route is via SH58 and SH1, as shown in Figure 6-15. SH58 is a two-way, two lane route through challenging topography which is not designed to carry large volumes of traffic, and adds an additional 30km of travel between Wellington and Lower Hutt. This equates to an additional half hour of travel time in off peak periods; vastly more in peak periods. The unpredictable nature of such events results in a greater economic impact, when compared to regular and expected congestion on the network. These events lead to delays for all road users and erosion of profit margin for commercial activities relying on the transport network. This impacts economic productivity in the wider region.

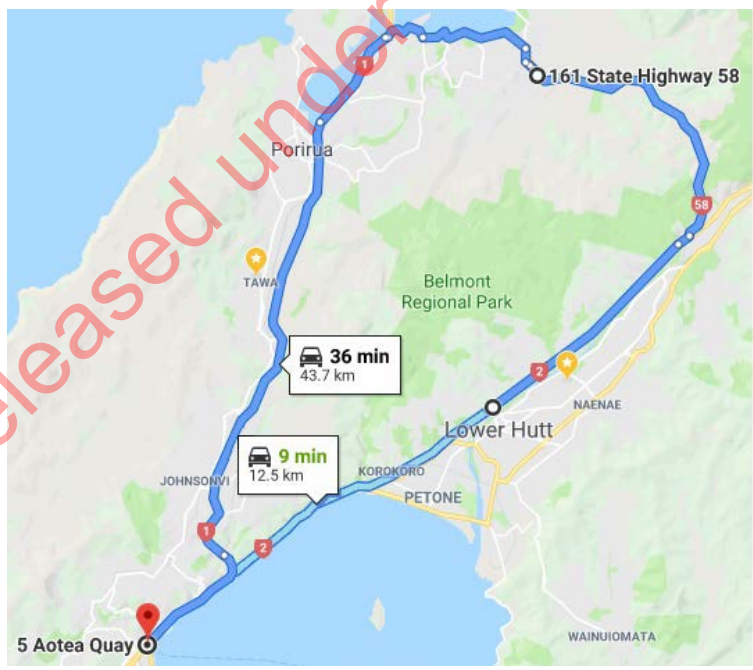


Figure 6-15: Inter-regional state highway detour route

6.1.5 Customer Insights Survey

The data shows issues with safety, access and resilience at the SH2 Melling Intersections. In 2016, the Transport Agency undertook a Customer Insights survey in October 2016, to understand how people using the intersections feel about them. These insights align with and support the problem statements. Key themes were:

- Hutt City is considered a great place to live and bring up families – there are excellent schools, services, retailers and recreational activities.
- There are many people who aim to avoid using the Melling area, using a variety of workarounds to do so.

"We avoid Melling. We go up to Kennedy Good Bridge from Lower Hutt to get out, even though Melling is closer, it's just because of the intersection."

- Safety concerns, congestion, navigation issues and traffic delays are all contributing factors to why people avoid using the Melling intersections and bridge.

"Sit out there at 5:30pm and count the amount of people that run red lights at Kelson, run red lights at Belmont, run red lights [at Melling], they just go."

- People's views about the Melling train station were polarised – for some the station is easily accessible, safe and a pleasant open space. For others the limited frequency of the train service and limited parking are considerable pain points.

"Moving down from Auckland we were blown away by how good the public transport is here."

- There is a 'lack of attachment to place' in terms of Melling being the gateway to Hutt city or a specific destination.

"*Ugly, industrial and hard, it's a funnel, which is a different tone from something like gateway. Gateway has a sense of presence…whereas Melling when I use it it's simply a way to get somewhere…it's aesthetically unpleasing but you know, it's a road."*

- There is a complex set of interactions that occur between those travelling along SH2 past Melling, and those using Melling to into and out of the Hutt.
- There is poor allowance for those who don't drive (pedestrians and cyclists) at the intersection and station.

"*Pushbike is a little bit more daunting because realistically if I want to bike into Wellington I have to go along State Highway 2 or take a hell of a long route through Pharazyn Street. There's not a lot of room for cyclists, in fact there's none"*

6.2 Opportunities

The opportunities of investing in Melling Transport Improvements are identified below.

6.2.1 Support the revitalisation of Hutt City Centre

The Melling Transport Improvements represent significant infrastructure spending, which is expected to increase developer confidence in Hutt City and lead to further investment and growth which supports the revitalisation of Hutt City Centre. This effect combined with the improved level of flood protection, would make property development less risky and more viable.

6.2.2 Provide gateway and legible route to Hutt City Centre

HCC's Making Places plan identifies the opportunity to make the turn off from SH2 into a Gateway for Hutt City Centre, and there is an opportunity to improve the urban design elements as well as functionality of the existing road layout. Once traffic arrives in the Hutt City Centre it distributes within the local road network, and many of the roads are similar in terms of their appearance, which makes the route to the city centre difficult to follow. There is an opportunity to provide a more legible journey to Hutt City Centre as part of the Melling Transport Improvements, and also to use the road network adjacent to the city centre to achieve the goal of a more compact urban centre. Anecdotally the customer insights data supports the view that the current road layout is a barrier to accessing Hutt City Centre.

There is also an opportunity to create a legible route to Hutt City Centre for other modes by investment in quality walking and cycling infrastructure along the route across SH2 and river, as well as to and from the

railway station from the Hutt City Centre and Hillside communities. HCC have identified within the Making Places plan a direct pedestrian/cycle bridge from the city centre to the relocated Melling Station which would provide an attractive route and also supports the proposed growth in residential activity within the city centre. Dwellings that are within walking distance of public transport can become highly sought after.

6.2.3 Collaborate to achieve RiverLink objectives and maximise efficiencies

This project presents a significant opportunity for the Transport Agency to collaborate with its partners, the GWRC and HCC, who have worked together to date on the planning and consultation on the RiverLink project. All three organisations are planning to invest in the locality. Each organisation has a different focus, but by collaborating there is an opportunity to develop a package of improvements which can achieve a broader spectrum of outcomes.

The RiverLink Investment Objectives are to:

- Increase flood plain resilience of the Hutt River Valley to reduce the economic and social impacts of a catastrophic flood event – valued at $1.1B of direct damages (and an equivalent amount of intangible damages)
- Improve connectivity between the Hutt City Centre and its adjacent transport corridors and the Hutt River
- Improve SH2 and local road network safety, reliability and multi-modal transport choices
- Provide the opportunity for urban regeneration in Hutt City Centre

There is an opportunity to collaborate through the consenting and designation process, which will maximise land use and transport integration, reduce consenting risk for all partners and provide cost efficiencies.

Collaboration also results in efficiency of effort and streamlining of resources. For example, consultation processes can be run as one package, with no duplication of effort or repetition for community and stakeholders. Land/property purchase can be managed more efficiently, for example as GWRC acquire properties for flood defences they can make an in kind[19] contribution of land they do not need to the partners. In terms of consenting, this can be managed as one package of works, again preventing duplication of effort and costs.

Other opportunities of collaboration include land use and transport integration, and potential District Plan rezoning as a Transit Oriented Development or similar.

6.3 Benefits

The benefits have developed from those identified in the two overarching PBCs, as identified in Table 6-9.

Table 6-9: Project Benefits

Melling Gateway Programme Business Case	SH2: Ngauranga to Te Marua Programme Business Case	Melling Transport Improvements Benefit Statements
An integrated, resilient, safe and efficient transport network	Safer journeys for all users	Safer journeys for all road users
Enhanced Economic Growth	Efficient, reliable journeys that support economic productivity and growth	Improve access by all modes to Hutt City Centre, Hutt Hospital and to/from SH2 during peak periods and at weekends improving the accessibility of goods and services in Hutt City and supporting economic growth
Improved liveability of Hutt City Centre		Improve access to quality transport choices in the vicinity of Melling
A connected, resilient and secure floodplain	Reduce social and economic impact of HILP[20] and LIHP[21] events	Improved security and availability of the road network

[19] An in kind contribution is a financial contribution covering GWRC share of costs, as explained in Part C.
[20] HILP: High Impact Low Probability
[21] LIHP: Low Impact High Probability

It is recommended that a benefit realisation assessment occur post construction to confirm (or otherwise) if the benefits were achieved.

7. Outcomes

7.1 Investment Objectives

Investment Objectives have been developed for the Melling Transport Improvements. The problems and benefits have been used to develop the Investment Objectives. The connections are shown in Figure 7-1.

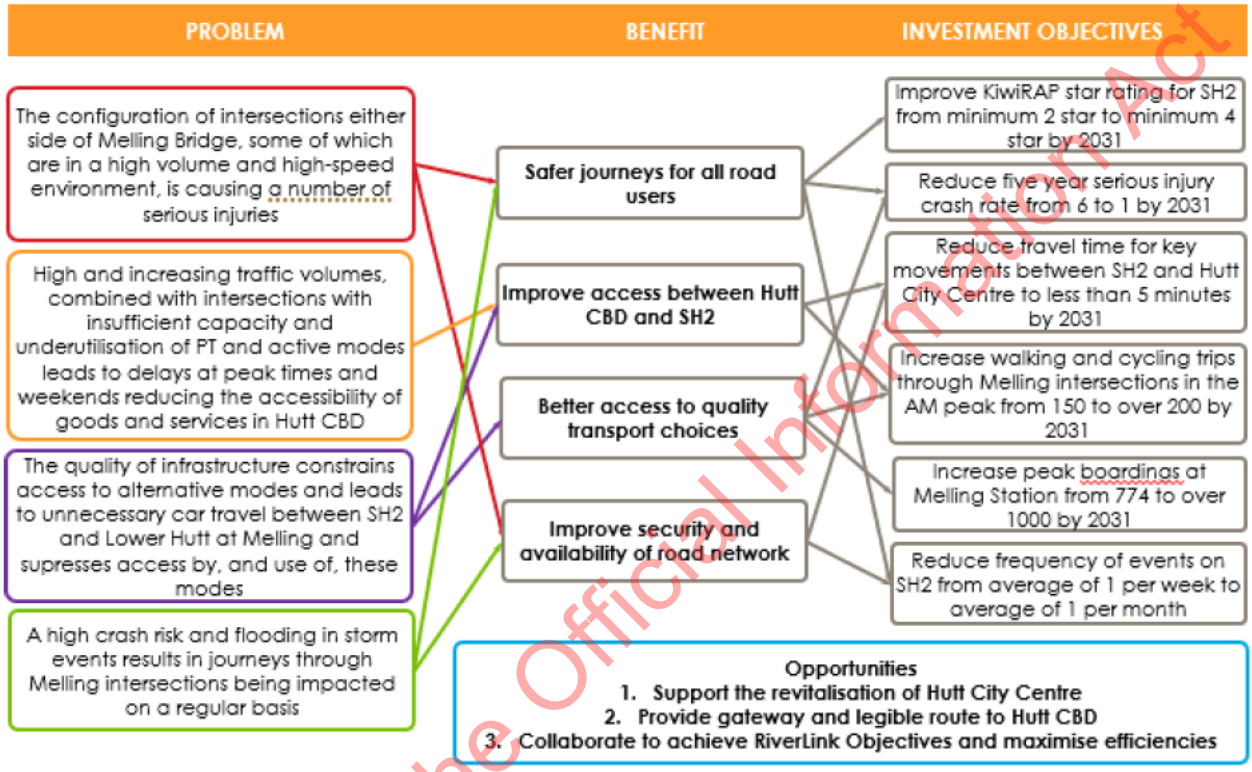


Figure 7-1: Diagram showing development of Investment Objectives

Timeframes for the Investment Objectives will be determined when an implementation programme has been confirmed. At this stage, 2031 has been used as a target date, which assumes implementation of the Melling Transport Improvements begin in 2028, the earliest date for construction as indicated by the Board. Key performance indicators have been identified for each Investment Objective. These will be used to measure the effectiveness of any improvements, and to evaluate the options. These are shown in Table 7-1.

Table 7-1: Indicators and Outcomes

Investment Benefit	Indicator	Investment Objective
Safer journeys for all road users	Road Assessment Rating (State highways)	Improve KiwiRAP Star Rating for SH2 from a minimum 2 star to minimum 4 star by 2031
	Deaths and serious injuries	Reduce five-year serious injury crash rate from six to one by 2031
Improve access between Hutt City Centre and SH2 during peak periods and weekends	Peak period travel time between SH2 and Hutt City Centre	Reduce travel time for key movements between SH2 and Hutt City Centre to less than 5 minutes by 2031
Better access to quality transport choices in the vicinity of Melling	People – throughput of pedestrians, cyclists and public transport boardings	Increase walking and cycling trips through Melling intersections in the AM peak from 150 to 200 by 2031
		Increase peak boardings at Melling Station from 774 to 1000 by 2031

Investment Benefit	Indicator	Investment Objective
Improve security and availability of the road network	Temporal availability – road	Reduce frequency of events disrupting traffic on SH2 from average of one per week to average of one per month by 2031

7.2 Urgency to Address Problems

The evidence shows that the current transport issues are affecting access to Hutt City Centre and will undermine efforts to regenerate and grow the area. With future growth in travel demand resulting from population growth and other schemes such as Transmission Gully reaching completion, there is a need to act now to address the existing issues relating to access, mode choice, resilience and safety. It is expected that pre-implementation activities such as property purchase, designations and consenting could take 4-5 years to complete. The urgent problems to address are:

- Congested SH2 and intersections during peak hours of commuter travel. Queues on SH2 can extend back up to 1.5km during peak hours, which proves the inefficiency of the two signalised intersections. This is causing safety concerns on the highway but also rat-running and putting state highway traffic onto local roads.
- Future flood risk and climate change. The community, businesses and developers want confidence that Hutt City will not flood in a significant rainfall event (possible in a 1-65 year event) and that their lives, property and possessions are protected. Climate Change adds a level of uncertainty to future climate patterns, but scientists predict that it will mean more extreme weather events, which makes large floods more likely.
- Current crash risk (not just historic) will get worse as traffic volumes increase, especially traffic induced by other regional routes that are being upgraded, such as Transmission Gully (and further beyond on SH1) which makes commuting for work from the Kapiti Coast Region a better proposition. There are stretches of KiwiRAP 2 star highway which present a significant risk to death or serious injury. This is also reflected in the Safe System Assessment Framework which has a poor score for the current situation.
- Transmission Gully traffic volumes will add further pressure to an already stressed segment of the Hutt Valley road network.

Natural population growth, let alone the additional urban development as proposed by the Making Places element of RiverLink, will further exacerbate these problems.

7.3 Uncertainty Log

There are several uncertainties which may impact the timing and need for the recommended option. These uncertainties were originally identified in the SH2 Ngauranga to Te Marua PBC and reviewed and updated in mid-2018 for the Project Re-Evaluation. These uncertainties have been revisited and updated for this SSBC and are summarised in the uncertainty log in Appendix B.

The assessment shows that there are no uncertainties that would reduce the need for the project or that would result in the project needing to be pushed further into the future. However, there are uncertainties that could influence exactly when the project could or should be designated and delivered. These fall under two broad areas:

1. Those that will be managed through RiverLink:
   - GWRC need to dispose of surplus land which has been purchased as part of the flood protection works. Some of this land is needed for the interchange and it would be both efficient in terms of cost and process if this land could be directly transferred/sold to the Transport Agency. A decision has not been made that this should happen, nor has a process for land transfer been determined.
   - Co-funding contributions from partners for key elements of RiverLink are included in the respective LTPs. However, for improvements where the benefit is shared between the partners (e.g. River Bridge, Railway Station), co-funding contributions have not been confirmed and there is a risk they may not materialise.
2. Other transport network upgrades which could affect travel demand. These have been modelled, but the uncertainty is around whether the real effects of these upgrades are different to what is expected. The main upgrades are:

- **Transmission Gully:** The impact of this project has been included in the modelling and increased traffic expected to be generated has been considered. However, there is a risk that this demand differs from what occurs upon project opening.
- **Petone to Granada:** This project was recently re-evaluated and found that the need for improved east-west connections generally aligns with the Government's priorities, but further investigation is needed on how best to improve resilience, safety, and east-west transport choice. This means taking a step back and ensuring other east-west options across the state highway network (the triangle formed by SH1, SH2 and SH58) are considered. In endorsing the recommendations, the Transport Agency Board has noted that a link road is required, but funding will be considered later. The re-evaluation recommended that construction of an east-west connection be considered for funding from 2028.

  Transport modelling was undertaken to determine the likely impacts of either the Petone to Grenada Link Road occurring, or a smaller intervention of geometric improvements at the Petone Interchange to improve capacity though this location.

  The Petone to Grenada link is expected to increase traffic on SH2 between Petone and Melling of around 300 vehicles in the peak hour. This will result in significantly increased travel times (up to 5 minutes) for some movements at the Melling Interchange.

  Even capacity improvements at the Petone Interchange will result in an increase in travel time of 2 mins for vehicles turning right into Hutt City in the PM peak.

  Both examples demonstrate that the current intersection in operating at capacity and any increase in demand will result in significant additional delay.

8. Issues and Constraints

This section provides a high level explanation of the expected issues and constraints for the project. These are explored in more detail in Part B, for each option.

- **Environmental:** The most significant environmental issue within the study area is the Hutt River. The riverbanks are vegetated and highly valued by the community for their natural amenity and recreation opportunities. The river floods during storm events and the existing stop banks and the Melling Bridge constraint mean that protection can only be provided up to a 1 in 65 year event (when resilience for a 1 in 440 year event is desired). Impacts on the natural environment within, and adjacent to, the river will need to be considered as part of the selection of a recommended option. Greater Wellington's proposed Natural Resources Plan and the National Policy Statement for Freshwater Management reflect the very high importance of this issue.

- **Property Acquisition:** Much of the land in the vicinity of RiverLink is held in private ownership. GWRC have started purchasing properties required for the flood works. Some property would be additional to GWRC needs, and it is proposed that this land be provided for other RiverLink works.

  Depending on the extent of the Melling Transport Improvements, there are buildings near the existing road network which will be required, or where access will be affected.

- **Resource Management:** Improvement works will trigger the need for consents as required under the Resource Management Act and other legislation. The area is particularly sensitive because of the proximity to the Hutt River watercourse, which would lead to additional consent requirements.

- **Geotechnical:** Geotechnical investigation was undertaken for the short-listed options to understand more about the strength and suitability of soils, underlying bedrock and the floodplain soils. The historic riverbed material is a significant issue. Geotechnical engineering is discussed further in Section 10.3.

- **Available Land:** The project site is significantly constrained with limited land available between the steep hillside and the river corridor. Within that narrow width there needs to accommodate SH2 traffic, local traffic, rail, cycle and pedestrian networks. This could result in closely spaced intersections and means that decisions to accommodate one aspect may negatively impact on other aspects. The lack of available land may necessitate land purchase and/or the use of retaining structures to limit the footprint of the project.

- **Heritage Building:** There is a heritage building located on the western side above SH2, between Harbour View Road and Tirohanga Road. The Transport Agency own this building and property. The building is scheduled in the HCC District Plan and listed as Category 2 Building in the Heritage List / Rārangi Kōrero of Heritage New Zealand. Any options that would require land on this side of SH2 need to be cognisant of this building.

- **Hillside Topography:** Encroachment into the hillside on the western side of SH2 should be restricted as much as possible to limit geotechnical instability risks and negative visual impact.

- **Wellington Fault:** The Wellington seismic fault runs parallel to both the Hutt River and SH2 and is thought to lay between the two. Whilst the exact location of the fault zone is not currently known, a previously estimated location has been used. This would pose a significant constraint on the layout of the intersections and the derivation of options.

- **Rail Line, Melling Station, Park & Ride:** Any new transport solution layout should incorporate any possible future extension of the Melling railway line northwards.

- **RiverLink Stopbanks:** The proposed new positions and crest levels of the RiverLink stopbanks are major constraints and are, for all intents and purposes, non-negotiable. GWRC has expressed the desire that, where possible, no hard infrastructure should be incorporated into the stopbanks to enable and maximise the space available for the river to pass the design flood.

- **New bridge connections south of Melling Link:** A new bridge would need to land at the intersections of Rutherford Street with either Queens Drive or Margaret Street after crossing over the stopbank. The constraint is limiting the amount these intersections would need to be raised whilst retaining the integrity of the stopbank and geometric design criteria for the bridge and intersection approach. Raising the intersection by up to 2.0 metres (or more) would require additional urban design and landscaping treatment to incorporate this into the surrounding current and future environment, as the height difference would be aesthetically unpleasant for adjacent retail and commercial premises.

The Design Philosophy in Appendix C reports on additional constraints for the recommended option.

PART B – OPTION DEVELOPMENT

9. Option Development and Assessment

This section outlines the option development and assessment process which led to the recommended option.

The following sections summarise the optioneering described in the Draft IBC (Part B presented in Appendix D), Further Options Report (Appendix E) and MCA Workshop Report (Appendix F). It outlines how the three shortlisted options for consultation were further assessed to reach a recommended option. It outlines how the investment objectives and MCA criteria were used throughout the option assessment process.

The option development and assessment process was subject to review through the re-evaluation process. The review found that:

- The idea generation process was inclusive of stakeholders and appeared robust.
- The long list option development was transparent and identified features which were crucial to the desired outcomes (identified as 'key principles').
- The revisions to the Investment Logic Map (ILM) arising from the re-evaluation are not likely to significantly influence the outcome of the option development process.

Overall, the finding from the re-evaluation was that 'while minor changes to the ILM are proposed, the relevancy of the existing ILM should not change. Therefore, the outcomes of the options development process remain valid within the current strategic context.'.

9.1 Process Overview

The overall process for the development of options is presented in Figure 9-1. The numbers in the orange ovals represent the number of options remaining at that stage.

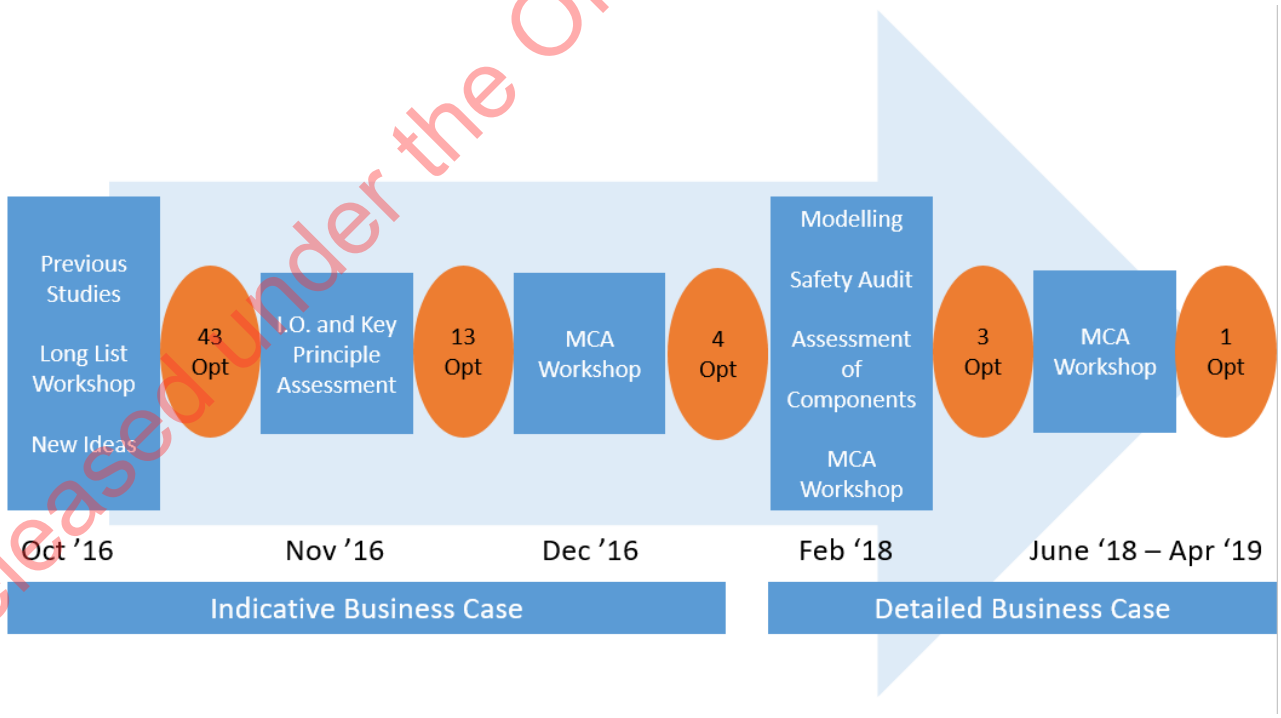


Figure 9-1: Option long list to recommended option process

Options to solve the transport and wider programme issues were identified by holding a long list workshop with the three funding partners, reviewing previous reports as well as the consultant team looking for new ideas. A total of 43 options were identified and subject to an assessment against the Investment

Objectives. This process discarded 30 options as they did not contribute meaningfully to the Investment Objectives.

The remaining 13 options were subject to an initial MCA workshop which identified four options for further investigation in the SSBC. At this point these options were further assessed under three categories of: traffic modelling performance, (external) safety audit of the concept design, and topographical survey investigation into the feasibility of the Tirohanga sub-option. This assessment provided more information about the performance of the options, but in turn also resulted in the identification of further options and sub-options. Therefore, a second MCA was conducted on four design elements, three of which could be included in the design independent of the others.

Following a Transport Agency review of the Safety Audit assessment, Option 11 was discarded. This was due to significant risks relating to the complexity of a Diverging Diamond Interchange that would have been a first for the country, and noted the site is too constrained to enable simple wayfinding which would be needed for such a complex design.

The remaining three options were put out for public consultation. A third and final MCA workshop[22] followed thereafter, which determined the recommended option.

The process is explained in more detail below. A full write up of the options considered and the process used at each stage is in Appendix D and Appendix E.

9.2 Key Principles

The key principles the options should aim to achieve were developed with key stakeholders at the end of the Problem Definition workshop after a long list of options was identified. These were agreed as:

- Traffic to connect into edge of Hutt City Centre - not the core or further away
- All routes for all modes should be legible and all existing connectivity should be retained
- There should be full pedestrian and cycle connectivity, taking desire lines into account
- Retain the ability to extend the Melling rail line further north should the need arise in the future.
- Proposal should allow for the flood protection works which were being designed for a 1 in 440 year event.
- Maintain Melling as the Gateway to the Hutt City Centre with the bridge to connect into road network adjacent to the Hutt River. The location of the bridge is critical for regeneration as it forms a 'gateway' to Hutt City Centre and influences people's first impressions. Ideal locations balance proximity to Hutt City Centre but do not interfere with the proposed slow zone.

9.3 Option Identification

A long list of 43 options was prepared by:

- reviewing previous studies
- developing new ideas that had not been considered previously, and
- through an Option Identification workshop with key stakeholders.

Options identified ranged from at-grade options, to public transport only options to large grade separated interchanges at Melling and grade separated interchanges at other locations.

9.4 Option Shortlisting Methodology

The 43 options were shortlisted by passing through several different sieves. These included:

- An assessment of the options against the Investment Objectives
- An assessment of the options against the Key Principles
- Transport Modelling

[22] Melling Intersection Improvements MCA Workshop (June 2018) Report (NZTA: May 2019)

- Road Safety Audit
- MCA Workshops

The options that did not substantially achieve the Investment Objectives or align with the Key Principles were discarded. This reduced 43 options down to 13. Discarded options are summarised in section and more detail is provided in Appendix D.

Following this point, three MCA workshops were used at appropriate points to move towards a Recommended Option. The process for the MCA workshops and assessment follows best practice including guidance from the Transport Agency and the New Zealand Asset Management Support organisation (NAMS)[23]. At each stage of the MCA process, the 'Decision Conferencing' method was adopted. This method is one where the investment partners, key stakeholders and technical specialists shared information and work through the issues and come to agreement on the principles, the options, the criteria, the weightings and the scoring to be applied to each option. Additional details on some of these steps are provided in Appendix D and Appendix E.

The criteria used to evaluate the options at each of the three MCA workshops are shown in Table 9-1. As indicated in the table, not all criteria were used at each workshop. This reflects the fact that at later stages:

- the options were narrowed down to similar options and therefore there was no differentiation on some of the criteria,
- more detail on the options were available so new criteria could be evaluated.

Whilst the Investment Objectives are not specific criteria, they are reflected by other criteria in the analysis. This relationship is shown in the table below..

Table 9-1: Assessment Criteria used across the three MCA Workshops

Criterion	Relevant Investment Objectives	MCA 1	MCA 2	MCA 3
Transport benefits	Road Assessment Rating Deaths and serious injuries Travel time Temporal availability – road	Y	Y	Y
Fit with local road system	n/a	Y	Y	Y
Utility for non-motorised travel modes	Numbers walking and cycling	Y	Y	
Railway/bus system utility	Number of rail boardings	Y	Y	
Impacts on tangata whenua values	n/a	Y		
Visual and landscape impacts	n/a	Y		Y
Natural hazards management fit	Temporal availability - road	Y	Y	Y
Impact on adjacent land uses	n/a	Y		Y
Urban design opportunities	n/a	Y	Y	Y
Consentability	n/a	Y		Y
Engineering degree of difficulty	n/a	Y	Y	Y
Ability to be staged	n/a		Y	Y
Additional Safety Benefits	Deaths and serious injuries		Y	
Recreational impacts	n/a			Y
Cost	n/a	Y	Y	Y

[23] http://www.nams.org.nz

A five point scoring system was used for each MCA, as outlined in Table 9-2.

Table 9-2: MCA Scoring System

Score	Description
1	The option presents few difficulties based on the criterion being evaluated and/or may provide significant benefits in terms of the attribute.
2	The option presents only minor aspects of difficulty based on the criterion being evaluated and/or may provide some benefits in terms of the criterion.
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and/or problems cannot be completely avoided. There are few apparent benefits in terms of the criterion.
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and/or very limited perceived benefits.
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and/or no apparent benefits.

9.5 Discarded Options

As presented above, a wide range of options (43) were identified at the start of the process, with many options being a slight variation on a common element/theme that grouped them together. Of these, 30 were discarded following an initial screen against the Investment Objectives and Key Principles. Others were discarded through the first two MCA processes before the team settled on the final three options.

This section outlines some of the key option elements/themes and describes why they were discounted through the process. For more detail refer to Appendix D and Appendix E.

9.5.1 Public transport only options

Assessment Criteria		Achieved?
Investment Objectives	Improve KiwiRAP Star Rating for SH2 to 4 star	✗
	Reduce five year serious injury crash rate at SH2/Melling intersections	✗
	Maintain travel time in study area	✗
	Increase walking and cycling trips through Melling intersections	✗
	Increase boardings at Melling Station	✓
	Reduce frequency of events disrupting traffic on SH2	✗
Flood Protection Benefits		✗

The Ngauranga to Te Marua PBC includes a range of public transport interventions for this corridor, including capacity, frequency and reliability improvements for rail and bus. These address the large and increasing demand for travel particularly between the Hutt Valley and Wellington, primarily by improving services on the Hutt Valley Line.

However, the problems at Melling, as presented earlier, are such that they cannot be solved by Public Transport alone. For example, public transport would not significantly address the safety issue as this is due to the layout and form of the road network.

It would also miss the opportunity to address resilience concerns, as a new bridge for public transport only would still leave the floodway restraint of the old bridge, or if only a public transport bridge was available then the key principle of retaining connectivity of all routes for all modes would not be met.

Public transport can improve access to Hutt City Centre. Bus service improvements are included in other options in the long list, rather than as a standalone public transport option.

9.5.2 At grade options retaining the existing Melling Link Bridge

Figure 9-2: One possible at-grade reconfiguration of Melling Link and SH2

Assessment Criteria		Achieved?
Investment Objectives	Improve KiwiRAP Star Rating for SH2 to 4 star	✘
	Reduce five year serious injury crash rate at SH2/Melling intersections	✘
	Maintain travel time in study area	✘
	Increase walking and cycling trips through Melling intersections	✘
	Increase boardings at Melling Station	✘
	Reduce frequency of events disrupting traffic on SH2	✘
Flood Protection Benefits		✘

An at-grade option refers to the treatments at the SH2 intersections with Melling Link and Block Road, that maintains the existing road levels and would retain the signalised intersections on SH2 (Figure 9-2). This option would fail to achieve both the Investment and RiverLink Objectives, particularly on resilience issues, as the current Melling Bridge presents a significant capacity constraint on both the floodway and the road network. Traffic conflict points at the SH2 intersections would also remain and there would be no distinct safety benefit for pedestrian and cyclist movements across (or through) SH2, as they would still be exposed to traffic movements. Right turning traffic from Hutt City would need to travel through the railway station carpark and under the Melling Bridge which exacerbates the existing safety and resilience issues.

Also, if the Melling Rail Line was extended, then a level crossing would be required which is an undesirable outcome for safety and traffic delays.

Under this option type, there would only be comparatively minor journey reliability benefits. These benefits would be restricted to improvements gained by any Block Road improvements.

9.5.3 At grade options connected with a new Queens Drive bridge

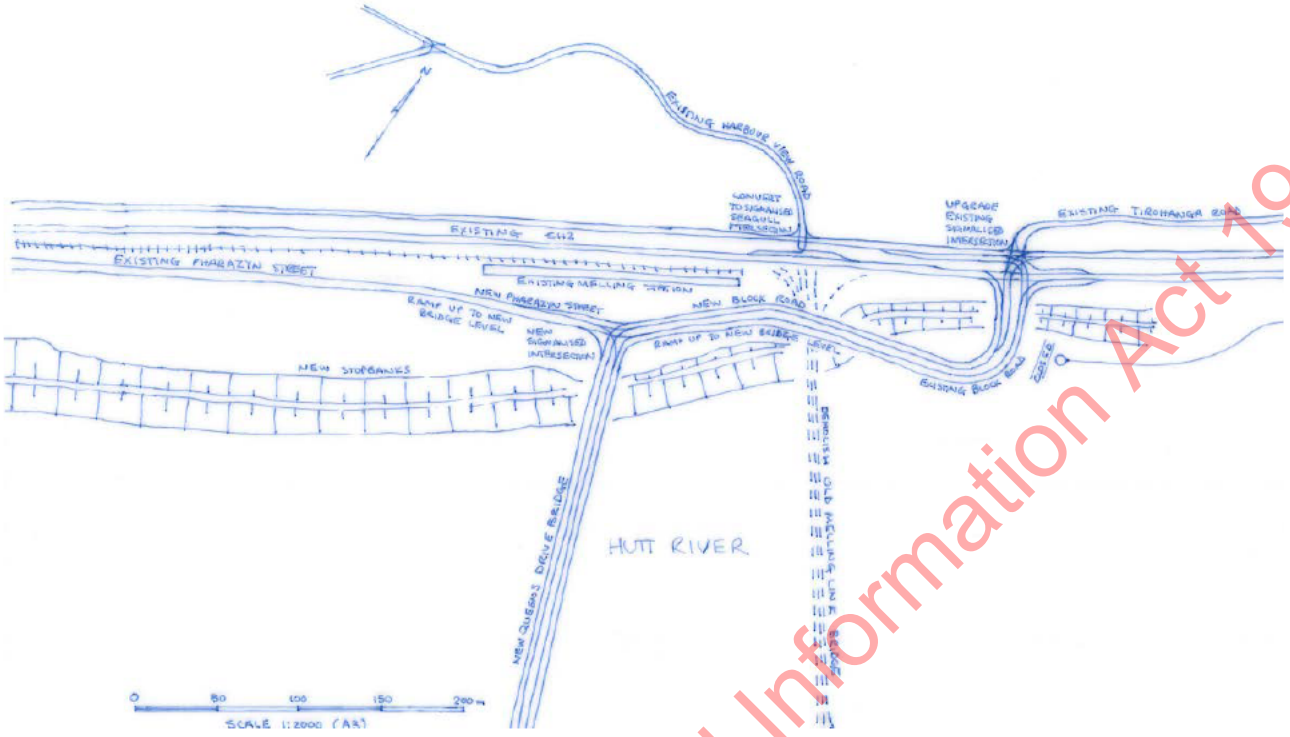


Figure 9-3: Possible reconfigured at-grade option with new bridge

Assessment Criteria		Achieved?
Investment Objectives	Improve KiwiRAP Star Rating for SH2 to 4 star	✗
	Reduce five year serious injury crash rate at SH2/Melling intersections	✗
	Maintain travel time in study area	✗
	Increase walking and cycling trips through Melling intersections	✗
	Increase boardings at Melling Station	✗
	Reduce frequency of events disrupting traffic on SH2	✗
Flood Protection Benefits		✓

This option was developed to determine if an option could be progressed that enabled the flood protection benefits to be realised without significant investment on the highway network. The above option was developed to deliver the requisite flood protection as well as being future-proofed for a future interchange.

A new higher bridge would help to address the flood risk, however retaining a section of road within the floodway would somewhat undermine this objective. This option would not address the safety and reliability issues occurring on SH2, and the conflict points would remain. It is likely the safety issues would worsen over time with increasing traffic volumes and further improvements would be limited by the need to link to the new bridge.

Traffic modelling has demonstrated that the traffic performance would be significantly worse than currently with all movements (except SH2 to Lower Hutt) being delayed by an additional 30s to 2m 40s in the morning peak. It also pushes around 2,000 more vehicles away from this location and probably onto the local road network.

Significant queuing is also predicted on SH2, even for through traffic. Significant queuing is also predicted Block Road, and the queues are predicted to extend back into the Lower Hutt area, creating a grid lock situation on Queens Drive.

The entry location from SH2 to Hutt City Centre changes, with a longer and more convoluted gateway (Figure 9-3). This could be confusing to people unfamiliar with the network and may also negatively affect the RiverLink goal of creating a better 'front door' gateway into Hutt City Centre.

9.5.4 Interchange and bridges in other locations

Figure 9-4: Other indicative new bridge locations

Assessment Criteria		Achieved?
Investment Objectives	Improve KiwiRAP Star Rating for SH2 to 4 star	✓
	Reduce five year serious injury crash rate at SH2/Melling intersections	✓
	Maintain travel time in study area	✗/✓
	Increase walking and cycling trips through Melling intersections	✗
	Increase boardings at Melling Station	✗
	Reduce frequency of events disrupting traffic on SH2	✓
Flood Protection Benefits		✓

New bridges over the Hutt River (Figure 9-4) that connected into different local roads (other than Melling Link or Queens Drive) would change the connection point to the City Centre. A key principle of the Melling project is that the bridge connection should be to the edge of the city centre and not into the city centre core or further away. This ensures the new bridge is a gateway to Hutt City Centre but does not affect the slow traffic zone created to encourage pedestrians and cyclists in the retail area. Bridge locations north of Melling Link were considered out of sync with HCC's desire for Melling to be a gateway into Hutt City Centre and increase travel distances for all road users (particularly those coming from the south). Bridge locations south of Queens Drive would place too much traffic directly into Hutt City Centre, significantly affecting the operation of the commercial area impacting on the amenity sought for the city centre. They also would not tie in well with the public transport or walking and cycling networks.

Only bridge locations at Melling Link and Queens Drive were retained in the short list.

9.5.5 Roundabout interchange

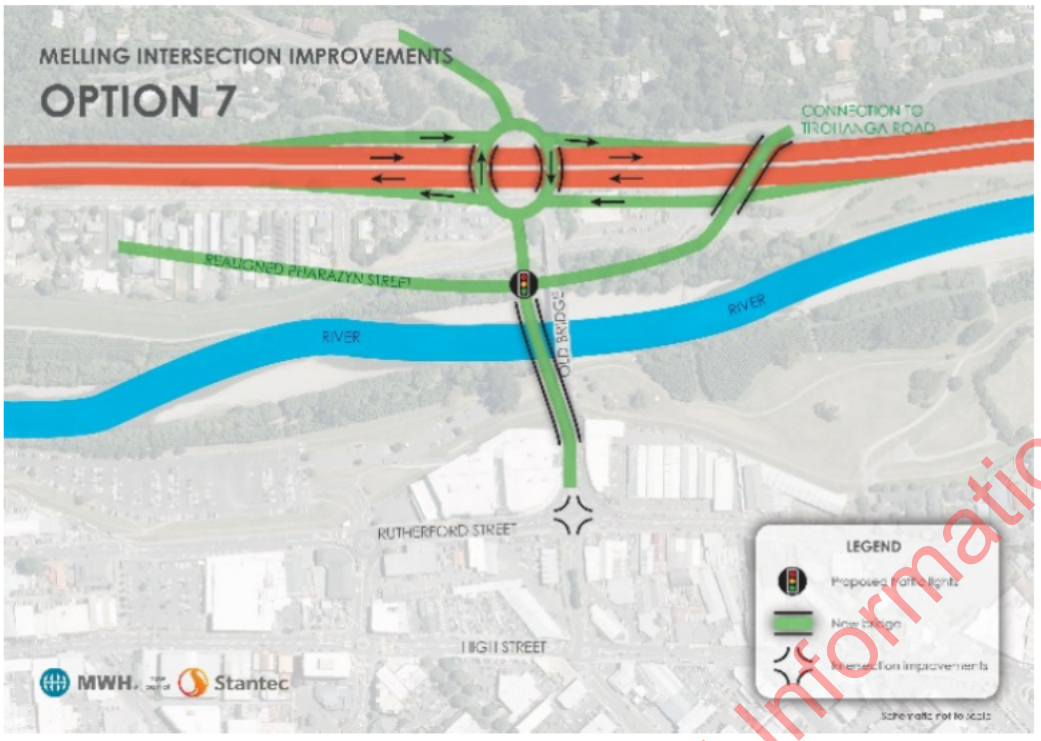


Figure 9-5: Possible roundabout interchange

Assessment Criteria		Achieved?
Investment Objectives	Improve KiwiRAP Star Rating for SH2 to 4 star	✓
	Reduce five year serious injury crash rate at SH2/Melling intersections	✓
	Maintain travel time in study area	✓
	Increase walking and cycling trips through Melling intersections	✗
	Increase boardings at Melling Station	✗/✓
	Reduce frequency of events disrupting traffic on SH2	✓
Flood Protection Benefits		✗

A roundabout interchange form progressed to the second MCA process (as Option 7 in Figure 9-5), with sub-options including a signalised roundabout or larger gyratory interchange[24]. The idea of a roundabout interchange initially made good sense as it would be consistent with the Dowse and SH2/58 interchanges, west and east respectively of Melling Link. However, there were several problems identified that meant a roundabout interchange was not appropriate. These were

- The higher traffic volumes through Melling Link (compared to Dowse) coupled with the strong opposing traffic movements for the northbound on-ramp and the northbound off-ramp meant that the layout was very inefficient and would result in queuing back onto SH2 from the northbound off-ramp. Signalising improved the efficiency but not to a point that it was comparable to other interchange options.
- When considering pedestrians and cyclists, roundabouts are traditionally unsuited to intersections for particularly cyclists to safely negotiate. The need to signalise crossing points for pedestrians would add further delays to traffic movement.

[24] Such as Dowse and SH2/58 interchanges.

- Finally, all roundabout type interchanges would encroach into the floodway, impacting on the effective performance of the flood protection scheme and increasing the likelihood of flood damage.

9.5.6 Diverging diamond interchange

Figure 9-6: The diverging diamond interchange

Assessment Criteria		Achieved?
Investment Objectives	Improve KiwiRAP Star Rating for SH2 to 4 star	✓
	Reduce five year serious injury crash rate at SH2/Melling intersections	✗
	Maintain travel time in study area	✓
	Increase walking and cycling trips through Melling intersections	✓
	Increase boardings at Melling Station	✓
	Reduce frequency of events disrupting traffic on SH2	✓
Flood Protection Benefits		✓

The diverging diamond interchange progressed to the second MCA process (as Option 11 as in Figure 9-6). This interchange form switches the side of the road a motorist drives on by diverging the traffic lanes (the lanes would cross over). After the Road Safety Audit process, the Transport Agency abandoned the diverging diamond interchange due to the safety concerns held by both the Safety Auditors and internally at the Transport Agency.

The main concern was the unique interchange lay out, when compared to the existing road environment and New Zealand in general. No such intersection type currently exists (where motorists are effectively driving on the other side of the road) in New Zealand. It was also felt that the constrained available space created by the escarpment and the Hutt River, meant in this location, it would not be possible to build a "tried and tested" diverging diamond design. Therefore it was deemed a less than desirable location to first introduce this interchange type in New Zealand.

9.5.7 Lower speed limit on SH2

Lowering the speed limit on SH2 in the vicinity of the Melling and Tirohanga intersections would help to reduce the crash risk, however it would not contribute to the access and resilience investment objectives, which are the key drivers for the project. It was therefore excluded as a long term option, although it should be considered in the short term to improve safety.

Assessment Criteria		Achieved?
Investment Objectives	Improve KiwiRAP Star Rating for SH2 to 4 star	✗
	Reduce five year serious injury crash rate at SH2/Melling intersections	✓
	Maintain travel time in study area	✗
	Increase walking and cycling trips through Melling intersections	✗
	Increase boardings at Melling Station	✗
	Reduce frequency of events disrupting traffic on SH2	✗
Flood Protection Benefits		✗

9.6 Short Listed Options Assessment

9.6.1 Common attributes

The following outlines the common attributes of the three options shortlisted for consultation. A deeper analysis against the assessment criteria is found in the MCA 3 Workshop Report in Appendix F. The three options have the following attributes in common:

- Multi-modal grade separated SH2 diamond interchange improving safety and accessibility for all modes to Hutt City Centre, the Western Hill communities and Melling Station. This removes the existing at-grade SH2 traffic signalled intersections at Melling.
- A new river bridge as in integral part of the interchange improving access and flood resilience for all transport users, the Hutt City community and businesses.
- Relocated Melling Station closer to Hutt City Centre (moved southwards) with a larger car park, improved bike storage facilities, direct connection to Hutt City Centre via a separate walking and cycling bridge and revised hours of rail operation
- Pedestrians and cyclists are, for the most part, separated from traffic by dedicated facilities to access Hutt City Centre, Melling Station, connecting to the Melling to Petone cycleway and local Hutt City Centre connections.
- New improved local road intersections with traffic light phasing synchronised to manage conflicting demands of vehicles, pedestrians and cyclists.
- Future proofed design to allow for a possible extension of the Melling railway line northwards.
- Tirohanga Road connects directly to Harbour View.
- Close alignment to, and enabling of, relevant sections of Hutt City Spatial Plan.

9.6.2 Differentiating attributes

There are also some key differentiating attributes amongst the three options, such as:

- Two possible locations for the new Melling Bridge connection, either Melling Link or Queens Drive.
- A Queens Drive connection helps to promote a more compact city centre.
- A Queens Drive connection provides better walking and cycling connections to Melling Station from the city centre.
- A Melling Link connection reduces the effectiveness of flood prevention work because the bridge will be at the narrowest part of the river.

9.6.3 QUEENS DIRECT: diamond interchange directly connected to Queens Drive

The key features of this option were:

- Direct gateway entrance to Hutt City Centre with a new bridge connecting at Queens Drive.
- Requires only two signalised intersections at the interchange.

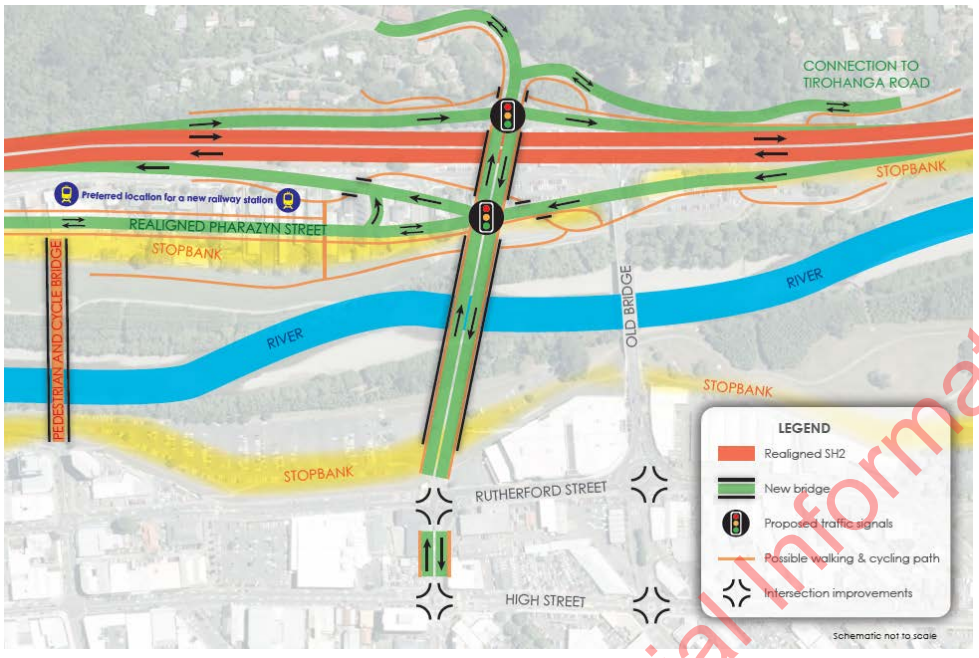


Figure 9-7: Diamond Interchange with direct connection to Queens Drive

There were many key positive attributes for this option, including;

- An opportunity to improve flooding resilience by reducing the floodway constriction created by the existing Melling Link Bridge location.
- A direct gateway entrance to Hutt City which better defined the desired edge of the city centre.
- Better gateway alignment than existing situation with the desired edge of the city centre, the proposed Eastern Accessway route around the city centre[25] and other local roads.
- Better access than existing situation to a relocated Melling Station and therefore better public transport mode integration.
- Provides good walking and cycling connections into Hutt City Centre.

The key negative attributes for this option included;

- Concerns over the safety and efficient operation of the five-leg intersection on the eastern side of interchange.
- The new traffic bridge would be above the riverbank carpark and may degrade the amenity, as it is a well-used public space for markets.
- The visual effect for adjacent local businesses of lifting Rutherford Street up to decrease the gradient to the bridge level on the eastern stop bank.

[25] The existing western access route along Daly Street is removed due to the location of the new stop banks, placing greater importance on the function of the eastern accessway route

9.6.4 QUEENS INDIRECT: diamond interchange indirectly connected to Queens Drive

The key features of this option were:

- Indirect gateway entrance to Hutt City Centre with a new bridge connecting at Queens Drive.
- Has three signalised intersections at the interchange.
- Separates SH2 southbound on-ramp from the interchange.

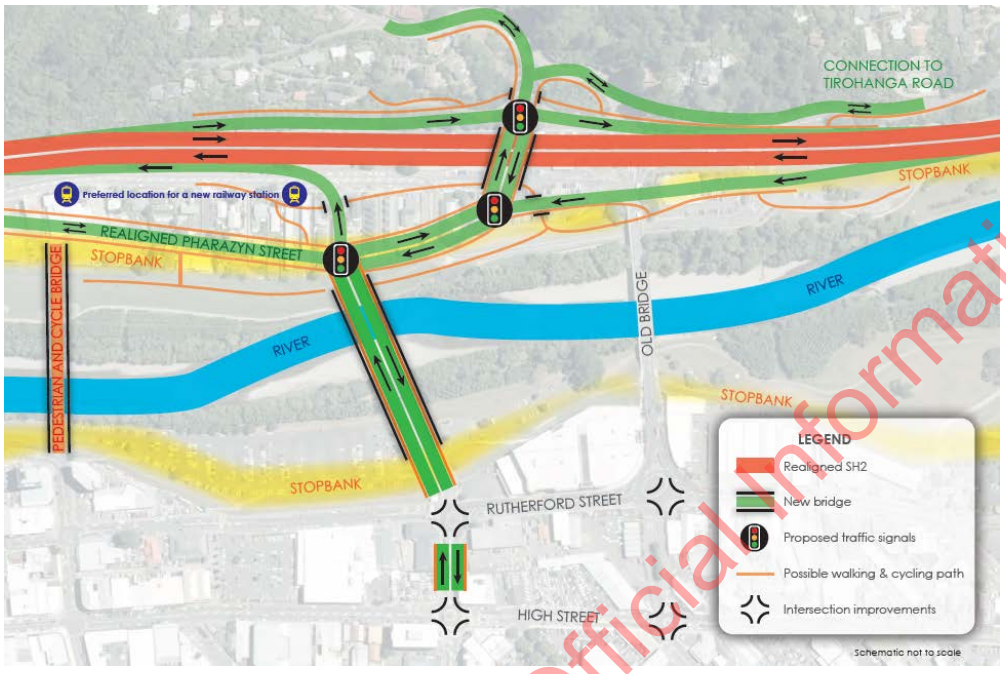


Figure 9-8: Diamond Interchange with indirect connection to Queens Drive

There were also many similar key positive attributes for this option, including;

- An opportunity to improve flooding resilience by reducing the floodway constriction created by the existing Melling Link Bridge location.
- Better gateway alignment than existing situation with the desired edge of the city centre, the proposed Eastern Accessway route and other local roads.
- Better access to a relocated Melling Station than existing situation and therefore better public transport mode integration.
- Reduces traffic congestion more than the Queens Direct option because of the distance between the intersections.
- Allows more local traffic to avoid the interchange because of the direct connection to Pharazyn Street.

The key negative attributes for this option, included;

- The indirect approach from the SH2 interchange does not achieve the desired gateway effect, therefore providing poorer legibility.
- The new traffic bridge would be above the riverbank carpark and may degrade the amenity, as it is a well-used public space for markets.
- The visual effect for adjacent local businesses of lifting Rutherford Street up to decrease the gradient to the bridge level on the stop bank.
- Engineering degree of difficulty was high due to significant interaction of the road on top of the western stop bank.
- The visual impact of the road running atop of the western stop bank was undesirable.

9.6.5 MELLING DIRECT: diamond interchange directly connected to Melling Link

The key features of this option were:

- A new bridge connects to Melling Link
- Requires only two signalised intersections at the interchange

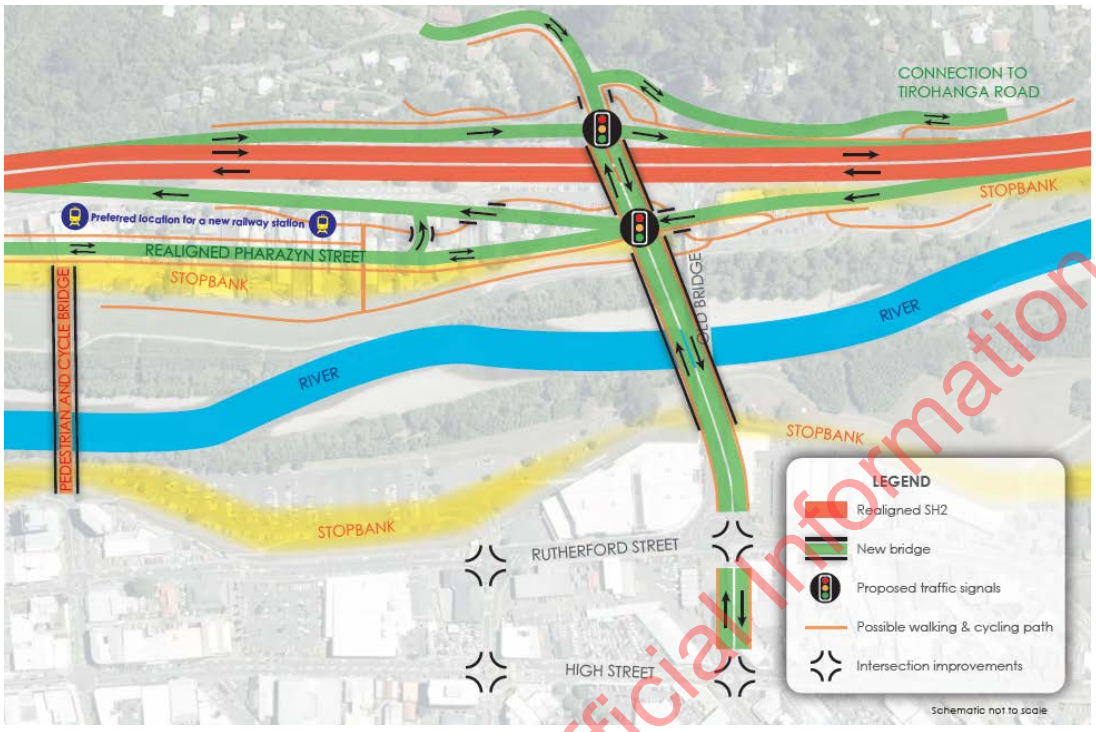


Figure 9-9: Diamond Interchange with direct connection to Melling Link

The key positive attributes for this option included;

- It left the well-used public space for markets on the eastern side of the river free from an overhead bridge.

The most significant negative attribute for this option was that although the bridge height was increased, the location of the bridge meant that it still presented a long term constraint to flood waters[26], and as such contributed only minimally to reducing the overall flood risk. The other key negative attributes for this option, included;

- The possible introduction of additional piers into the waterway than would otherwise be necessary (dictated by the staging of bridge construction), could further increase flood risks.
- Poor gateway alignment with the desired edge of the city centre, the proposed Eastern Accessway route and other local roads.
- The difficulty in building a new bridge that connected at the existing bridge location, whilst keeping existing traffic volumes operational.
- More difficult to consent this option under Section 6 of the RMA, as the management of a significant risk from a natural hazard was not being mitigated.

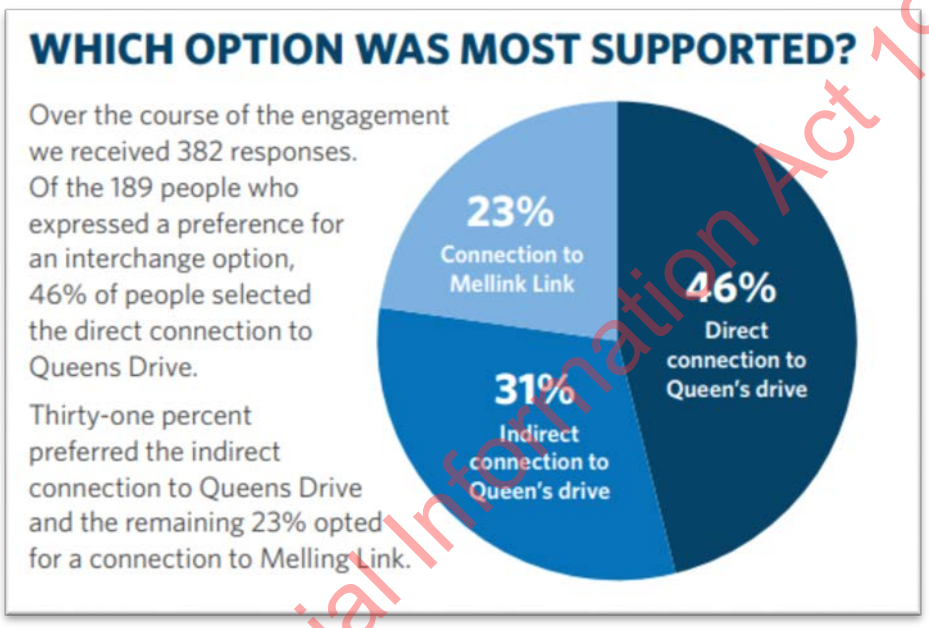
[26] As land acquisition of the businesses located west of Rutherford Street and the Hutt River (between Queens Drive and Melling Link) was not considered at this stage but would be considered in the long term. Replacing the bridge at this location removes the possibility of increased flood protection in the future.

9.6.6 Results of Consultation

The three shortlisted interchange options were presented to stakeholders and community for feedback during May and June of 2018, using a range of communication channels to ensure broad participation. A total of 382 responses were received. Of the 189 people identifying a preference, the direct connection to Queens Drive was the most popular, with 46% of people selecting this option. Respondents said they preferred this option because it has fewer traffic lights, was easy to navigate, had better access to the city centre and minimises disruption during construction.

31% supported an indirect connection to Queens Drive, and 23% the Melling Link connection. Factors identified as important by respondents were:

- Minimising local traffic queues.
- Ability to accommodate future expansion of rail network.
- Pedestrian and cyclists' safety.
- Ability to achieve flood protection goals.



Further details of engagement activities and community feedback is provided in the RiverLink Community Engagement Report (Appendix G).

9.6.7 MCA 3 workshop

An all-day workshop for MCA 3 was held in June 2018 following public consultation on three short listed options. By this point the specialists evaluating each MCA criterion had also completed their assessment (refer Appendix F).

MCA 3 helped the workshop panel to explore the key differences between the options and agree a recommended option. The workshop was attended by experts from each discipline, who prepared assessment material and initial scores for each of the options. Scores were then discussed by the panel and a final score confirmed. The overall community preferences[27] were rescored in light of the consultation results. For a full write up see Appendix F.

9.6.7.1 MCA Criteria

Initially ten criteria were proposed, however, during the workshop, the criterion of 'Urban Design and Recreational Opportunities' was modified to extract recreational considerations into a new category labelled as 'Recreational Functional Amenity'. The eleven criteria evaluated were as follows:

- Transport benefits.
- Fit with local road system.
- Visual and landscape impacts.
- Natural hazards management fit.
- Landuse effects
- Urban design opportunities
- Recreational Functional Amenity

[27] There were some affected parties whose views differed from the overall community and required further discussion.

- Consentability
- Engineering degree of difficulty
- Ability to be Staged
- Cost

9.6.7.2 MCA Scores

The scoring outcomes of the three options are set out in Table 9-3 (a low number is a good score, a high number is a bad score). While there was general agreement at the workshop, some of the scores differed from those initially proposed by the technical specialist in their presentation. Changes in score were robustly discussed amongst the workshop attendees, who sometimes would offer a point of consideration from their field of expertise that may not have been considered by the technical specialist. All scoring achieved consensus.[28]

The key topics of discussion that led to the scores are detailed following on from the table.

Table 9-3: MCA scoring summary

Option	Transport benefits	Fit with local road system	Visual and landscape impacts	Recreational Functional Amenity	Natural hazards management fit	Landuse effects and opportunities	Urban design opportunities	Consentability	Engineering Degree of Difficulty	Ability to be staged	Cost
Melling Link	2	3	3	2	5	3	2	4	5	5	3
Queens Direct	2	1	3	3	2	2	1	3	3	4	3
Queens Indirect	1	2	5	4	3	3	3	3	5	4	4

NB: dark green means a positive outcome (best) and dark red means a negative outcome (poor).

- **Transport benefits**: The options would all provide a significant but similar travel time improvement when compared to the existing road layout. All options were expected to significantly improve safety on SH2, by separating the local and state highway traffic streams. There were some concerns held about the safe and efficient operation of the five-leg intersection in the Queens Direct option. The Queens Indirect option had a better bus route alignment for Melling train station, as it takes buses nearer to the station. Queens Indirect would also provide a more direct connection (than the other two options) for walking /cycling to the train station.

  MOST FAVOURED OPTION: Queens Indirect

- **Fit with local road system**: The technical specialist leading the discussion highlighted the future importance of connectivity to HCC's Eastern Access Route, because the Western Access Route via Daly Street would be closed by the construction of the eastern stopbank for RiverLink. Therefore, the two options that connect to Queens Drive are preferred in order to help meet these objectives. These options also work better from a public transport point of view, as they would provide a more direct connection to Hutt City Centre than the Melling Link option. Queens Direct was preferred over Queens Indirect as it was considered to provide a more legible connection to the local road network, particularly Pharazyn Street.

  MOST FAVOURED OPTION: Queens Direct

- **Visual and landscape impacts**: The Queens Indirect option was considered the worst option because it requires the road to run along the top of/above the western stopbank which would have significant visual impacts particularly from the river corridor. The Melling Link connection was slightly favoured over the Queens Drive options, as there was already a bridge which would be familiar to residents and provide less of an adverse visual effect, and there would be no need to lift Rutherford Street for the

[28] Some scores may have changed since the workshop, such as engineering degree of difficulty related to Hutt River bridge now integrated with stopbank rather than going over it.

bridge connection. Overall these differences were considered minor in comparison to the effect of the road on the stop banks in the Queens Indirect option.

MOST FAVOURED OPTION: Melling Link or Queens Direct

- **Recreational functional amenity:** There were concerns about shading and noise from a new bridge above the vicinity of the car park / market area. As both options which connect to Queens Drive would only be 260m from the proposed new pedestrian bridge, it was thought that it would negatively impact on the recreational use of this popular stretch of the river corridor without providing significant additional benefits.

  MOST FAVOURED OPTION: Melling Link

- **Natural hazards management fit:** The main natural hazard concern is the waterway and river constrictions. If Melling Link was chosen, it would lock in the existing river channel constraint for the next 100 years. This would greatly restrict any chance of future flood protection improvements at this highly constrained location. The seismic, landslide and tsunami hazards were predicted to be similar for all three options, with no distinguishing differences.

  MOST FAVOURED OPTION: Queens Direct

- **Landuse effects:** All three options have impacts on land parcels on the city centre side of the river, as either Queens Drive needs widening or Melling Link needs realignment. The possible 5.0 m lift of Rutherford Street required for the Queens Indirect option would have major adverse effects for existing adjacent land uses, particularly close to the intersection where the height differential is greatest. A potential opportunity was identified that if a Queens Drive option was progressed, the current Melling Link could be used as a new informal connection to the river.

  MOST FAVOURED OPTION: Queens Direct (by a narrow margin)

- **Urban design opportunities:** The Melling Link option did not create the gateway effect into Hutt City Centre desired by HCC, whereas the two options that connect to Queens Drive do. The Queens Indirect option was, however, less desirable due to the dog-leg approach from SH2, which was thought to be less legible. The Queens Direct option was most preferred but would need more urban design development around how the new Rutherford Street level would work with the existing city centre blocks.

  MOST FAVOURED OPTION: Queens Direct

- **Consentability:** The key consideration was section 6 Matters of National Importance – in this case section 6(h): the management of significant risks from natural hazards[29]. Melling Link did not perform well against this criterion as it did not improve the existing river constraint at this location created by the width of the river channel at this point

  MOST FAVOURED OPTION: Queens Indirect or Queens Direct

- **Engineering degree of difficulty:** The Melling Link option provides the largest engineering challenge to overcome, as a segment of the existing bridge needs to be removed to enable completion of construction of the new bridge. Both the permanent and temporary works for this option make it complex to design and build. The Queens Indirect option has a significant interaction with the eastern stopbank, as the road would need to be constructed on top for the dog leg. This also increases the earthquake risk to the road in this option as it runs along the fault line and requires an approximately 5.0 m lift to Rutherford Street if interaction with the western stopbank is to be avoided. The Queens Direct has the least impact on the stopbanks and is the least complex to design overall.

  MOST FAVOURED OPTION: Queens Direct

- **Ability to be Staged:** With all options, the bridge and SH2 interchange would need to be built after the stopbanks. It is not possible to build the interchange before the bridge for any option, as the interchange would be too high to connect to the existing Melling Bridge. However, constructing the bridge before the interchange is feasible, as the rearrangement of the road connections between the new bridge, SH2 and local roads can be made. However, building the bridge before the interchange

[29] While other RMA section 6 matters of natural character of the river environment (section 6(a)) and public access to the river corridor (section 6(d)) were also potentially relevant the options were not distinguishable on the basis of those considerations.

would result in increased travel time delays and poor access to the Hutt City Centre. Overall, staging would provide disbenefits against some of the project objectives.

MOST FAVOURED OPTIONS: Queens Indirect or Queens Direct

- **Cost:** All options currently have similar cost estimates which are likely to be within 20% of each other. Queens Indirect is expected to be the most expensive of the three options due to it having the longest bridge and the likely additional cost of construction associated with the stopbanks. The Melling Direct option, whilst having the shortest bridge, will also have significant additional costs associated with traffic management and temporary diversions due to building a bridge alongside, and tying into the same location as the existing bridge. It must be noted that only indicative cost estimates were available at this stage, so certainty about costs was low.

  MOST FAVOURED OPTIONS: Melling Direct or Queens Direct

9.6.7.3 MCA Weighting Systems and MCA Result

There were six weighting systems applied to the MCA scores and these were used to understand the sensitivity of the MCA. The weighting systems are explained in detail in Appendix F. The systems used were as follows:

- **Workshop** - based on values of the attendees. Transport Benefits and Natural Hazards Management Fit were the most important aspects, followed by Fit with Local Road System and Urban Design Opportunities.
- **Alternative Workshop Weighting** –Visual and Landscape, Recreational Functional Amenity and Urban Design Opportunities reduced to 1/3 of their weighting to account for potential double counting.
- **RMA Balanced** – This reflects the important elements of the Resource Management Act.
- **Environment** – This weighting system emphasised the impacts on the physical environment.
- **Community** – This weighting system emphasised the aspects likely to be most important to the community and was informed, in part, by community feedback.
- **Economic** – This weighting system placed full weight on the criteria with a significant economic component.

Figure 9-10 graphically represents the outcome for each weighting scenario, with the shortest bar indicating the most favoured for each weighting scenario. A clear order of preference emerged from the overall analysis across the various weighting systems. Based on the Workshop Weighting, **Queens Direct** was the most-favoured option with the lowest aggregated score. The subsequent additional weighting systems also all identified Queens Direct as the most favoured. In all but the Environmental Weighting, the Queens Indirect option was second favoured and Melling Link least favoured.

The analysis was also run with costs excluded and similar results were obtained.

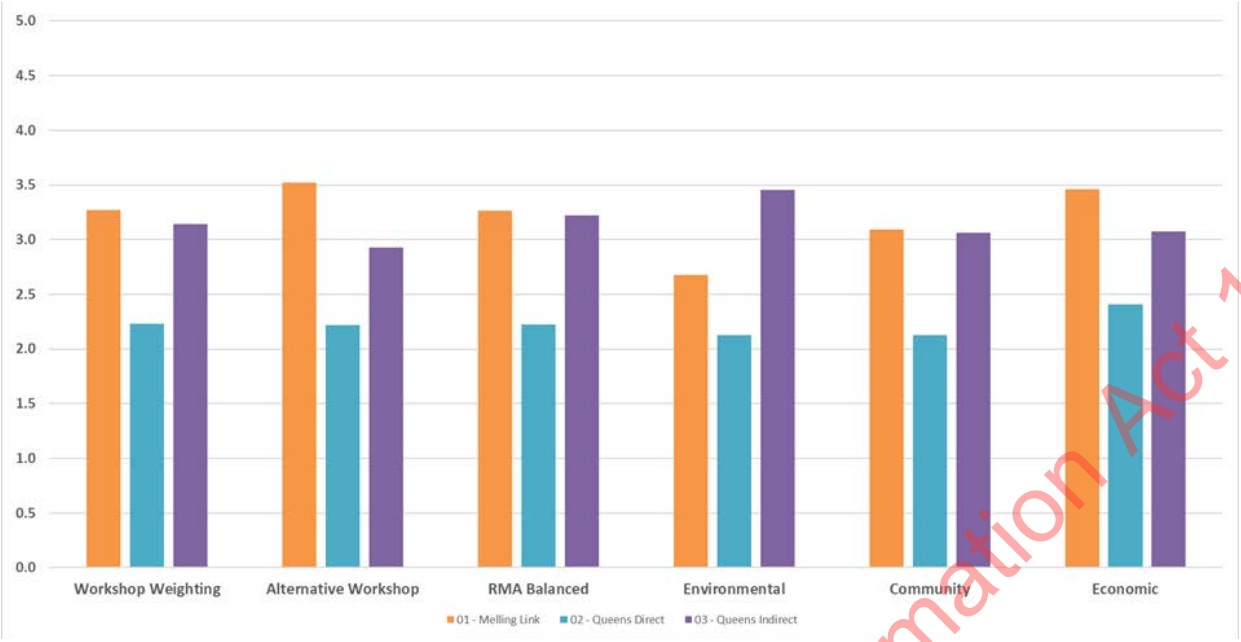


Figure 9-10: Outcome of MCA weighting process

10. Recommended Option

The recommended option of Queens Direct (Figure 10-1), was endorsed by the Transport Agency Board at its December 2018 meeting.

Figure 10-1: Recommended Option of Queens Direct

The main roading aspect of the project involves the replacement of the two signalised at-grade intersections of SH2/Harbour View Road/Melling Link and SH2/Tirohanga Road with a grade-separated interchange to create a safer, less congested junction. The project also includes the realignment of local roads, a new river crossing into Hutt City and the upgrade of public transport, walking and cycling infrastructure.

The existing road network (connectivity) has been maintained, however some re-routing has been required to replace the existing dual signalised intersections with one interchange. The recommended option proposes a diamond interchange (DI) south of the current SH2/Harbour View Road intersection with a direct (straight) connection to a new bridge across the Hutt River landing in Queens Drive. Tirohanga Road is connected to Harbour View Road via a new link adjacent to the northbound entrance ramp. Pharazyn Street connects to the interchange at a combined intersection with the southbound on and off ramp terminal intersecting on the eastern side.

The recommended option comprehensively outperformed both other short listed options under each of the MCA weighting systems used. This was also the option preferred by the community during consultation. It is the most compliant solution (from a geometric design perspective) given the general layout of the adjoining road network. The key benefits of the recommended option over the alternative options considered, include:

- **Resilience:** The bridge in this location, combined with new stopbanks, will reduce the risk of flooding in Lower Hutt and around the Melling intersection.
- **Safety:** The grade separated interchange will be safer for motorists, cyclists and pedestrians as the traffic lights are removed, turning movements are separated, and pedestrians and cyclists have dedicated facilities that tie into the recreational routes.
- **Transport choice:** Access for pedestrians, cyclists and public transport will be improved. The railway station will be moved closer to the city centre and better park and ride facilities provided. The improvements will also future proof for a possible extension of the Melling railway line.
- **Readability:** Provides an alignment into Hutt City that is direct, easy to understand, and easy to sign;

- **Land use integration**: A Queens Drive connection promotes a more compact city centre and enables a gateway into the Hutt City Centre.
- **Land use**: The layout minimises the area of land required for infrastructure, maximising the future development potential for the Pharazyn Street area and reduced the need for additional work on or over the stopbanks and in the flood plain.
- **Reliability**: A new interchange and river bridge will reduce congestion during peak travel periods and enable through traffic to use SH2 rather than rat running on local roads, improving conditions for driving to and from the city centre.

The high level scope of the Recommended Option is shown in Table 10-1 and illustrated in Appendix H. The table also shows transport improvements being undertaken by HCC.

Table 10-1: Overview scope of Recommended Option

No.	Element
1	Section 9(2)(j) [redacted]
2	Relocate railway station, car park, Pharazyn Street access, realign railway line
3	Section 9(2)(j) [redacted]
4	New bridge over Hutt River, including walk/cycleways
5	New SH2/Melling interchange, including walk/cycleways
6	New signalised intersections on Queens Drive (2 sets)
7	Intersection changes Melling Link/Rutherford Street
8	Intersection changes Melling Link/High Street
9	Demolish existing Melling Link bridge
10	Potential extension of pedestrian and cycle river bridge across the highway into the western hill suburbs

10.1 Road design

- **Design speed**: Although SH2 north of Ngauranga operates as an expressway, the design standards adopted would be applicable to a motorway. Therefore, a design speed of 110 km/h has been adopted for the SH2 alignment through the interchange and 80 km/h for the interchange ramps. A design speed of 50 km/h has been retained for the local road network
- **Cross section**: Typical cross sections are shown in the drawings in Appendix H and reproduced schematically in Figure 10-2. A 3.5m width is proposed for all traffic lane elements and a 4m median is proposed for SH2, incorporating a wire rope barrier.

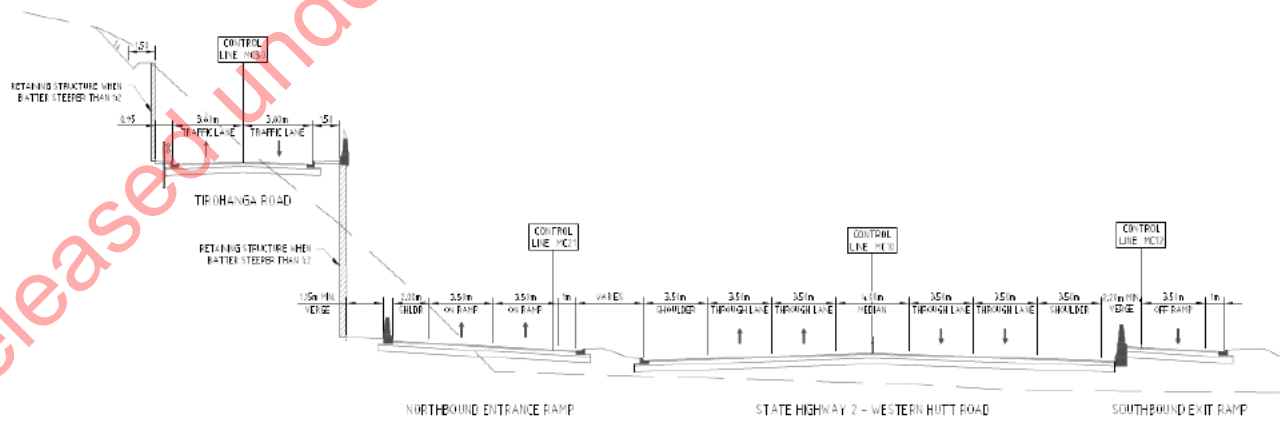


Figure 10-2: SH2 design cross section

- **Pavement design**: Detailed pavement investigation work is yet to be completed, however based on engineering judgement the following outline design has been adopted:

Table 10-2: Pavement Design Assumptions

SH2 Expressway	Ramps and Queens Drive	Tirohanga and Harbour View
40 mm SMA or OGPA 200 mm of AC20 250 mm of GAP65 Subgrade of 3.5%	40 mm SMA 180 mm of AC20 200 mm of GAP65 Subgrade of 3.5%	40 mm SMA Membrane seal 180 mm of M4 200 mm of GAP65 Subgrade of 3.5%

- **Barrier design**: Median and side protection barriers are provided in accordance with the Safe System philosophy. A TL-5 median barrier is proposed for SH2 and for side barriers on the interchange bridge and river bridge. Wire rope barriers (WRB) are preferred for outside shoulder protection and semi-rigid barriers have been detailed where WRB is not feasible
- **Street lighting**: Light poles are currently proposed to be placed in the berm areas or on the edge of structures, as there is a preference for wire rope barrier to be provided within a 4.0m wide the central median on SH2.
- **Signs and markings**: The recommended option proposes a road and lane layout that is clear and legible for all road users and can be signed in a straightforward manner. Road markings have been detailed for the recommended option in accordance with MOTSAM Part 3 (SH2) and MOTSAM Part 2 (local roads). ATP and RRPMs will also be required.

10.2 Intersection Treatments

The design seeks to reduce conflicts. A grade-separated interchange is proposed to replace the following at-grade signalised intersections:

- SH2/Harbour View Road/Melling Link, and
- SH2/Tirohanga Road/Block Road.

Signalised intersections are proposed at the following locations:

- the ramp terminal intersections either side of the interchange (including the consolidated intersection with Pharazyn Street); and
- The four local road intersections of Melling Link / Rutherford Street, Melling Link / High Street, Queens Drive / Rutherford Street, and Queens Drive / High Street[30]

A priority-controlled intersection is proposed at the new Tirohanga Link / Harbour View Road intersection.

10.3 Geotechnical Engineering and Earthworks

Geotechnical assessment to date has been limited to a Preliminary Geotechnical Appraisal Report (PGAR) which included a review of readily available historical information at the site. This is appended to the Design Philosophy Statement which is in Appendix C. A high-level ground investigation has been completed in the general locations of proposed large structures (interchange at SH2 and bridge over the Hutt River), consisting of one fully cored borehole and Cone Penetration Testing at several locations.

Significant geotechnical risks at this stage of the project include variable ground conditions, the location of the Wellington Fault, which is understood to be between the proposed interchange and bridge (roughly following Block Road), and constructing deep foundations into the artesian gravel aquifer.

In order to mitigate these risks, further geotechnical investigations will need to be undertaken. Some, such as fault line trenching are currently programmed. In the meantime, assumptions have been made about the location of areas of instability and risk, and an allowance has been made in the cost estimate.

In relation to cut and fill slopes, the following design philosophy has been adopted:

[30] The Road Safety Audit challenged the use of signals instead of roundabouts at the Melling Link intersections and therefore this element may change as this is further investigated.

Cut slopes: No significant cut slopes are anticipated. If cut slopes in natural materials are required, then the cut batter angle will depend upon the nature of the cut material and height. cuts in slightly to moderately weathered greywacke rock should be capable of supporting slope angles of 0.5H:1V (64º). Superficial soil layers such as colluvium and alluvial deposits may stand up at between approximately 1H:1V (45º) to 2H:1V (26º).

Fill slopes: Fill under 3m should remain stable unsupported between 2H:1V (26º) and 1.5H:1V (32º) depending upon the nature of the fill material. Slopes steeper than this should be reinforced or retained while fill slopes adjacent to the Wellington Fault zone may require reinforcing.

10.4 Structural Design

A range of options were investigated for the different structures and this is presented in the Preliminary Structural Options Report (This is appended to the Design Philosophy Statement which is in Appendix C). This section outlines the recommended approach.

For details refer to Appendix H and Preliminary Structural Options Report. All preliminary bridge and retaining structure designs are in accordance with the NZ Bridge Manual 3rd Edition Amendment 2. Due to proximity to the Wellington Fault, designs need to be highly tolerant to seismic movements. A site-specific seismic hazard assessment is recommended during final detail design.

- **Interchange bridge:** The bridge deck comprises 35m precast pre-stressed concrete Super-T beams with insitu concrete deck on reinforced concrete bankseats on mechanically stabilised earth (MSE) abutments. Dead and live loads are transferred through the girders directly into the abutment beam and into the MSE abutment retaining walls. Figure 10-3 shows the typical bridge cross section.

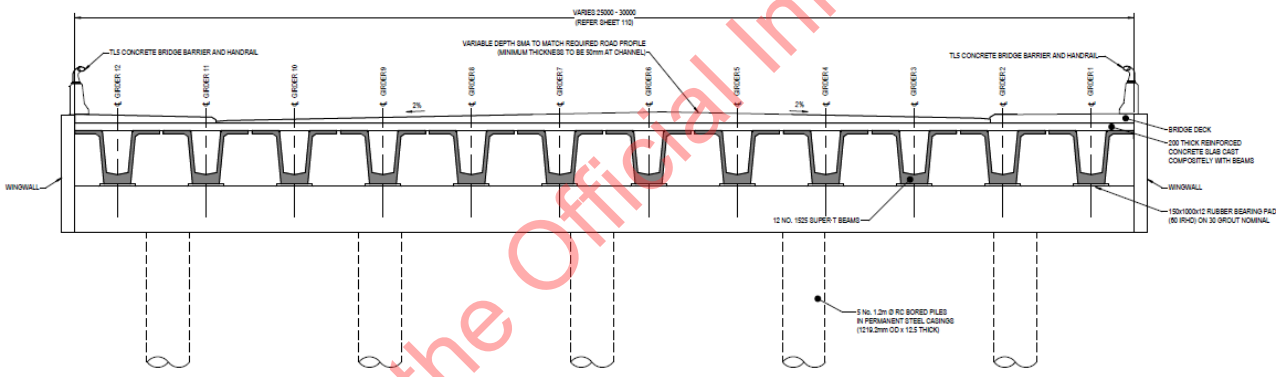


Figure 10-3: Proposed interchange bridge typical cross-section

- **Cycleway subways:** The pedestrian/cycle underpass providing access to and from the relocated railway station comprise reinforced concrete off-the-shelf box culvert/subway units. The path alignment is relatively straight on all options therefore visibility through the underpass structure is good and public safety not compromised. Lighting will be provided for night time use.

- **Hutt River Bridge:** The approximate length of a new Hutt River Bridge from stopbank to stopbank is approximately 175 m. It is proposed to span this distance with a five-span Super-T superstructure with spans of approximately 35 m on piled foundations. This type of structure is tried and tested in NZ and has proven to be a cost-effective solution with low whole-of-life costs.

  Bridge piers would generally follow the river alignment and be parallel with the flow of the river to minimise river disturbance and scouring effects. Given the proposed width of the bridge a solid slab pier is proposed as this reduces the likelihood of debris entrapment and the lateral loading effects when the river is in flood.

  The required hydraulic capacity of the river influences the size and shape of the piers and the height of the underside of the bridge (required freeboard at points across the river). Early optioneering allowed for the river bridge to span over the top of the eastern stopbank as this was an initial GWRC constraint. However further design suggested this would adversely impact Rutherford Street and access to adjoining properties, significantly increasing cost. The recommended option, agreed with GWRC, now proposes to integrate the eastern bridge abutment with the stopbank to reduce the impact on Rutherford Street.

  Figure 10-4 shows the typical bridge cross section at a pier.

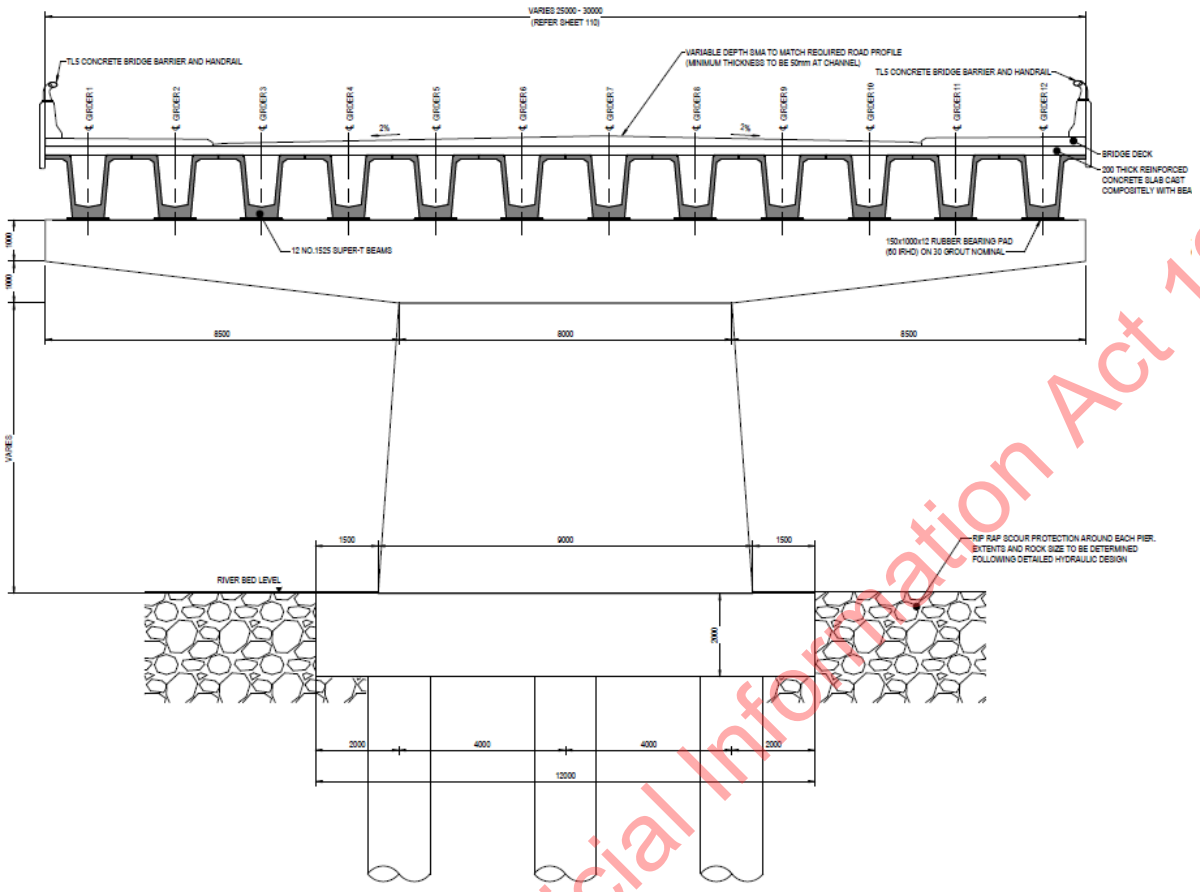


Figure 10-4: Proposed Hutt River Bridge typical cross-section at pier

- **Retaining walls.** The design intent is to avoid interchange ramp retaining walls on the river side to prevent an impact on the GWRC river hydraulics. The design philosophy is to locate the ramps slightly outside the stopbank alignment such that any ramp fill slopes tie into the top of the stopbank. MSE type structures are the proposed retaining method for retaining the interchange on and off ramps. This is in keeping with other recently constructed sections along the SH2 route. Retaining structures above the northbound off ramp and Tirohanga Road are proposed to be soldier pile walls tied back with grouted anchors.

10.5 Stormwater

The western side of SH2 is mountainous, and between Dowse Drive (Maungaraki) and Wairere Road (SH2 north of Melling Bridge) there are a number of culverts already under SH2, some which take significant hill catchments and some have concrete wall surrounds at the SH2 road edge.

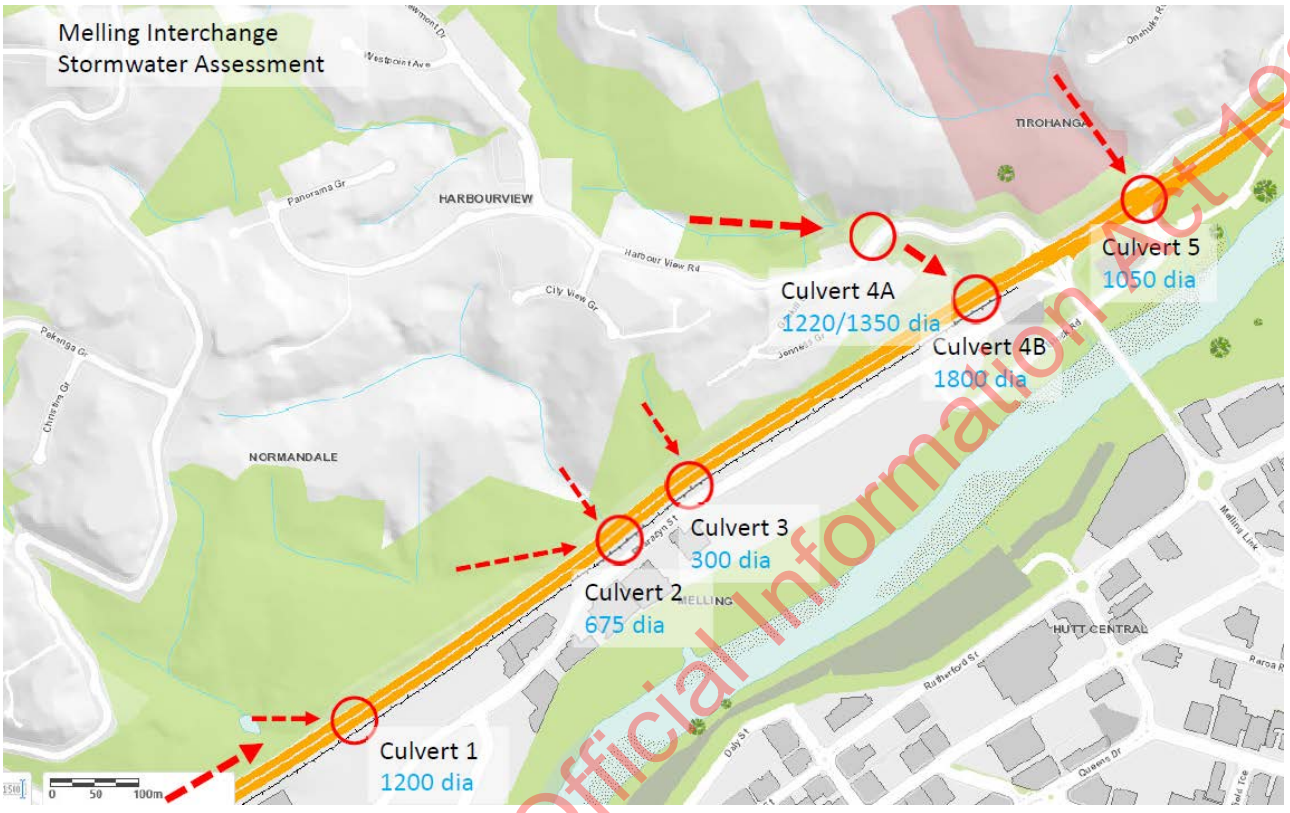


Figure 10-5: Cross drainage culverts

The initial high-level assessment indicates several of the cross-drainage culverts are undersized with a level of service between a 5 and 10-year storm event ARI (average return interval). This is reflected in the TREIS data which shows that flooding of SH2 is an ongoing concern.

The catchment with the largest flow drains the Harbour View Road gully and is in the direct location of the proposed Melling Interchange. The works associated with the proposed new bridge crossing and approach into Harbour View Road, will impact on the 1350mm pipe, open channel and entry point into the box culvert and require a new stormwater pipe to avoid the bridge piles and new earthworks.

The hydraulic capacity shortfall at several other cross highway culverts may be resolved through the creation of a secondary overland flow path between those culverts and the installation of the new stormwater culvert from the Harbour View Road Gully.

A new stormwater collection system will be required to collect stormwater from the new Melling Interchange – the system should be designed to meet performance limits outlined in Transport Agency standards, namely, providing a collection system capacity to meet a future 10 year ARI storm event (with climate change), and passing stormwater through a stormwater quality treatment device, either at source or located in downstream locations, prior to discharge into the Hutt River.

The recommended design approach is to minimise the volume of stormwater runoff needing conveyance and treatment by maximising the use of ground soakage and or mitigation storage through the use of Raingardens, Swales, Tree pits and Wetlands to both reduce the peak runoff flow and to remove contaminants, sediments and silts.

10.6 Pedestrian and Cycling Infrastructure

The design approach for cycling is that facilities separated from general traffic (i.e. dedicated cycle lanes and/or off road shared use paths and/or separated cycle paths) will be provided for cyclists passing though the SH2 Melling Link interchange and across the Hutt River. On local roads, on-road facilities (e.g. wider traffic lanes or shoulders) will be provided for experienced riders. Pedestrians will be accommodated on a network of shared use paths and footpaths tying into and matching existing footpaths. Crossings will be toucan style signalised crossings or subways for both pedestrians and cyclists.

A minimum width of 4.0 m for the shared use path has been adopted. This allows several shared or separated arrangements to be considered during the detail design phase. It is proposed that the shared use path be grade separated through the interchange to provide an equivalent level of service for cyclists and pedestrians as that provided to road based traffic.

A high level of service cycling network with complete connectivity is proposed. The network is designed so that it can be expanded beyond the limits of the scheme to tie in with any future walking and cycling facilities, especially with Petone to Melling and Ngauranga to Petone cycleways to the south and with the Hutt cycle trail to the north.

- **SH2:** The design philosophy for SH2 is to provide a safer alternative to crossing the exit and entrance ramp gore areas in both north and southbound directions. The ramps will have generous road shoulders that can be utilised by cyclists. In both northbound and southbound directions, cyclists will be able to cycle on the ramp shoulder up to the ramp terminal intersections where they can join the off-road shared use path facilities and cross the intersections by means of signalised toucan crossings. They will be able then to re-join the entrance ramp shoulder on the far side of the intersections and continue down to the expressway. In addition, southbound cyclists have the option of leaving the ramps just past the nose and using a network of two-way shared use paths and subways instead of continuing up to the ramp terminal intersections and crossing at the toucan crossings. These shared use facilities, which are separated from road traffic, connect with existing cycle trail/lanes in the Hutt River corridor so that cyclists can leave or join the SH2 expressway route at the Melling Interchange if desired.
- **Local roads:** On local roads minimum 1.5 m wide footpaths have been provided. Footpaths are provided on both sides of the road, where possible. On Harbour View Road and Tirohanga Road, for example, a footpath is only provided on one side of the road. In the HCC CBD area footpaths are a minimum of 2.4m wide as agreed with HCC.

Section 9(2)(j)

[redacted]

10.7 Railway line, Melling Station and Pharazyn Street

The Melling Interchange will require replacement of the existing railway station with a new facility (similar to the recently constructed facilities at Tawa or Naenae), along with a relocated park 'n' ride, a realignment and shortening of the rail line (in order to create space for the interchange construction and correct the current run-out space deficiency), and realignment of Pharazyn Street. More detail on the rearrangement of these two assets is provided in the Melling Station Location Options Assessment (Appendix J) and the Pharazyn Street Options Assessment (Appendix K).

To date, no specific design has been undertaken of the railway station or rail line however any ultimate redesign would need to be in accordance with KiwiRail standards and guidelines. In consultation with GWRC, HCC and KiwiRail a land requirement plan is being developed that will show a preliminary design of the train station alongside a Park 'n' Ride with like for like parking provision. At this stage enough space has been allocated for two lines and two platforms to future proof for a potential rail line extension. The span under the interchange bridge has been sized to accommodate a future single line rail extension.

Future work on the train station design and land use integration will be undertaken as part of the RiverLink ULDF, with the ultimate extent of design and integration decided by GWRC as they are the owners of the train stations.

The railway station, Pharazyn Street and Park 'n' Ride area will become GWRC and HCC assets and therefore the ongoing design of this area will be led by them. Accordingly, the current drawings do not show any detail in this area, but some initial thinking about the layout has been discussed between GWRC and HCC and is presented in Figure 10-6.

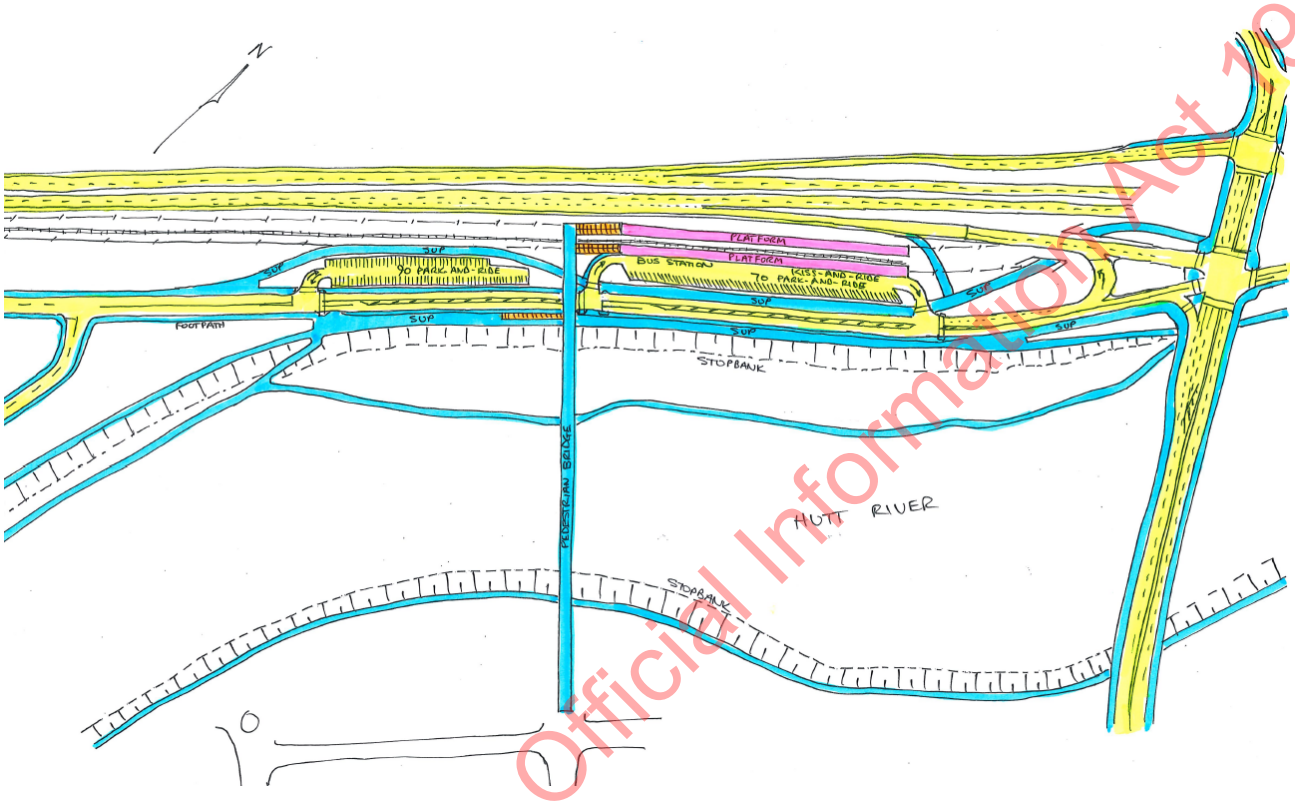


Figure 10-6: Potential Railway Station Area Layout

10.8 Railway Line Extension

The preferred layout of the interchange has been designed so as to not preclude the possible extension of the Melling rail line to the north at a later date.

This has primarily been done by lengthening the span of the interchange bridge to provide enough width and height to thread a single-track envelope through the interchange alongside SH2. The approximate alignment of the extended rail corridor is shown in below.

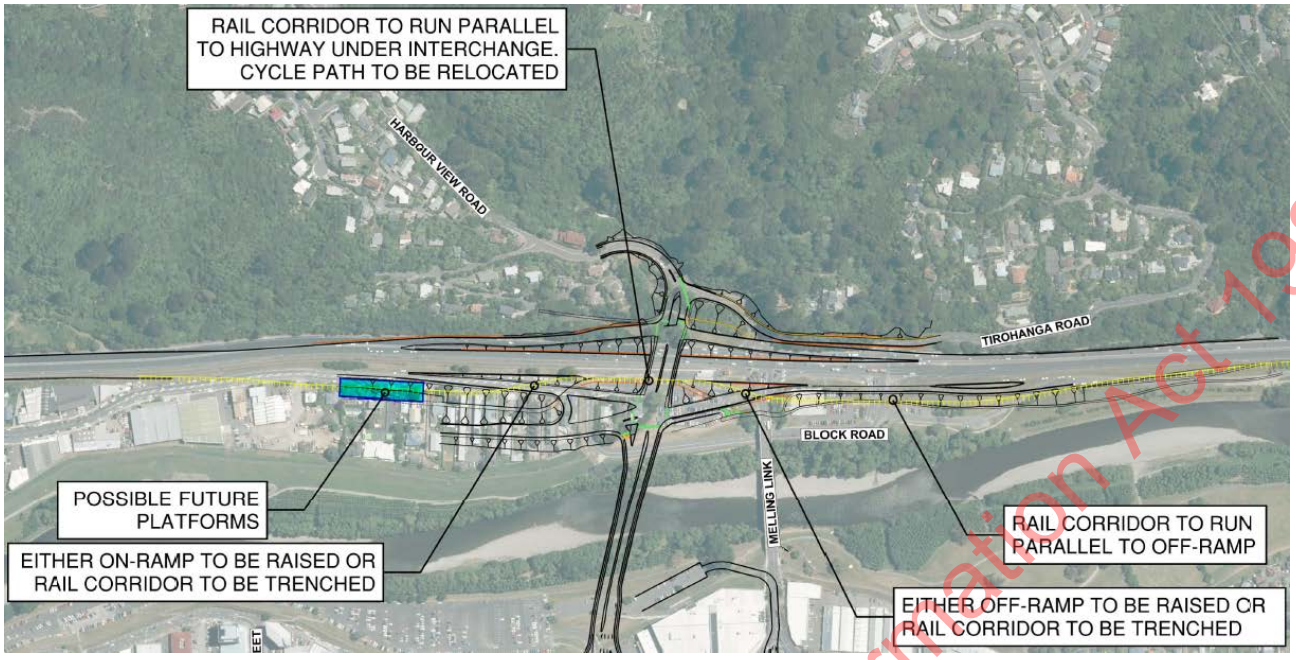


Figure 10-7: Potential Railway Line Extension (Yellow Line)

Extending the rail line north would be a costly and technically challenging exercise due to (amongst other things):

- the need to construct two significant box culverts under the southbound entrance and exit ramps, likely necessitating the full reconstruction of both ramps and rerouting the cycleway/share use path along the riverbank;
- the location and interaction with the Wellington seismic fault; and
- the need to transition the rail line over the stopbank north of the interchange to a position within the river flood plain, which could have an impact on the resilience of the stopbank system.

These elements would need further investigation and detailed design when options for extending the railway line are considered in the future.

10.9 Safety Audit

An external Safety Audit of the Recommended Option scheme design has been conducted. The Project Team has responded to the auditors findings and currently are awaiting the client decision from the Transport Agency. The Safety Audit report is appended in Appendix L.

11. Recommended Option Assessment

11.1 Investment Objectives and Outcomes

The assessment of the recommended option forms part of the Economic Case for the project along with the Economic Analysis. The assessment identifies all the impacts of the proposal and the resulting value for money. This section outlines the extent to which the option meets the Investment Objectives.

Table 11-1: Investment Objectives and Outcomes Summary

Investment Benefit	Investment Objective	Recommended Option	
Safer journeys for all road users	Improve KiwiRAP star rating for SH2 from minimum 2 star to minimum 4 star by 2031	✓	The current KiwiRAP star rating is 2 for the northbound lane as it passes Tirohanga Drive, and 3 star for other parts of the highway. The project will bring these ratings up to 4 star.
	Reduce five year serious injury crash rate from six to one by 2031	✓	The recommended option will achieve the following reductions in DSIs: • SH2 – 4 DSIs • Local Roads – 1 DSI In real terms this equates to a saving of 1 DSIs per year over the next five years. This represents an 83% reduction in the number of people who would have been seriously injured when travelling through the study area.
Improve access between Hutt City Centre and SH2	Reduce travel time for key movements between SH2 and Hutt City Centre to less than five minutes by 2031	✓	SH2 South to Hutt City Centre 2031 AM / IP / PM Do Min: 7:15 / 3:55 / 9:25 Option: 2:55 / 2:40 / 3:50 SH2 North to Hutt City Centre 2031 AM / IP / PM Do Min: 3:30 / 2:55 / 6:00 Option: 2:40 / 2:05 / 2:30
Better access to quality transport choices	Increase walking and cycling trips through Melling intersections in the AM peak from 150 to over 200 by 2031	✓	• 100-200 additional pedestrian movements by improving connections between the Hill suburbs and the railway station / city centre. • In addition, the project will also improve connections between the railway station and city centre. An increase in recreational trips are also expected. This will increase even further once coupled with the other RiverLink programme elements.
	Increase peak boardings at Melling Station from 774 to over 1000 by 2031	✓	Based on elasticities from research reports: • Relocating and upgrading the station is expected to increase patronage by 30% (TIC, 2018; NZTA, 2016; TRL, 2004). • Improving walking and cycling facilities to the station is expected to increase this even further.
Improve security and availability of network	Reduce frequency of events disrupting traffic on SH2 from average of one per week to average of one per month	✓	Estimated reduction from 45 per year to 17 per year. (Estimated 80% reduction in crashes, 0% reduction in breakdowns, 80% reduction in obstruction, 100% reduction in flooding, 100% reduction in traffic signal faults)

11.1.1 Transport System Users

The following table outlines the benefits of the project for the different users of the transport system

Table 11-2: Road User Assessment

Road User	Considerations
Local residents and businesses	Improved capacity at the intersections means that local residents will experience fewer delays and improved safety at these locations. Better facilities for walking and cycling mean active modes will be safer and more attractive for local residents accessing Hutt City Centre or the railway station, while addressing perceptions of severance created by SH2. Reduced flood risk and improved safety means the transport network will be more resilient and less subject to closures, benefiting residents and local businesses.
Commuters	Improved capacity and reliability at the Melling intersections will reduce journey times for commuters. Mode choice for commuters will also be improved through local access and active mode improvements, as well as improved access to Melling Station for those travelling south. There would be improved safety for commuters also.
Long distance freight and traffic	Providing an expressway interchange means that through traffic including freight travelling between Wellington, the Hutt Valley, Wairarapa and Hawkes Bay will experience far fewer delays than are currently experienced. It will also improve the journey for Seaview/Gracefield trips with an origin or destination north up SH2 or SH1(once Transmission Gully is opened) Safety will be improved as the current signals are out of context on a 100km/h highway, and are leading to increased risk.
Rail passengers	Relocating Melling station would allow the possibility for a larger parking area to be provided for Park & Ride, aligning with GWRC ranking of Melling Park & Ride in the top band for potential expanded services. It will be located closer to Hutt City Centre which will increase the number of working rail commuters within walking distance. It will be accessed by a walk/cycle bridge (part of HCC's remit) which will improve access to the station from the CBD, plus the possible extension of the bridge across SH2 into the western hill suburbs. It would make any new Hutt City Centre apartments more accessible to travel to Wellington by train
Cyclists	A full network of cycle lanes, paths and shared paths are being provided throughout the interchange, on local roads and along the river corridor. These would significantly improve the safety and accessibility of this mode. Specific new connections would link with Petone to Melling and Ngauranga to Petone cycleways to the south and with the Hutt Cycle Trail to the north. Thereby improving the safety and experience for cyclists.
Pedestrians	The HCC footbridge over the river and the Riverside Promenade will improve local access and through movement between residential areas, Melling Station and Hutt City Centre destinations. To compliment this, the new interchange will provide a network of connecting footpaths that meet Transport Agency standards, and traffic signals will all have pedestrian phases to improve the safety of pedestrians crossing the road.

11.1.2 ONRC Performance

The ONRC defines the Customer Levels of Service expectations for each road category. SH2 is classified as a National High Volume highway to the south of Melling Link intersection, and a National highway to the north. For this reason, the National High Volume Highway standards have been used to assess the current performance of SH2 in the vicinity of Melling. This is summarised in Table 11-3.

Highlighted in red are the criteria where a significant gap currently exists between expected levels of service and actual levels of service. Orange indicates an identified gap, while green indicates the levels of service are acceptable. Overall, a gap assessment is based on an understanding of how the road is performing against all criteria. A significant gap is assigned to a road that is significantly underperforming against at least one key criteria, resulting in a performance that is lower than its classification. The assessment shows that SH2 in the vicinity of Melling is underperforming, with significant gaps for speeds, safety and accessibility.

Table 11-3: One Network Road Classification Assessment of SH2 (Melling Intersections)

Criteria		Level of service benchmark – National High Volume State Highway	Assessment of Existing Conditions (2018)	Recommended Option
			Significant Gap / Identified Gap / Achieved	
Mobility	Travel Time Reliability	The majority of road users experience consistent travel times with some exceptions in major urban centres	Travel times are inconsistent, with sometimes considerable delays at peak times and during the weekend, and route unavailable due to events, including crashes on average once per week.	Travel times would be far more consistent for all road users with the new interchange. Flood and crash risk would be reduced, improving resilience.
	Resilience	Route or viable option is always available. Very rapid restoration of route affecting normal operating conditions. Road users are advised well in advance of issues affecting network performance and availability.	Normal highway operating conditions are disrupted around once a week. Alternatives routes are mostly available, although they are not suitable for all traffic and add delays. The Block Road off ramp has been closed thirteen times due to flooding in the five year period. Melling Bridge is a constraint to flood protection for local road network and other assets. This is significant, but does not affect the resilience of SH2[31].	Flood and crash risk would be significantly reduced, and route would normally be available.
	Speeds	Higher speeds on KiwiRAP 4 star dual carriageway roads, lower or variable speeds where required to support network safety/productivity.	The speed limit on SH2 through the Melling intersections is 100km/h. Traffic lights in a high speed environment is not good practice. The Safe and Appropriate Speed is 80km/h. The operating speed is 70-80km/h.	A 100km/h speed limit can be maintained on SH2 and is much safer as a grade separated interchange. KiwiRAP 4 star rating would be achieved.
Safety		Mostly forgiving roads and roadsides, equivalent to KiwiRAP 4 star. User hazards absent or mitigated including head on risk. Active road users generally do not have access – if present they are provided with separate space or are physically separated.	SH2 in the vicinity of the Melling intersections has a KiwiRAP 3 star rating, with a section of 2 star on the northbound exit. This falls short of the desired standard. The combined SH2 / Melling Link / Block Road intersection has a HIGH intersection collective risk (based on four Dsi crashes). The SH2/Block Road intersection has a medium collective risk. Cyclists are not provided for on the SH2.	The SH2 intersection collective risk would be lowered to LOW (based on one DSi on SH2). A KiwiRAP 4 star rating would be achieved. Cyclists would be provided for through the intersection. Safety for active road users would be greatly improved.
Amenity		High level of comfort, no discernible roughness. Aesthetics of adjacent road environment reflects journey experience needs of higher numbers of through traffic users. Character of scenic/tourist routes protected/enhanced.	The road is functional with trees on one or both sides providing some aesthetic amenity. The rail corridor is immediately adjacent to the road.	Amenity would be enhanced.
Accessibility		Land use access for road users rare and highly engineered, usually only to highway service centres. Strategic network connectivity for road users due to infrequent connections. High volume traffic will not be unimpeded by other traffic at junctions. Active road users generally do not have access – if present they are provided with network access and journey continuity by a separate space or are physically separated.	SH2 corridor is not consistent, with intersections to north and south grade separated. SH2 does not have priority when signals are red; highway traffic gives way to a lower order road. When signals are red traffic backs up on SH2 with queues of up to 1.5km on the southbound approach in the morning peak, and 160 m on the northbound approach in the evening peak. Active road user provision is inadequate given the traffic volumes, speeds and presence of heavy vehicles.	The SH2 intersection would be consistent with Dowse and SH58 intersections with SH2. Red light signals will no longer cause queues on the through lanes of SH2. Active mode facilities will be provided throughout the intersection. Improved accessibility for all modes.

[31] The Wellington Region Resilience PBC addresses wider resilience issues for highways in the region.

11.1.3 Summary

The recommended option supports the RiverLink objectives and is well integrated into HCC and GWRC RiverLink components. The recommended option would:

- Improve the resilience of the transport network which is susceptible to an average of one closure per week due to unplanned events (crashes, floods, etc)
- Improve safety with an 80% reduction in the number of people who would have been killed or seriously injured when travelling through SH2/Melling intersections. Over the next 5 years this represents a saving of 5 DSIs.
- Increase the SH2/Melling intersections KiwiRAP rating from 2 to 4 stars
- Support future growth in Hutt by improving accessibility for people moving between SH2 and Hutt residential areas and Hutt City Centre.
- Improve travel choices for Hutt residents by providing for active mode access to Hutt City Centre and Melling station from the western hill suburbs; improving attractiveness of Melling Station by relocating it closer to Hutt City Centre, improving active mode access and increasing capacity of the Park & Ride car park.

The overall outcome of the complete Melling RiverLink Improvements is an integrated, aligned, consistent and future proofed solution.

11.2 Constructability

In terms of construction complexity, whilst not easy, the Queens Direct Option was the least complex of the three short-listed options. The five-legged intersection on the eastern side of the interchange is less than ideal, however was much more efficient (for peak hour travel times) than having two intersections closely spaced together, which was considered in an earlier iteration of this option. There are certainly some design challenges that need to be overcome, some of which may require design exceptions, however on whole the scheme is implementable.

An advantage of the Queens Direct Option is that it can be built largely offline, meaning that disruption to existing traffic is minimised, something that the Melling Link Option could not achieve. The western river bridge abutment may be able to be progressed without any interaction with the stopbanks. The existing Melling railway line and any potential future extension need to both cross under the SH2 southbound on-ramp and off-ramp restively, which can be catered for although it would be a tight fit.

Relocation of Melling Railway Station and trackwork is driven by the other transport improvements. The trackwork and building works are considered to require different expertise and resources from what is required for the rest of the project. The timing is also likely to be earlier than for other project elements.

The recommended high level stages of construction are:

- Section 9(2)(j) [redacted]
- Relocate railway station, car park, Pharazyn Street access, realign railway line;
- Section 9(2)(j) [redacted];
- New bridge over Hutt River, including walk/cycleways;
- New SH2 / Melling interchange, including walk/cycleways;
    - Construct the southbound exit and entrance ramps and as much of the southbound carriageway as possible.
    - Deviate southbound traffic onto the southbound exit and entrance ramps.
    - Complete construction of the southbound carriageway and deviate northbound traffic onto the new southbound carriageway.
    - Construct the new northbound carriageway and northbound exit and entrance ramps, including a new temporary signalised intersection north of the interchange bridge.

  - Deviate northbound traffic onto the northbound exit and entrance ramps and complete construction of the bridge over the motorway.
  - Deviate traffic onto the new interchange bridge, decommission the signalised intersection, and open the northbound and southbound carriageways to traffic.
- New signalised intersections on Queens Drive (2 sets);
- Intersection changes Melling Link / Rutherford Street;
- Intersection changes Melling Link / High Street;
- Demolish existing Melling Link bridge;

11.3 Operability

The main element of the operability of the recommended option is the traffic signals, and particularly the operation of the five-arm intersection where Pharazyn Street connects to the interchange.

To ensure operability aspects were covered, a Traffic Signals Design Review was commissioned (Appendix M). This review has recommended several changes to help with the operation and safety of the intersections, but no major flaws were found.

11.4 Statutory requirements

An assessment of the most suitable approach to obtaining statutory approvals for the SH2 Melling Intersection Improvements has been completed (Appendix N). This looked at risks and benefits of three different approaches to consenting and concluded:

1. Designation – best approach as protects the land from the time the Notice of Requirement is submitted to the Council and allows much more flexibility to make changes to the design prior to construction. The robustness of the process followed to determine a recommended option means the project should withstand any challenge through the designation process. Section 9(2)(g)(i) [redacted]
2. Resource consent – possible but key risk is that consent can be granted for activities on land now owned by the applicant, but if the land owner is opposed to the application and can demonstrate that the proposal will have significant adverse effects on them that cannot be avoided, remedied or mitigated, then the consent could be declined.
3. Plan change – not viable option, plan changes are not used for establishment of specific infrastructure projects.

These options are discussed further in the Commercial Case.

Works or activities associated with the Melling Intersection Improvements which are expected to trigger the need for designation, alteration to existing designation or consent under the Hutt City District Plan:

- Upgraded and new connections to local roads (outside existing designation)
- Construction of new over bridge, interchange and new Melling Link Bridge
- New cycleway/lanes
- Relocation of the Melling railway line and Melling station
- Earthworks (if not using designation process) – if certain thresholds are exceeded and then will need resource consent (discretionary activity)
- Works and activities in a listed Natural Resource area (Harbour View and Jubilee Park Bush – resource consent (discretionary activity)

There is a heritage building in the study area and works resulting in demolition or relocation of that building would have resulted in a resource consent. However, the recommended option affects access to the heritage building only, so a consent will not be needed.

There are also works or activities which trigger the need for designation, alteration to existing designation or consent under the Natural Resources Plan for the Wellington Region, as follows:

- Earthworks and associated sediment discharges

- Discharge of stormwater from the state highway
- Structures in the riverbed including disturbance of the riverbed, deposition on the riverbed, diversion of water, discharge of sediment to water, temporary damming of water, partial stream reclamation associated with the structure.

It still needs to be confirmed whether other activities which will trigger the need for a consent are required as part of the scheme. This would include dewatering, discharge of contaminants from contaminated land and discharges other than sediment and stormwater.

Statutory approvals will not be required from Heritage NZ as there are no significant Archaeological Resource Sites or Significant Cultural Resource sites in the vicinity of the study area. The works avoid the need to demolish or relocate the only heritage building within the study area. It will be necessary to identify whether the 'River Recreation', 'Primary River Corridor' and 'Secondary River Corridor' District Plan zones are classified as Reserves under the Reserves Act and therefore subject to the Act's provisions and if there are any relevant management plans that apply.

It will be necessary to seek statutory acknowledgements in conjunction with Port Nicholson Block Settlement Trust and Te Runanga o Ngati Toa as affected parties.

11.5 Property impacts

The recommended option impacts on 56 properties, however the vast majority of these are properties owned by the Crown or Councils, including those that are currently being purchased for the RiverLink flood protection works. The impacts on these properties is the same across all options.

The major differences between options were the properties affected by the tie in at Queens Drive or at Melling Link. Property and land use impacts was discussed at the MCA workshop and it was hard to differentiate between the options.

Section 9(2)(j)

[redacted]

Further information on property costs and strategy is presented in Part C.

11.6 Social and Environmental impact

Investigation was undertaken into the social and environmental effects of the options to help with the option selection processes. Much of this is presented in the MCA reporting. In addition, an Environmental and Social Responsibility Screen has been populated and this, along with supplementary information is presented in Appendix O.

Some of the more significant impacts of the recommended option are presented below:

- The Hutt River is the highest value environmental and cultural asset within the study area. However, this is being substantially modified by the RiverLink project through dredging, river channel works and stopbank upgrades. If Melling Intersection Improvements were to happen after RiverLink then the effects on the river will need significant mitigation.
- The District Plan identifies Harbour View Bush and Jubilee Park Bush as listed natural resources that will be affected by construction. There are also two notable trees in the SH2 road reserve near the intersection of Harbour View Road.
- Whilst there are no significant Archaeological Resource Sites or Significant Cultural Resource Sites in or within the study area identified in the Hutt City District Plan, there is a Category 2 heritage building listed at 125 Western Hutt Road, opposite the Melling Bridge. Whilst the works will not affect the building, it may affect its setting. This building and property is owned by the Transport Agency.
- Engagement with iwi has not identified any significant concerns however a full cultural impact assessment will need to be undertaken.
- The Hutt River corridor is also a significant social and recreational asset. Our initial assessment through the MCA process has identified some adverse impacts with the Queens Drive bridge location due to shading and noise.

The above impacts will need to be investigated and mitigation proposed through the designation and consenting processes.

11.7 Safety impacts

A Safe System Assessment Framework analysis has been undertaken (see Appendix P) to assess the level of alignment of this project to the Safe System objectives, for both the existing intersection and the recommended option. The framework assessment considers key crash types and road user types and assigns a numerical risk score to their exposure, the likelihood of a crash and the severity of a crash, should one occur. These are multiplied to give a score for each crash or road user type. The overall sum of these scores gives a total score for the scheme.

The current scheme yields a score of 228 out of 448, whereas the recommended option yields a score of 72 out of 448, a vast improvement as the lower the score, the closer the scheme comes to meeting the Safe System objectives.

12. Economic Analysis

The economic analysis forms part of the economic case and is focused on the monetised and non-monetised elements of the analysis as defined in the Transport Agency Economic Evaluation Manual (EEM). Full calculations using the specified EEM proforma are included in Appendix Q.

12.1 Travel Time Benefits

The assessment used two tiers of traffic modelling, the North Wellington SATURN model and a PARAMICS microsimulation model of Melling. The modelling assessment showed that the majority of the benefits of the Recommended Option are derived from travel time savings.

The travel time savings are expected to be significant during the morning peak and greater still during the evening peak. This is because significant congestion is predicted in the Do Minimum scenario in the 2031 evening peak, and the Recommended Option provides additional capacity to alleviate that. The most significant travel time savings are expected on SH2 between north and south, particularly northbound in the evening peak where a reduction from the Do Minimum of 8:05 minutes for to 2:20 minutes (5:45 minutes saving) with the project. For journeys from SH2 south to Lower Hutt, a similar saving is expected in both the morning and evening peaks.

Queuing is expected in the morning and evening peaks for the Do Minimum scenario. For the Recommended Option, queues on the motorway ramps at the Melling Interchange are expected to remain within the length of the off-ramps, and not extend back on to the motorway through lanes. Queueing within Lower Hutt will still be present for the option albeit significantly less than the Do Minimum.

12.2 Safety Benefits

A total of four serious injury crashes were reported at the SH2/Melling Link/Block Road intersection over the most recent five year period with a further two serious crashes within the project area.

As the recommended option provides a grade separated solution for the SH2 through traffic and travelling to/from local roads, the safety issue of a signalised intersection in a high-speed environment is removed. Although traffic signals remain a feature of the interchange design, these are now located in a lower speed environment which reduces the severity of any future accidents. However, the project is expected to enable higher travel speeds along SH2 which could result in shift to lane change crash types.

12.3 Road User Cost Benefits

Project benefits for all road users have been assessed against the Do Minimum. Discounted project benefits compared to the Do Minimum are shown in Table 12-1. As noted above, the majority of benefits are derived from travel time savings.

Table 12-1: Discounted benefits ($) millions

Benefit Stream	Recommended option
Travel Time Savings	153.9
Driver Frustration (Congestion)	26.1
Vehicle Operating Costs	14.3
Vehicle Emissions	0.7
Trip Reliability	9.0
Crash Costs	7.8
Active Modes	1.3
Public Transport (decongestion)	5.0
TOTAL	**218.1**

12.4 Economic summary of recommended project option

The economic assessment has used a 40 year evaluation period and a 6% discount rate. The project has been assumed to start in July 2028 with an assumed contraction period of three years, and a 37 year benefit period from August 2031 to July 2068.

Table 12-2 provides a brief economic summary of the expected monetised impacts for the recommended option.

Table 12-2: Economic Summary Table

Timing	
Earliest Implementation Start Date	1 July 2028
Expected Duration of Implementation	3 years
Economic Efficiency	
Time Zero	1 July 2019
Base date for Costs and Benefits	1 July 2028
Present Value net Total Project Cost of Recommended Option	$131.0m
Present Value net Benefit of Recommended Option (exc. WEBs)	$218.1m
BCR	1.7

12.5 Incremental assessment

No incremental assessment has been undertaken because the options are very similar in benefits in costs and the recommended option was clearly preferred over the other shortlisted options through the MCA processes.

13. Investment Assessment Profile

The Investment Assessment Framework (IAF) 2018-21 was applied to the Melling Transport Improvements, with the Results Alignment presented in Table 13-1.

Table 13-1: Recommended Option – Results Alignment with IAF (2018-21)

Activity Class	State highway improvements
Alignment	Very High – Priority Order = 1
Explanation for rating	**Safety (Very High)** • The SH2/Melling intersections have a high crash risk. • Vulnerable road users (motorcyclists) have been involved in all serious injury crashes on SH2 in the vicinity of the Melling intersections. Motorcycle crashes are a Safer Journeys area of high concern. • This stretch of SH2 is in the top 10 percent of the network that will result in the greatest reduction in deaths and serious injuries if a speed management approach is taken • This stretch of SH2 has a high collective risk with the recommended option estimated to achieve a DSI reduction of 80% **Access – Thriving Regions (High)** • Addresses significant resilience gap or impediment to access on nationally important social and economic connections: SH2 closed on average once a week due to unplanned events and the flood risk is compounded by the restriction Melling Bridge has on the floodway. • Makes best use of key corridors that prioritise national freight and tourism: SH2 is a National highway which plays a key role in the national network for freight and tourism. It is also part of the national wine trail corridor. **Access – Liveable Cities (High)** • Supports high priority elements in agreed integrated land use and multi-modal plans: HCC Making Places Plan, Urban Growth Strategy and Central City Transformation Plan, as well as the RiverLink PBC and SH2 PBC. Addresses a significant resilience risk to continued operation of key corridors: Currently SH2 at Melling is affected on average once per week due to unplanned events including crashes and flooding; Melling Bridge adds to flood risk as can only pass waters from a 1 in 65 year flood. The recommended option removes this constraint.

PART C – READINESS AND ASSURANCE

14. Commercial Case

14.1 Summary

Commercial arrangements for future phases of the Melling Transport Improvements will be aligned to the Transport Agency's Procurement Strategy. Procurement activities will be progressed in accordance with the rules and guidelines documented in the latest version of the Transport Agency Procurement Manual.

The Transport Agency have stated that funding for the construction of the Melling Transport Improvements Project will be considered beyond 2028. While it has been agreed that consenting will begin now, a decision is yet to be made on when other pre-implementation activities may commence, including final design, and property purchase, however, this is very much dependent on the timing of construction.

Two scenarios have been considered for the implementation phase:

1. **Combined with RiverLink**: transport improvements are implemented as part of the wider RiverLink scheme with a merged delivery programme
2. **Independent (and after)**: progression of the transport improvements separate to the remainder of RiverLink.

Following a review of these scenarios, which is outlined in more detail below and in Commercial Considerations Report (Appendix R), it is recommended that the Transport Improvements be delivered separately and after the flood protection and place-making elements of RiverLink via a collaborative contract managed by the Transport Agency.

14.2 Approach to Assessing Alternative Commercial Arrangements

The assessment investigated whether enough benefits are gained, or risks reduced, by implementing the public projects together as a combined work. The assessment is presented in Appendix R. It considered:

- Strategic context
- Scale and complexity of works
- Timing, duration and urgency of works, including consequences of not investing
- Uncertainties and risks, including consenting and property issues and hydrological and geotechnical information
- Innovation potential and appetite
- Management approaches, practices and maturity of the contracting parties
- The need for specialist skills and the supplier market.

The conclusion was that the majority of benefits of collaboration are obtained for the pre-implementation phase, rather than the implementation phase. Overall the combined project option yields more benefits due to co-operation at the consenting and preliminary design phases. However, delivering it together may be more expensive as competitive pressures will be lower. Also, there is currently a misalignment of implementation timelines between RiverLink (2021-2026) and Melling (2028 beyond). Accordingly, a combined approach for consenting only is recommended.

The benefits that may be derived from the ongoing collaboration of RiverLink Partners during pre-implementation activities include:

- Clarity of full benefits of combined project – merged and managed risks plus cost savings
- Quality of outcome
- Certainty of outcome
- Disruption minimisation
- Reputational enhancement

- Matching cash flows

After pre-implementation, it is recommended that the Melling Intersection Improvements proceed separately to RiverLink and utilise either a shared risk delivery model or a lump sum design and construction model to implement the transport improvements.

14.3 Pre-Implementation

14.3.1 Designation and Consenting Strategy

The Consenting Strategy is provided in Appendix N. The strategy outlines:

- Proposed activities and works
- An assessment of the key planning instruments
- Statutory approvals required including designations, resource consents, historic places act, natural resources plan etc]
- The current scope and status of the RiverLink RMA approvals process and options to integrate with this process
- A discussion on the different RMA approval options to protect the study area (plan change, designation or resource consents)

The strategy confirms that efficiencies would be gained and risks reduced by completing the consenting for the transport improvements at the same time as the other elements of RiverLink. The benefits of a joint designation/consenting process are:

- Enables integrated planning so that priorities and trade-offs are optimised and transparent
- Easier for those determining the planning decision to understand the combined benefits of the programme
- Easier for communities to understand the combined benefits of the programme
- Cost savings resulting from sharing expert witnesses and a single hearing for all NoR
- Encourages partner organisations to resolve any differences collaboratively prior to any hearings.
- Shared professional services costs for property acquisition/transfer/disposal; legal services for preparation and presentation applications for resource consents, NoRs for the land for the combined project; investigation and modelling for an AEE and to support design (archaeological, ecological, survey, geotechnical, hydraulic, services, groundwater, traffic, visual and noise); engineering design services; project management services to act for the project's principles from each partner organisation.
- Ability for the Transport Agency to acquire property for the transport improvements, some of which GWRC have purchased for the flood works but do not need.

The risks of a joint designation/consenting process with RiverLink are:

- If the Transport Agency lodges a NoR and a designation is granted, the Agency would be required to purchase or lease any land within the designation, where the owner wishes to sell. The Transport Agency needs to make allowance for property acquisition funds when considering this decision.
- Any designation is time limited which means that applying for a designation assumes delivery within a set timeframe or risk wasting the money spent on achieving statutory approval. However a longer designation timeline can be requested.

It is noted that the Transport Agency has not committed to completing and integrated consenting design, AEE and NoR with the RiverLink partners. After this, a key decision point follows, when the Transport Agency Board will decide whether they wish to apply for a designation. Even if, at this stage, the Transport Agency decide not to apply for a designation, the Transport Agency and RiverLink will still achieve the integration that is so important for delivering the community and project outcomes.

14.3.1 Designation and Consenting Commercial Approach

Previously, the RiverLink Project Partners agreed in principal to pursue a consenting pathway for the RiverLink project that involves, as much as possible, a collaborative approach, comprising:

- Separate Notices of Requirement (NoRs) and resource consent applications prepared together as single package of documents;
- The supporting environmental and technical input provided by a single team of experts, contributing to one overarching Assessment of Environmental Effects and evidence set, and
- The designations and resource consents being issued under each responsible requiring / consenting authority and implemented by the respective agencies in a coordinated approach.

On this basis, a Professional Services Contract was prepared for the designation and consenting of all three project partners' work. At that time, the Transport Agency could not commit to being part of the contract due to their business cases approvals process and funding availability, so their elements were included as an additional service and not part of the core scope. The Transport Agency Contract proforma for professional services was used, and the Transport Agency were on the Tender Evaluation Team.

In July 2019, this contract was awarded, without the Transport Agency element. However, in September 2019 the Transport Agency announced that it would join the consenting process and negotiations are currently underway with the preferred supplier.

However, as the team selected to undertake the designation and consenting have had no involvement in the development of the Melling Transport Improvements SSBC, it is suggested that specialists from the Melling Intersection Improvements SSBC team are brought in to bring continuity, technical knowledge and project history of this part of the scheme. This would have several benefits including; a greater understanding of the transport improvements, better co-ordination between the project elements, better understanding of impacts if elements are changed, and expert witnesses with a better understanding of the project development process. This would also have overarching benefits of reducing the time in getting the new team up to scratch, reducing the cost involved in incorporating the transport improvements and reducing the risk of difficult conditions.

Key risks for the pre-implementation stage have been identified, evaluated and recorded in the risk register. The main risks are:

- Political shifts in objectives and managing associated scope change
- Managing Public Relations
- Engagement of third parties (e.g. Iwi)
- Alignment of objectives across three agencies
- Coordination of specialists
- Providing the right level of detail in a 'consenting' design
- Not thinking big enough (innovation curtailed)

The Transport Agency needs to ensure these risks are understood and managed appropriately by the RiverLink supplier and/or RiverLink partners.

14.3.2 Design Strategy and Commercial Arrangements

The Melling SSBC has developed the design to a level that can inform operational requirements, the designation boundary and the cost estimate. However, additional design will be needed for consenting and subsequently implementation.

Table 14-1 outlines the design that has been completed under the current SSBC and what additional design and investigation would be required to submit for designation and consents.

Table 14-1: Level of design completed at SSBC stage

Element	Melling SSBC Scope	RiverLink Consenting Design Scope for Melling Intersection Improvements
Topographical Survey	Limited survey undertaken	Survey needed to accurately assess footprint for notice of requirement

Element	Melling SSBC Scope	RiverLink Consenting Design Scope for Melling Intersection Improvements
Geometrics	3D Design at SSBC level	Incorporate Melling into RiverLink design models
Traffic Design	Preliminary intersection design, cross sections etc	Pharazyn Street design to be progressed alongside Railway Station. Parking design will be needed.
Geotechnical	Limited geotechnical design undertaken for retaining walls and bridge abutments to ensure a workable solution.	No additional work expected. However, this may change once geotechnical test results are received. Erosion and Sediment Control Plan to be done by RiverLink.
Structural	Preliminary Structure Options Report includes • Service requirements • Design philosophy and constraints • Structural form, materials, constructability cost for a range of options • Recommended options	Preliminary design, including urban design elements, to enable structure form and element sizing, particularly for works in the bed of the river and visual/landscape assessment. Incorporation into other RiverLink elements.
Architectural and ULDF	Not required	Incorporation into the existing RiverLink Architectural and Urban and Landscape Design Framework (ULDF) particularly for the interchange and bridge design.
Cultural Input	N/A	RiverLink to obtain cultural input
Drainage	Hydraulics, catchment analysis, project drainage path identification and outline of infrastructure required for cost estimate	Treatment options to be identified and analysed. Preliminary design phase to enable water quantities, contaminants and treatment process to be robustly reported
Pavement	Concept level for cost estimation purposes only	No additional work except incorporation into wider RiverLink
Services	Identification of where services could be relocated and approximate cost	No additional work except incorporation into wider RiverLink
Property	High-level land information plans	Development of land requirement plans
Transport Analysis	Modelling and impacts analysis undertaken	Transport impacts analysis and reporting including wider scheme
Construction methodology	High level programme only	Construction methodology to understand impacts, including; discharges from construction, diversion of watercourses, disturbance of riverbed, traffic diversions and additional land needed for construction worksites
Railway Station	Location confirmation only	Railway station and site layout design
Walking and Cycling	Preliminary design	No additional work except incorporation into wider RiverLink
Noise	None undertaken	Investigation and design of any noise mitigation needed
Impacts assessment	High level assessment of impacts – updating MCA assessments	AEE and specialist assessments

Subsequent to statutory approvals being achieved, additional design work will be needed before implementation. The level of design and the commercial arrangements for this will depend on the commercial arrangements agreed for the implementation phase; i.e. Traditional, Design and Construct or Alliance.

14.3.3 Property Strategy and Commercial Arrangements

A property strategy (Appendix S) has been developed by The Property Group which outlines the estimated current market value of land required underneath the assumed Transport Agency and KiwiRail designations.

The strategy makes several key points and assumptions:

- As the Transport Agency project is not being constructed for some time, Section 9(2)(j) [redacted]
- The acquiring of replacement land for the Melling Park and Ride Facility, a realigned Pharazyn Street and associated access should be the responsibility of GWRC and/or HCC.

Section 9(2)(j) [redacted]

Section 9(2)(j) [redacted]

The above figures are based on an expected cost sharing arrangement with Greater Wellington and Hutt City Council. This is subject to change, as presented in the Meeting Record also in Appendix S, and discussions are ongoing between the different partners.

The property strategy identifies a total of 60 properties affected by the project. This is broken down into:

- Section 9(2)(j) [redacted]
- Seven land parcels on Harbour View Road which are owned by the Crown or HCC
- Three land parcels around Melling Bridge which are either Legal Road and/or owned by the Crown
- Four land parcels in the river corridor which are owned by GWRC
- Nine land parcels around the railway corridor which are owned by the Crown or GWRC
- Section 9(2)(j) [redacted].
- One parcel on the western side of Pharazyn Street which will be required for a realignment of the rail designation.

The property strategy recommends a simple approach to the purchase of land from GWRC Regional Council, which would enable the property to be transferred in one transaction.

Land required from local roads will not need to be compensated due to the provisions of the Public Works Act.

Further investigation is required into some of the Crown land to determine which department administers this land.

Section 9(2)(j) [redacted]

The land adjacent to Queens Drive also has high re-development potential and therefore it is recommended that discussions continue with HCC as to the future use of this land and whether they want to facilitate or encourage appropriate development at this location through initially acquiring some of the land.

Section 9(2)(g)(i) [redacted]

14.3.4 Timing

The current timelines for RiverLink, are

- lodgement of NoRs and resource consent applications (with Melling) - December 2020

- construction commencement (without Melling) 202
- construction completion 2026

It is understood that the construction of the project could be expanded or contracted to fit Transport Agency implementation timeframes (within reason) or respond to Council cashflow requirements.

14.4 Implementation Phase

Given the Transport Agency have not programmed the transport improvements until after 2028, it is assumed that delivery will be separate from, and after the other elements of, the RiverLink programme.

At this point in time and given the size and complexity of the transport improvements, it is recommended that the Melling Intersection Improvement works be delivered via a design and construction (D&C) delivery model. Given the expected timing for delivery of the transport improvements is more than 10 years away, market and commercial considerations may be very different. Therefore, an assessment of market conditions has not been undertaken at this time. Nor has an outline procurement plan for this project been prepared. These items should be revisited nearer the delivery date and a final decision made on the delivery model.

Staging the transport improvements has not been considered as the two major elements, the interchange and the river bridge, should be delivered together to avoid additional safety and congestion concerns, and these elements comprises the vast majority of the project. This is discussed earlier in Section 9.6.7.2.

14.4.1 Project Elements and Key Considerations

The project elements, as initially presented in the recommended option section in Part B, are replicated below along with an assessment of whether the elements are typical for Transport Agency projects or whether they are more unusual. Table 14-2 summarises these as follows.

Table 14-2: Key considerations for project elements

No.	Element	Standard or Specialist Expertise
1	Demolish existing Melling Link bridge	Specialist demolition contractor may be required, as a separable portion to the main contract, particularly to appropriately manage effects on the Hutt River.
2	New bridge over Hutt River at Queens Drive, including walk/cycleways	Standard bridge construction can be applied, assuming super-T structure is progressed, noting the presence of an aquifer which may be reached by the bridge piers.
3	New SH2/Melling interchange, including ramps, walk/cycleways and western suburbs connections	Standard road construction, with the exception of the southbound off-ramp which will double as a stopbank so will need careful oversight and approval by GWRC.
4	Relocate railway station, car park, Pharazyn Street access, realign railway line	The track works and railway station require different expertise and resources to the remainder of the project. Furthermore, the timing of these works is likely to be earlier than required for the other project elements. If indeed it is progressed earlier then this should be a separate contract and procured through KiwiRail procurement processes, alternatively a specialist supplier could be novated under the main contract.
5	Demolish properties on Queens Drive	Specialist demolition contractor may be required but as a separable portion to the main contract.
6	Realignment and new signalised intersections on Queens Drive (2 sets)	Standard construction
7	Intersection changes Melling Link/Rutherford Street	Standard construction
8	Intersection changes Melling Link/High Street	Standard construction
9	Property purchase associated with: interchange; railway realignment; railway station; Queens Drive	Property purchase only.

Based on the above, and on the key principles identified by the Project Partners, it is important that the delivery mechanism and approach enable consideration of the following key outcomes:

- Managing the resilience risk from floods and earthquakes during construction and in the long term
- Undertake stopbank works in compliance with GWRC's needs and railway works in compliance with KiwiRail an GWRC
- Appropriately manage effects of construction and demolition around the Hutt River
- Minimal disruption to / innovation in managing people and freight movement during construction. This may include consideration of incentivising people to change modes to reduce the impact of delays on the road network during construction. Impact on the following areas need to be managed:
  - rail services
  - access to the railway station
  - pedestrian and cycle movements
  - bus services
  - local road traffic and access to businesses and homes
  - state highway traffic

- Achieving appropriate urban design outcomes

To obtain the above outcomes, it is recommended that construction tenders are assessed using the Price Quality Method (PQM) with a high-quality weighting.

In addition, a Tangible Cost Assessment (or Adjustment) can be used to consider and monetise risks or opportunities inherent in each submission. For example, it may be felt that a Tenderer has not adequately considered the resilience risks, and that potentially variations may be required to fully address these risks during construction. Or it may be that there are opportunities or value in the submission e.g. traffic management innovations not included in the NPA assessment, that the client may wish to value or take account of in the assessment.

14.4.2 Potential for Risk Sharing

A key consideration in deciding a procurement model for implementation is the way that the Transport Agency would like to apportion risk. When project risks are best shared, a collaborative procurement model such as an Alliance or ECI would be appropriate. These models would include fully assigned risks in addition to shared risks.

Where project risks are fully assigned to either the Principal or Contractor, any form of contract would be suitable. However, this scenario is generally suited to competitively based tenders such as Design and Construct (D&C).

Some risk share is possible in competitively bids such as D&Cs or Lump Sums. For example, the Contractor may be required to take the risk of pile depth up to such 30m, beyond which they are paid a liner metre rate.

For this scenario with different principals, there will be a need to consider risk sharing between these organisations. Councils have previously signalled that they have no appetite for risk sharing and much prefer a lump sum for their contribution. This need for cost certainty might influence the commercial model recommended.

No assessment has currently been made as to how the project proposes to apportion risks between the principal and potential provider. This will need to be undertaken before a procurement model is agreed.

14.4.3 Contractual Arrangement

The scale and value of the work is medium to large [redacted] There is a high concentration of large structures in a confined site over a highway and a river into a city centre. The implied average spend rate is [redacted] and may be at least double that at peak due the high concentration of structures.

Complexity, uncertainty and risk are correspondingly medium to large as well. Geotechnical risks are significant due to large cuts required and piling with the avoidance of damage to underlying aquifers. Traffic management and health and safety risks will also significant as the work involves working on a live and congested four lane state highway. Subcontractor and materials coordination, scheduling and complex temporary traffic management will be demanding.

There is a solid opportunity for the supplier to innovate during delivery in terms of staging, lifts, materials and sequencing. The Transport Agency will be funding the majority of the work and will have an eye to obtaining the best overall value and transferring the major risks to the contractor, where appropriate.

Consequently, the available options for procurement are design and construct (D&C), Early Contractor Involvement (ECI) or Alliance. A Lump Sum contract is not considered to be particularly suitable considering the scale, complexity and risk of the two-element contract. Furthermore, it lacks the benefits of designer and constructor integration of the abovementioned models.

A D&C model potentially has advantages for the following reasons:

- Whilst the risks are high, they are known and can be adequately priced.
- Historically, lower out-turn costs have generally been achieved for D&Cs as compared with ECIs or Alliances, although there are some high-profile exceptions of D&Cs that have incurred significant additional claims.
- Geotechnical risk may be mitigated through a higher level of ground investigation, and provision for remeasurable geotechnical payment items within the Lump Sum schedule of prices.

- Client input may be achieved through well documented tender documents, albeit to a lesser extent than ECI or Alliance.

D&C models have arguably not always provided Clients with the value that they have sought, particularly on non-structural contracts. The amount of risk that a D&C contractor is required to take on a civil contract is high, particularly in respect of geotechnical uncertainties. This risk is very relevant to this project. Nevertheless, the risk can be adequately managed if the details around these risks are well known and priced.

ECI and Alliance models, are typically introduced for projects larger than this. However, these have the added benefits of:

- Providing for a high level of client or community input during the contractor-led design phase
- Having greater flexibility to change the scope of the contract in response to external political, community or funding pressures
- Appropriate consideration and assignment of project risks during the design and pricing phase of the project
- Flexibility to manage and address project risks during the course of the contract. Examples include:

Proceeding to tender even if all land or resource consents have not yet been acquired or received, and completing these processes during the design phase, or even the construction phase of the contract.

Operational requirements such as client participation in temporary traffic management and intervening, as required, to preserve or restore required traffic flows.

A potential disadvantage of an ECI model is that the construction phase is priced as a Lump Sum, and similar commercial pressures are often experienced in this phase of an ECI, as in the case of D&Cs. These pressures are somewhat reduced in the case of an ECI, as a more robust inclusion of risk is incorporated into the design and pricing phase than is the case for a D&C.

An Alliance model is capable of effectively addressing the objectives, risks and disadvantages discussed above. The contractor's risks and potential commercial pressures are substantially mitigated by the capping of their contract liability to the amount of their off-site overheads and profit (known as the Limb 2 payment). A further advantage is a saving in MSQA costs.

Given that the likely schedule is more than ten years away, a market assessment is premature at this point suffice to say that there should be a competitive market for this scale of work if it is promoted early enough, all other things being equal.

Overall, there are pros and cons of all the above procurement options, but the Design and Construction option is preferred due to the size, risk and potential for risk transfer. However, as the project is still at least 10 years away, it is recommended that the procurement model be agreed closer to the time of implementation, once market considerations and principal requirements of the day are considered.

14.5 Recommended Timing for Future Project Phases

The recommended programme for future phases is presented in the simplified programme below.

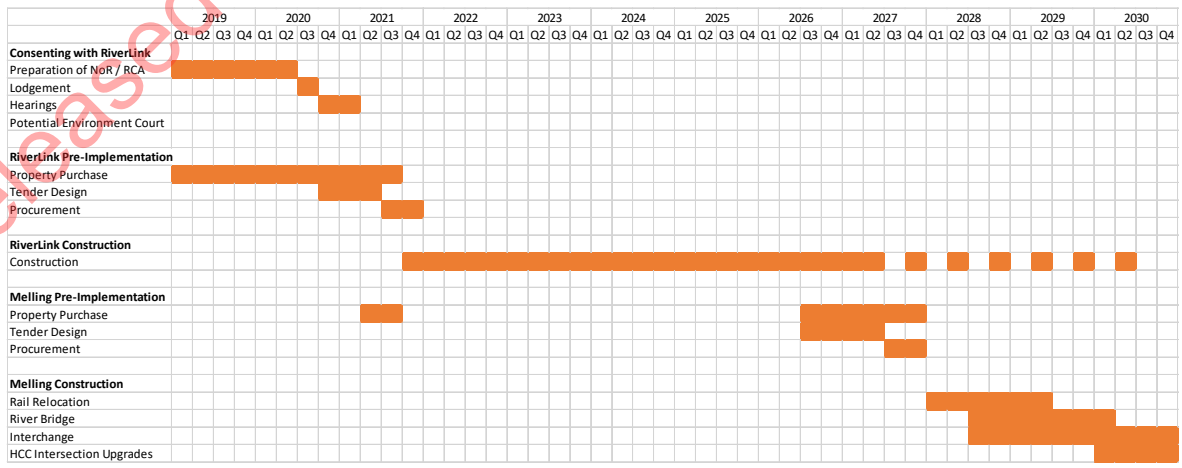


Figure 14-1: Potential RiverLink project timeline

This programme assumes that implementation of the project will not commence until 2028. This is because, although the project is justifiable now, the project is not affordable due to NLTP cashflow restrictions, until 2028.

The construction of the Melling Intersection project can be split into four sections – railway works, river bridge, interchange and Hutt Centre intersections, which have varying degrees of inter-relationships. We have shown a recommended staging approach to these below, but others are possible, or may be needed, particularly if funding for the rail relocation cannot occur before 2028.

As presented above, construction of the RiverLink elements is currently scheduled to occur between 2022 and 2026, however, this programme can be stretched out past 2028 to incorporate the Transport Agency works if the timing of this becomes certain, as shown in Table 14-1.

When considering the timing for progressing the Melling Transport Improvements decision-makers must consider the affordability of:

- the Transport Agency's contribution to pre-implementation activities
- possible liability for land property within a designation
- delivering different components of the Melling Transport Improvements

Other considerations which may influence any decision on timing include:

- land use changes
- other changes to the transport network.
- funding contributions from local authority partners; and
- advances from local authorities designed to accelerate the project.

This is discussed further in the Financial Case section.

15. Financial Case

15.1 Project Delivery - RiverLink Costs, Cashflow & Funding Sources

The Melling Transport Improvements is just one project component of the overarching RiverLink programme. To realise the full benefits of the programme, each partner organisation must deliver their component project. The constrained space means that infrastructure needs to be integrated and the designations will need to overlap.

This section provides context to the Transport Agency's decision of how to proceed with the Melling Transport Improvements by outlining what the Councils are committing and signalling. It gives an indication of the quantum of potential transport agency expenditure relative to the Councils.

The current cost estimates for the RiverLink programme are presented in Table 15-1.

Table 15-1: Estimated Costs for RiverLink Programme (excluding Melling)

Element	RiverLink Flood Protection (GWRC)	Making Places (HCC)
Property (excl Melling)	$82m	
Flood Protection Infrastructure	$43m	
Making Places (including Ped Bridge)		$59m
TOTAL	**$125m**	**$59m**

The current funding commitments from the partner organisations, are summarised in Table 15-1 above.

The vast majority of this is allocated in the respective councils LTPs and, where there is a perceived shortfall, additional money is available through underspend in previous years.

However, no funding is currently allocated by the Transport Agency for the Melling Intersection Improvement elements, with the exception of the consenting, nor is any budget put aside by the partner organisations for any those elements that could be shared across the partner organisations. Specifically, no partner budgets include an allowance for the following shared elements of the Melling Intersection improvements:

- Station and Park & Ride
  - Melling – Demolish and Replace Bridge
  - Melling – Melling Link Intersections
  - Property
  - Pedestrian bridge over SH2 (if this were to occur)

Section 9(2)(i) [redacted]. Some of this land is land that will be required by the Melling Intersection Improvement project. Hutt City are also expecting some residual land value, but this will not affect the Melling project.

15.2 Pre-implementation Costs

There are two main elements to the pre-implementation costs; consenting and detailed design.

The Transport Agency has agreed to partner with RiverLink to deliver the consenting phases of the project. The budget allocated for this element of pre-implementation phase of the Melling Transport Improvements are shown in Table 15-2.

Section 9(2)(j)

[redacted]

The Transport Agency are currently negotiating with the RiverLink consenting supplier to deliver the works within this budget.

Section 9(2)(j)

[redacted] his figure is subject to change however, based on the agreed construction contract form (i.e. traditional vs design and construct) and the timing of the phase.

15.3 Delivery Costs for the Melling Transport Improvements

15.3.1 Expected Capital Costs

Assuming the Melling Transport Improvements are delivered after the wider RiverLink programme, expected delivery costs by main element are shown in Table 15-3.

Section 9(2)(j) [redacted]

The above cost estimates were developed based on the working plot drawings in Appendix H. They include a 30% contingency above the base estimate. Section 9(2)(j) [redacted]

The detailed cost estimate is provided in Appendix T along with a list of assumptions and exclusions.

Section 9(2)(j) [redacted]

15.3.2 Cost of Land Needed for Transport Improvements

Section 9(2)(j) [redacted]

Section 9(2)(j) [redacted]

Some of the property could be considered for cost sharing:

- GWRC have been purchasing entire properties along Pharazyn Street, the majority of each property will be required for flood protection, but there will be residual land and some of this will be required for the transport improvements. GWRC have stated that this could be transferred to the Transport Agency and considered a payment-in-kind for its contribution to other elements of the scheme[33]. Section 9(2)(j) [redacted]
- The property required for Queens Drive may be considered for purchase by HCC to facilitate and encourage appropriate development at the gateway entrance to the Hutt City Centre. Section 9(2)(j) [redacted] Section 9(2)(j) [redacted]

Both above opportunities should be considered as cost sharing discussions progress.

[32] However, this figure would increase if the Transport Agency were too late to purchase the land from GWRC and would need to buy improved parcels from private landowners.

[33] The Transport Agency and GWRC will need to negotiate to confirm this with GWRC through a resolution of council. GWRC is unable to legally hold the land for another party. At present GWRC would be forced to resell the residual land not required for the project upon completion of the flood protection works

15.3.3 Ongoing Maintenance and Operations

Additional costs associated with ongoing maintenance and operations of the new scheme will be estimated in the pre-implementation phase.

Increases in operational costs are expected due to additional Intelligent transport systems (ITS) infrastructure and increased pavement surface. However, the project will be replacing a lot of older infrastructure with higher maintenance costs.

HCC will incur additional maintenance costs for the new signal controlled intersections.

The Melling Bridge is currently an HCC asset and it has been agreed that the new Melling Bridge would remain an HCC asset.

15.4 Cost Sharing Principles

Discussions regarding cost sharing arrangements for the RiverLink programme were first developed between November 2017 and June 2018, before the Transport Improvements project was put "on hold" pending re-evaluation against the National funding priorities. A variety of co-funding models were considered (Appendix U), with a hybrid cost allocation model being preferred. This stated that if the benefits of delivering a component of RiverLink align to only one organisation then the costs would fall to that organisation, and where benefits of a component align to more than one party the costs are shared between those parties. This model provides flexibility and fairness for the allocation of costs across the three agencies involved.

Based on this funding model, and assuming all three parties continue to co-operate on an integrated programme, the following proposed co-funding principles were developed and confirmed at a meeting between the partners in August 2019. These funding principles will be further discussed with RiverLink project board on 18th September to seek their agreement.

1. Any costs associated with developing designs to a level appropriate for consenting would be paid by the organisation promoting and leading that element of RiverLink[34];

2. Applicant costs associated with managing and developing a single Assessment of Environmental Effects (AEE), notice of requirement (NOR) and resource consent applications would be shared between HCC, GWRC and the Transport Agency in proportion with the complexity and risk associated with their element of the application;

3. Any cost savings or cost overruns resulting from planning, specialist assessment or management involved in the consenting process would be shared between HCC, GWRC and the Transport Agency in proportion with the complexity and risk associated with their element of the application;

4. Where the benefits of delivering (constructing) a component of RiverLink are aligned to only one organisation, then the cost of that component would be borne by that one organisation[35]

5. Where a project component delivers multiple benefits aligned to more than one of the parties to RiverLink, the costs would be shared between those parties;

6. The Transport Agency would contribute no more than the agreed Funding Assistance Rate (FAR) for any new asset or improved asset which will ultimately be owned by the HCC, GWRC or KiwiRail;

7. Commercial and management arrangements to apportion and manage risk to progress of the project and partner organisations will be developed to the satisfaction of HCC, GWRC and the Transport Agency and documented in a deed before commencing pre-implementation activities;

[34] The Transport Agency would pay for design necessary to inform Notice of Requirement and Resource Consent Applications associated with relocating Melling Station, a new road bridge across the Hutt River and the SH2 interchange.

[35] For example, only the GWRC has a statutory objective to deliver flood protection outcomes.

8. Transfer of appropriately valued land from one party to another may be accepted in place of a monetary funding contribution; and

9. Co-funding arrangements for any additional transport system changes that emerge during the further development of RiverLink would be negotiated using the agreed Funding Assistance Rate as a starting point.

The Co-funding Principles Memo in Appendix U outlines the officer interpretation of these funding principles.

The table below outlines how the cost of the Melling Transport Improvements could be distributed according to these funding principles.

Section 9(2)(j)

[redacted]

A draft Deed, governing how the three organisations would collaborate was developed by GWRC for discussion by the three partners to RiverLink. If the Transport Agency decides to progress the Melling Transport Improvements project then some, or all, of the co-funding principles could be incorporated within that legal agreement.

15.5 Funding Sources

There is currently only very limited funding available within the State Highway Improvement activity class. Early in 2019, the Transport Agency announced their decision that implementation of the Melling Transport Improvement projects would be considered after 2028.

The total project cost could be funded from the State highway and local roads improvements activity class. Alternatively, relevant elements could be funded from the public transport and/or walking/cycling improvements activity classes. However, there is no allowance in the National Land Transport Programme (NLTP) 2018 – 21 for either pre-implementation or implementation. All relevant activity class are oversubscribed for the current NLTP and therefore it will need to be prioritised with other activities in future years.

[36] Includes an allowance for cost recovery of selling unneeded property

[37] It is noted that funding a new bridge is not within GWRC's statutory responsibilities. However, GWRC may contribute to enable the bridge to proceed via, for example, gifting property.

15.6 Summary

GWRC and HCC have committed over $150M towards the RiverLink programme to cover flood protection and urban development.

The implementation of the Melling Intersection Improvements is estimated to cost $210M.

There is an opportunity to RiverLink partners to contribute around $33M towards Melling Transport Improvements for their share of the benefits associated with the bridge, local road improvements and public transport improvements.

Section 9(2)(j)

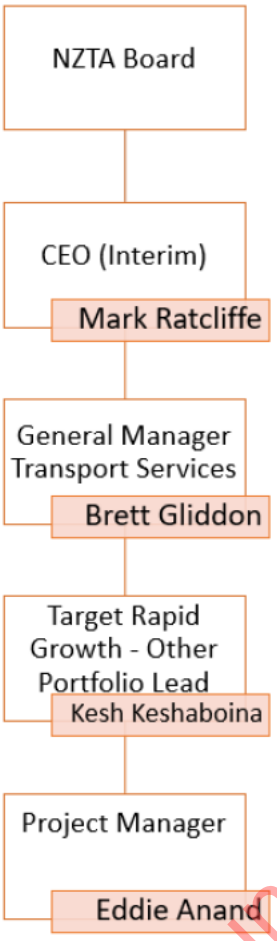
[redacted]

16. Management Case

16.1 Governance Structure

The Transport Agency has an internal governance structure for the Melling Transport Improvements, which reflects their organisational structure. The current structure is outlined in Figure 16-1. Alongside the project manager there are several NZ Transport Agency support staff as part of the project team, presented in the adjacent table.

However, this is likely to change as it proceeds into the pre-implementation phase and will be different depending on whether the Transport Agency integrate with RiverLink.



Project Support Team	
Support Role	**Nominated Person**
Project Advisor	Roger Burra
Communications and Engagement	Rachel Dahlberg, Joel Rowan
Investment Quality Assurance	Coral Aldridge
Investment Assurance Client	Carolyn O'Fallon
RMA Planning	Heather Sinclair
Lead Safety Advisor	James Hughes
Property	Jonathan Gulland

Figure 16-1: NZ Transport Agency governance structure

16.2 Pre-Implementation Roles and Responsibilities

RiverLink is an integrated project that brings together three Client organisations; HCC, GWRC and the Transport Agency. While each partner organisation has its own strategic objectives, they recognise that investment activities need to be coordinated because they are inter-dependent. The Partners need to work closely together to achieve their individual and collective objectives and to meet the needs of residents, businesses, commuters, road users and visitors in and through the Hutt Valley region. Figure 16-2 illustrates how the partners propose to work together. To facilitate close working and collaboration, a Project Office has been established that reports to a joint Project Board to maximise the integration and coordination between the projects and across the whole programme.

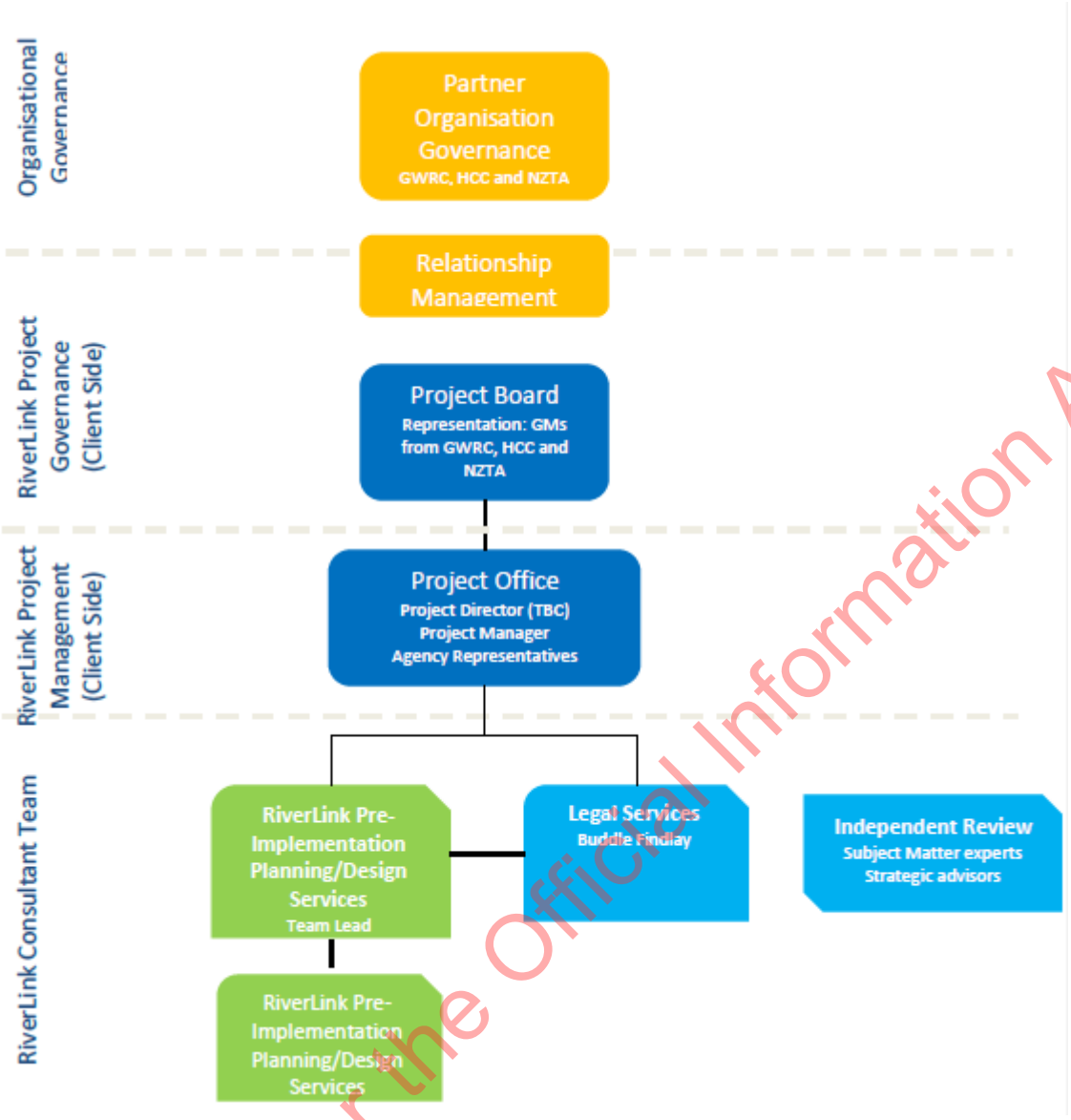


Figure 16-2: Proposed Collaboration Arrangements

A deed has been developed for RiverLink, governing how the three organisations would collaborate. HCC and GWRC are signatories and if the Transport Agency decides to progress pre-implementation as part of RiverLink then they could also become a signatory to this document.

The Transport Agency representative on the Project Board is Adam Nicholls

The Transport Agency representative in the Project Office is Eddie Anand.

16.2.1 Personnel implications

With the Transport Agency joining RiverLink for the consenting and designation activities, there will be a requirement for ongoing Transport Agency involvement in the project to ensure that the transport improvements element of the programme is progressing appropriately and in line with the Agency's objectives. It is expected that this could involve 0.3 to 0.5 FTEs during the bulk of the project, however this will ramp up to 1-2 FTEs during the NoR review, approval and hearings processes.

In addition, it is suggested that the Transport Agency procure their own specialist input into the project through Stantec due to their role in the development of the SSBC design and impacts analysis.

16.2.2 Project Plan

A Project Procedures Manual has been prepared by the RiverLink project team to document governance and management arrangements and streamline decision making processes. The manual provides clear responsibility and accountability for all decisions made on the project. The intention is to enable the project to be managed efficiently, with agreed parameters for decision making and accountability. This Manual is attached as Appendix V.

16.2.3 Design and Implementation

The governance of any subsequent design and implementation activities will be determined later once a decision has been made into timing and procurement model.

16.3 Assurance and Acceptance

Several key decisions will need to be made during the consenting and designation phase. These are outlined in Table 16-1.

Table 16-1: Key decision responsibilities

Task	Responsibility	Approval
Safety audit of consenting design	Eddie Anand	James Hughes
Approval of consenting design	Eddie Anand	Various Internal
Approval of local road aspects	HCC	
Approval of public transport impacts	GWRC	
Approval of rail infrastructure impacts	KiwiRail	
Approval of interface with flood protection	GWRC	
Approval of funding of mitigation proposed in AEE	Caroline O'Fallon	NZTA Board
Public engagement prior to lodgement (if any)	Rachel Dahlberg	Chloe Grosser
Approval of lodgement of AEE	Heather Sinclair	NZTA Board
Property acquisition	Jonathan Gulland	NZTA Board

Any conflicts between partners will be resolved by escalating the issue through the project office and project board.

16.4 Change Control

The Project Procedures Manual outlines the change control procedures associated with RiverLink.

The physical interfaces between the Melling Interchange project and the other elements of RiverLink, for which changes could affect the scope, cost or risk of the Transport Agency's project are summarised below:

a) The requiring authorities will need overlapping designations – the size, scope and order of layers is important.

b) On the western side of the river the embankments that will support part of Pharazyn Street (south of the interchange) and the southbound off-ramp (north of the interchange) may need to operate as stopbanks and form part of the flood protection system.

c) The design and location of stopbanks on the eastern side of the river where the new Queens Drive bridge abutment would ideally integrate within the stopbank, as per the current design.

d) Dredging of the riverbed and disposal of surplus material at Melling and along Pharazyn Street which will form the new ground level on the western side of the river where the transport improvements are proposed. The Melling project could also make use of this material.

16.5 Outstanding Decisions / Hold Points

16.5.1 Current Decisions

There are several key decisions that will need to be made at the pre-implementation phase. These are outlined below.

- Pharazyn Street Layout: The exact position and design of the train station, the layout of the park and ride and the alignment of Pharazyn Street are yet to be decided. The project team have deferred decisions on this area to GWRC and HCC as they will be the ultimate owners of the infrastructure in this area. It is noted that GWRC and HCC need the Agency to commit to an interchange design before they are able to confirm the Pharazyn Street layout.
- Rail designation: The width of the relocated railway designation needs to be agreed by KiwiRail and therefore the impact on the properties on the north-western side of Pharazyn Street.
- Recent discussions with GWRC have resulted in an agreed conceptual realignment of the stopbank at the eastern abutment of the new Queens Drive bridge to reduce bridge costs and adjacent urban amenity impacts. However, the design of this needs to be undertaken to determine any additional property impact and subsequent land costs.
- Agreement as to the design integration for the southbound and northbound on/off ramps. These structures may negate need for stopbanks in these locations because they remove at risk elements from the floodplain.
- The Road Safety Audit and Traffic Signal review have been completed and the majority of the items identified have been resolved through design refinement, however there are some outstanding items. The audits need to be closed out with Transport Agency decisions. One key item still being resolved is the future intersection form of the Melling Link intersections to balance motorist safety, non-motorised user safety and traffic flow.

However, the key decision for the Transport Agency and its partners is how to split the costs of the entire RiverLink programme, including Melling, across the three agencies.

16.5.2 Future Hold Points

Hold points can be used throughout the pre-implementation and implementation phases to make decisions on the project development and to re-confirm investment. These include:

- Before lodgement – whether to lodge designations and consents
- Pre-implementation – whether to proceed with other elements of pre-implementation such as property purchase and detailed design
- Pre-implementation – when the timing of construction is clearer, a decision on the procurement model for construction

16.5.3 Timing of Construction

The timing of construction is likely to be a function of funding availability. Nevertheless, consideration has been given as to how the Melling Intersection Improvements should be programmed against other projects such as the Petone to Grenada Link Road, the Cross Valley Link and Kennedy Good Bridge intersection upgrade.

From the initial modelling that has been undertaken, it is clear that the Cross Valley Link and the Kennedy Good Bridge intersection upgrade would not have a significant impact on the numbers of vehicles travelling through the Melling Interchange. Accordingly the programming of these elements is not of much consequence. If the Cross Valley Link was coupled with a de-tuning of The Esplanade, this may result in a shift in traffic routes, however this is more likely to impact on the Dowse Interchange than Melling.

However, the Petone to Grenada Link Road is expected to significantly change traffic routes around the southern part of the Hutt Valley and result in an increase in traffic using the Melling Interchange. This will create additional safety risk, additional severance and significant additional delays. Accordingly, it is recommended that the Melling Interchange be progressed in advance of the Petone to Grenada Link Road.

16.6 Risks

The key risks going forward include:

- **Political**: The project is highly political. Both GWRC and HCC have funding in their LTPs to progress key elements of the RiverLink programme flood defences and regeneration initiatives. RiverLink is progressing to designation/consenting. The partners believe the Transport Agency's involvement is key to deliver an integrated outcome for Lower Hutt, to reduce the flood risk created by the Melling Bridge, and to ensure the success of regeneration activities by improving access to Hutt by all modes. This situation adds to pressure on the Transport Agency. There appears to be wide political support for this project and local politicians have been publicly calling on the Transport Agency for action and clarity. This is resulting in increased community and stakeholder perception of indecision as well as an increased expectation of action. Mitigation: Ongoing communication with local and national politicians.
- **Financial:** The financial risk profile is different depending on whether the transport improvements are implemented with the wider RiverLink programme and how the cost split arrangements are structured. The main risk of progressing pre-implementation now is the Transport Agency's liability for property purchase once a designation for roading is approved. Mitigation: additional work on the funding splits to understand the likelihood and consequence of this risk
- **Flood risk:** The Transport Agency have indicated that construction will not be until after 2028. Given that the existing Melling Bridge restricts the passing of flood waters from a 1 in 65 year event or greater, there is a significant risk that flooding will occur in the next ten years, causing damage to assets within the floodplain, which could be extensive. Mitigation: consider previously identified works to increase flood protection for at least 1 in 120 year event, however this would not benefit Block Road and the connection to/from SH1.
- **Safety:** Given the SH2/Melling intersection has a high collective risk and there have been four serious injury crashes in the last five years all of which have involved vulnerable road users (motorcyclists), there is a significant risk of a fatality before construction starts. Mitigation: it is recommended that an urgent safety review be completed of the intersection, focusing particularly on signage for southbound traffic and potential lowering of the speed limit to 80km/h, to reduce the risk.
- **Cost estimates:** At this stage the accuracy of the cost estimates is a risk. The uncertain ground conditions combined with the inherent difficulty in estimating risks at this stage mean there will be a margin of error in the risks. In addition, there is also a risk that market conditions and supply chains which change significantly over the next 10 years before this project is constructed. Mitigation: allow for contingency in the risks and couple the estimate with an explanation of the uncertainties.
- **Property:** GWRC already own a significant proportion of the property required for the flood scheme but will not require all of it. Some of the surplus property will be required for the transport improvements. However, with the uncertainty around the timing of the Transport Agency's investment, there is a risk that the surplus property will be disposed of, rather than transferred to the Transport Agency. This will add to costs if the Transport Agency must acquire improved land from private landowners. Mitigation: discuss with GWRC possibility of retaining land or leasing to the Transport Agency at a reduced rate.
- **Unknown ground conditions:** The Wellington Fault traverses this area and is seismically active. The river and hillside also add uncertainty around stability and geotechnical risks. Assumptions have been made about the location of areas of instability and risk, however until ground conditions are fully understood, this is an area of risk. Mitigation: geotechnical investigations are currently underway, but more may be required.

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