Sensitivity: General

ARTHURS POINT CROSSING

Single Stage Business Case

CHRIS BAKER

21 DECEMBER 2020

FINAL DRAFT

New Zealand Government

More information

NZ Transport Agency
Published November 2020

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

NZ Transport Agency
Private Bag 6995
Wellington 6141

This document is available on the NZ Transport Agency's website at http://www.nzta.govt.nz

Rev	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
1	9 Nov 2020	Issue for Client Review	Chris Baker	Tim Mueller	Holly Atwell	Holly Attwell
2	13 Nov 2020	Add Financial Case, Update Cost Estimates	Chris Baker	Tim Mueller	Tim Mueller	Holly Attwell
3	21 Dec 2020	Incorporating Client Feedback	Chris Baker	Tim Mueller	Tim Mueller	Holly Attwell

EXECUTIVE SUMMARY

The single lane Edith Cavell Bridge at Arthurs Point is the sole crossing of the Shotover River on the route between Arrowtown and Queenstown. The heritage-listed single span reinforced concrete arch bridge was constructed in 1919 and is approximately 50m long and 30m high. The road carries between 4,500 vehicles and 8,000 vehicles per day depending on the time of year (i.e. peak of off-peak tourist season). The project's geographic context is shown in Figure 1.

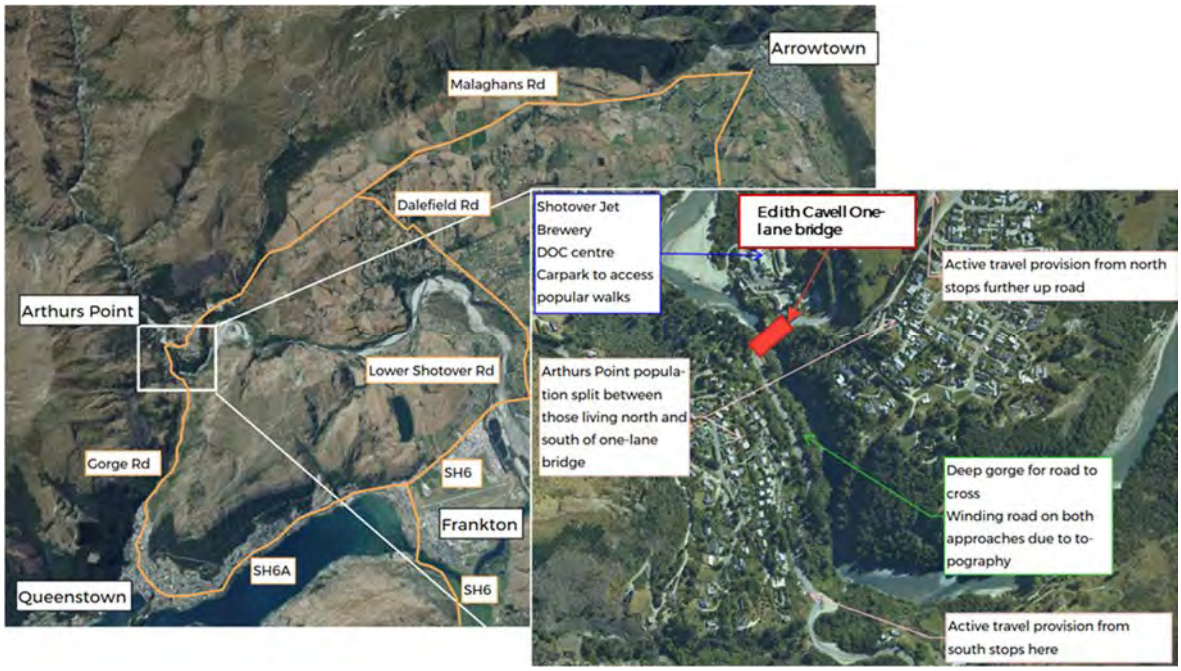


Figure 1 Geographic Context

Problems

At the project's Investment Logic Mapping workshop, project partners from Queenstown Lakes District Council (QLDC), Waka Kotahi NZ Transport Agency (Waka Kotahi) and Otago Regional Council (ORC) agreed on the Problem and Benefit Statements shown in Figure 2.

The primary constraint on the crossing is that the carriageway is currently 3.9m wide, with a 3.1m wide vehicle lane and two 0.4m wide kerbs. No dedicated facilities are provided for pedestrians or cyclists, which the community has indicated deters even the most confident users. The lack of a suitable crossing for pedestrians and cyclists at Arthurs Point is one of the few remaining barriers to completing the Wakatipu Active Travel Network (WATN).

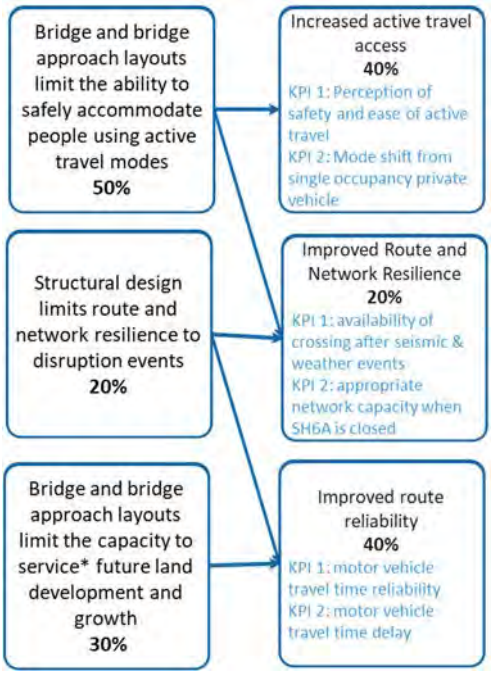


Figure 2 Project Problem and Benefit Statements

Pre-implementation for WATN Stage 2, which includes the Arthurs Point to Queenstown route, has already begun. The economic justification for implementing WATN Stage 2 was predicated on a safe and attractive crossing of the Shotover River being in place, meaning benefits identified for that project will not be realised without further investment in the crossing. At just over 5km, the route is one of the most 'cyclable' for commuters in Queenstown, representing opportunity to achieve good mode shift on the route.

There is no history of pedestrian and cyclist crashes on the bridge, though this was determined to be caused by a perceived safety risk on the bridge and approaches that is discouraging pedestrians and cyclists. Feedback received from the community for the project indicated strong support for immediately addressing the lack of facilities at the crossing.

The existing bridge has limited traffic capacity, calculated at around 950 vehicles per hour (combined directions), which data suggests is already being reached at peak times (this figure was reached during peak season surveys in 2019). Due to structural and heritage constraints, it is not possible to increase capacity of the existing bridge, which is leading to increasing delays and decreasing journey reliability. The existing capacity constraint also limits the ability to use Malaghans Road / Gorge Road as a secondary route to SH6A Frankton Road (acknowledging that the route itself would need wholesale upgrades to provide an appropriate alternative).

The traffic capacity constraint however needs to be understood within the context of the anticipated growth. The Covid-19 pandemic has reduced traffic volumes throughout the district to levels observed in 2017, while the Whaiora Spatial Plan for Queenstown Lakes has identified only limited growth on the corridor in the future. This reduces the urgency of the problem and the overall need to increase capacity.

Tourist attractions at Arrowtown, Skippers Canyon, Coronet Peak and Shotover Jet at least partially rely on the bridge for bus and car access by customers from the Town Centre. The bridge also lies on the only alternative route to SH6A Frankton Road for travel to/from Queenstown. A serious crash on SH6A on 11 January 2020 provided evidence of the network's fraught reliance on the bridge to provide a secondary route during disruption events when queues extended from the bridge into the Town Centre, causing delays of up to 50 minutes. The existing bridge itself has been estimated to have a remaining useful life of 20 years and is unlikely to be useable after a large seismic event.

Investment Objectives

To address these problems, the following investment objectives were agreed with project partners (% weighting):

1. Provides a safer, more accessible path for all confidence levels of pedestrian and cyclist between existing routes (and planned upgrades) in the short term (40%)
2. Ensures travel time reliability is maintained for growing vehicle traffic volumes (35%)
3. Improves overall network and route resilience to seismic events and closures of SH6A in the long term (15%)
4. Enables future land use development and growth by providing additional traffic and utilities capacity (10%)

Optioneering

The Arthurs Point Crossing (APC) project was identified as an activity in the programme-level Queenstown Integrated Transport Programme Business Case (PBC). It was therefore taken through a full optioneering process, from longlist to preferred option. Options taken forward for public consultation following a preliminary review of the longlist are shown graphically in Figure 3.

A	A	B	B	C	C	D	D	D	E	F	F
New single-lane bridge, existing bridge becomes opposite direction		New single-lane bridge, existing bridge becomes opposite direction		New 2-lane bridge		New single-lane bridge, existing bridge becomes opposite direction			New 2-lane bridge	New 2-lane bridge	
Clip on to existing bridge		Included on new structure		Convert existing bridge		New separate structure			Included on new structure	New separate structure	

Figure 3 Arthurs Point Crossing Options

Recommended Option

Through a robust multiple-stage MCA process, stakeholders agreed on the Recommended Option:

- **APC Stage 1:** a separate active modes bridge approximately 400m downstream from the existing Edith Cavell bridge (with connecting trail tying in around the old Arthurs Point pub car park to the south and Atley Road to the north)
- **APC Stage 2**: a new two-lane road bridge approximately 100m downstream from the existing Edith Cavell bridge. The heritage Edith Cavell Bridge will be converted to a walking and cycling bridge once the road bridge is built

The Recommended Option aligns strongly with QLDC and Waka Kotahi strategic objectives by:

- Forming part of an integrated, safe and efficient transport network
- Providing for future growth needs
- Promoting shift from car dependency to public transport and active modes
- Contributing to reducing the effects of climate change

Delivering the project in 2 stages while prioritising the active modes component provides a strong investment case that satisfies strategic objectives (giving action to Government Policy Statement (GPS) priorities and QLDC strategies), mitigates financial risk (prioritising the lower cost, lower risk component while providing ample lead in time for planning of the more significant investment), provides for community needs (an immediate active modes solution has strong community buy-in), maximises use of existing assets (the Edith Cavell bridge has 20 years useful life remaining) and provides agility to deliver improvements when needed (monitoring of traffic operations, resilience needs and structural performance will enable partners to deliver infrastructure efficiently).

Expected estimates for the Recommended Option are shown in Table 1.

Table 1 Recommended Option Expected Cost Estimates

	Road Bridge Only Costs	Active Modes Only Costs	Combined Project Costs (road and active modes)
Total P50 Project Costs	$18,572,100	$2,273,200	$20,845,300

It was identified that the economic case for APC Stage 1 is inextricably linked to the WATN Stage 2 Arthurs Point to Queenstown route. For the crossing to attract users (thereby achieving benefits), it would need to be part of a full route connecting origins and destinations (i.e. Arthurs Point and Queenstown). Equally, the economic justification for implementing WATN Stage 2 was predicated on a safe and attractive crossing of the Shotover River being in place, meaning benefits identified for that project will not be realised without APC Stage 1. The economic case for Stage 1 is therefore based on an update to the WATN Stage 2 economics, incorporating the additional cost of the active modes bridge and trail.

Economic Appraisal

As the project evolved into two discrete stages, it was determined that a combined project economic appraisal was illogical; the scales of costs and benefits of the two stages are so different that benefits from the roading improvements (Stage 2) could easily mask a weak case for the active mode improvements (Stage 1). A programme Benefit Cost Ration (BCR) for the overall project does not precisely convey the relative benefits and costs of each project stage but is presented in Table 14 for context.

A BCR of 1.1 was calculated for the update to the WATN Arthurs Point to Queenstown route (i.e. Stage 1), indicating that the benefits for the overall route will still provide a return on the expected cost over the life of the project, including the cost of the Arthurs Point Crossing.

An economic case exists for Stage 2 from a travel time savings and vehicle operating cost perspective. However, there is only a weak strategic case for seeking these benefits. Discussions with funding partners also indicate that Stage 2 is unaffordable in the current economic climate, while traffic modelling shows that the crossing is not needed from a traffic operations perspective until between 2028 and 2031.

Similarly, while there would be resilience benefits brought by upgrading the crossing, evidence for the magnitude and frequency of large-scale events is relatively weak, so too is the strategic justification based on current QLDC and Waka Kotahi policies. Exact timing of the need to replace the existing bridge from a structural perspective will become clearer as the bridge nears the end of its useful life and a regular inspection and maintenance programme is implemented. QLDC are also expected to develop an infrastructure resilience strategy through their Long Term Plan.

No significant maintenance or renewals have been identified for the Edith Cavell bridge at this stage. Ongoing maintenance costs for the Do Minimum scenario have been calculated at $816,960, significantly lower than the expected cost of a replacement bridge (likely to be in the order of millions). It is therefore concluded that there is no economic case for investing in a replacement bridge from an end of life perspective at this stage.

However, without detailed seismic and load assessments, the exact condition of the bridge (and therefore scale of maintenance requirements) is uncertain. Monitoring of the bridge, as recommended as part of the Preferred Option, may identify the need for a more costly maintenance regime than could be identified here. This may bolster the economic case for a replacement bridge from an end of life perspective.

Table 2 Project Benefit Cost Summary

STAGE	BENEFITS* ($M)	COSTS* ($M)	BCR
1 – Active Modes Only	10.6	9.7	1.1
2 – Road Bridge	37.2	18.6	2.0
Project	47.8	28.3	1.7

*Benefits and Costs for Stage 1 include the WATN Stage 2 Arthurs Point to Queenstown Route

Staging

APC Stage 1 is intended to be implemented in 2021/22 as part of WATN Stage 2 to achieve Investment Objective 1: *Provides a safer, more accessible path for all confidence levels of pedestrian and cyclist between existing routes (and planned upgrades) in the short term*. Stage 2 is recommended to be deferred for reconsideration in the next realistic funding horizon, expected to be the QLDC Long Term Plan 2031-2041, which corresponds with the 2030-2033 NLTP.

If through monitoring it transpires that traffic delays and queues exceed acceptable levels, there may be a case for investing in interim traffic control measures such as traffic signals. As a relatively low-cost intervention (less than $400,000), this could occur outside of the business case process. However, signals should be considered in the context of the full project lifecycle, in that benefits provided by signals would be short-lived if the full road bridge was implemented quickly thereafter. In this case, signals would be a sunk cost. Even with increasing volumes in the peak hours, there may not be an economic case for signals due to significant disbenefits in the off-peak. There will therefore likely need to be supplementary justification through strategic objectives and community demand.

Traffic modelling indicates that signals would be required by 2028, assuming the forecast growth scenario materialises. However, the Covid-19 pandemic has effectively moved growth back 3 years, indicating that signals may not be required until 2031, when the new road bridge is recommended to be revisited. Additionally, operation of the bridge is highly sensitive to travel patterns as different directional demands have a big influence on priority give way behaviours. It is therefore recommended that funding partners take an agile approach to signals and implement as

necessary based on data from ongoing monitoring. A key component of the Recommended Option is revisiting the case for investment in a new road bridge prior to the 2031 Long Term Plan

Triggers

APC Stage 1 (active modes) was found to have an immediate need for investment as an enabling project for the WATN Stage 2 Arthurs Point to Queenstown route. Community engagement also highlighted strong demand for pedestrian and cycling facilities over the Shotover River in the short term.

APC Stage 2 (roading) was found to have a strong economic case, but weak strategic case, and current funding constraints mean it is unlikely to be prioritised. The triggers for investment in Stage 2 will be:

1. the existing bridge reaching the end of its useful life (the point at which ongoing maintenance exceeds the cost of replacing it);
2. traffic volumes increasing to the extent that delays and queues (average day or network events) become unacceptable to QLDC and the community (assumed to be LOS F for the overall crossing in this business case); and/or
3. a need to improve resilience of infrastructure being established in policies and strategies.

QLDC's Long Term Plan 2031-2041 is an administrative trigger for the project as the next realistic horizon for funding availability at the scale of investment required for the road bridge. Completion of an infrastructure resilience strategy as part of the LTP may also necessitate investment in the crossing.

The business case should be updated when monitoring identifies that these triggers are being reached, or to enable investment in the next Long Term Plan (i.e. by 2031), whichever comes first.

Investment Appraisal

The Recommended Option was found to satisfy both QLDC and Waka Kotahi investment requirements as shown in 8 Investment Appraisal.

The Recommended Option delivers a key piece of infrastructure to fill a gap on the Arthurs Point to Queenstown route of the Wakatipu Active Travel Network. This aligns strongly with local, regional and national strategies and policies by providing transport choice, reducing reliance on private vehicles and improving safety for vulnerable road users.

Using the 2018-21 National Land Transport Plan Investment Assessment Framework, the project rates High/Low, which equates to Priority Level 5. Using the 2021-24 Investment Prioritisation Method, the project rates High/High/Low, which also translates to Priority Level 5. Stage 2 of the project has not been assessed against Investment Appraisal requirements as delivery is proposed to be beyond the timeframes of existing frameworks.

Project Delivery

A summary of the recommended approach to implementation is given below:

1. QLDC and Waka Kotahi endorse the SSBC and approve funding for pre-implementation of APC Stage 1 at the Business Case and Funding Decisions Delegations Committee in **early 2021**
2. The pre-implementation phase of APC Stage 1 is added to the scope of WATN Stage 2 as a Cost Scope Adjustment. WATN Stage 2 is scheduled to complete detailed design in **April 2021** and pre-implementation in **May 2021**. However, property acquisition negotiations for APC may take up to 6 months, which could delay completion of pre-implementation (risk mitigations are presented in 7.4.6 Project Delivery Risks). APC Stage 1 is expected to be complete by June 2021 at the latest.
3. As part of pre-implementation of APC Stage 1, geotechnical investigations and topographical survey will be completed. These technical investigations should be carried out for the APC Stage 2 scope concurrently to confirm the appropriateness of the Recommended Option alignment.

4. Following confirmation of the Recommended Option alignment, property acquisition and designation is undertaken for APC Stage 1; property acquisition is completed and applications for statutory approvals and designations are jointly submitted for WATN Stage 2 and APC Stage 1 **mid-2021**.

5. WATN Stage 2 (now including APC Stage 1) goes to QLDC Programme Control Group and Waka Kotahi Business Case and Funding Decisions Delegations Committee for funding approval to proceed to Implementation.

6. WATN Stage 2 and APC Stage 1 are implemented as one project in **2021/2022**. If funding is not approved for implementation of the full WATN Arthurs Point to Queenstown route, APC Stage 1 is implemented with interventions for key gaps on the route funded through Low Cost Low Risk budgets.

7. The business case for APC Stage 2 is revisited to reconfirm the economic case with updated traffic data as well as the strategic justification for investment (including end-of-life assessment and confirmation of resilience strategy) in 2030/31 or earlier as indicated by triggers (refer 11.4 Project Staging Triggers).

8. APC Stage 2 is taken through pre-implementation in 2031/32, subject to approval of the business case update and funding availability

9. APC Stage 2 is taken through implementation in 2032/33

The Financial, Commercial and Management cases found that the Recommended Option is deliverable, although the funding environment is currently constrained. Stage 1 is relatively low cost and low risk, and funding is available through the Long Term Plan and budget earmarked for the Wakatipu Active Travel Network. Stage 2 is sufficiently far into the future (10 years) that funding can be appropriately planned and allocated.

Both Stage 1 and Stage 2 can be procured through standard QLDC and Waka Kotahi procedures, while the recent formation of the Queenstown Transport Alliance presents opportunity to engage high quality and experienced contractors to deliver the project. Alternatively, the QLDC Project Management Office could deliver the project with advice from suitably qualified and experienced engineers. The recommended procurement approach would be the Price Quality Method for both pre-implementation and implementation phases. However, it is expected that Stage 1 will be delivered as part of WATN Stage 2, and procurement and delivery methods proposed under that project should be used. While the short timeframe to the deadline for pre-implementation of WATN Stage 2 (May 2021) presents a programme risk, property acquisition is the only exercise expected to take longer than the time available. Delivering the project jointly brings substantial efficiency benefits.

Contents

List of Tables

List of Figures

Disclaimers and Limitations

This report ('Report') has been prepared by WSP exclusively for Way to Go ('Client') in relation to a single stage business case investigating upgrading the crossing at Arthurs Point ('Purpose') and in accordance with the CCCS contract C-19-115 Arthurs Point Crossing Single Stage Business Case dated 15 April 2020. The findings in this Report are based on and are subject to the assumptions specified in the Report and the Proposal Response for C-19-115 dated 23 January 2020. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

In preparing the Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in the Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable in relation to incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

PART A: THE CASE FOR THE PROJECT

1 BACKGROUND

The single lane Edith Cavell Bridge at Arthurs Point is the sole crossing over the Shotover River on the route between Arrowtown and Queenstown. The heritage-listed single span reinforced concrete arch bridge was constructed in 1919 and is approximately 50m long and 30m high.

The bridge lies on the only alternative route to SH6A for travel to/from Queenstown. Tourist attractions at Arrowtown, Skippers Canyon, Coronet Peak and Shotover Jet rely on the bridge for access by customers. Geographic context is provided in Figure 4.

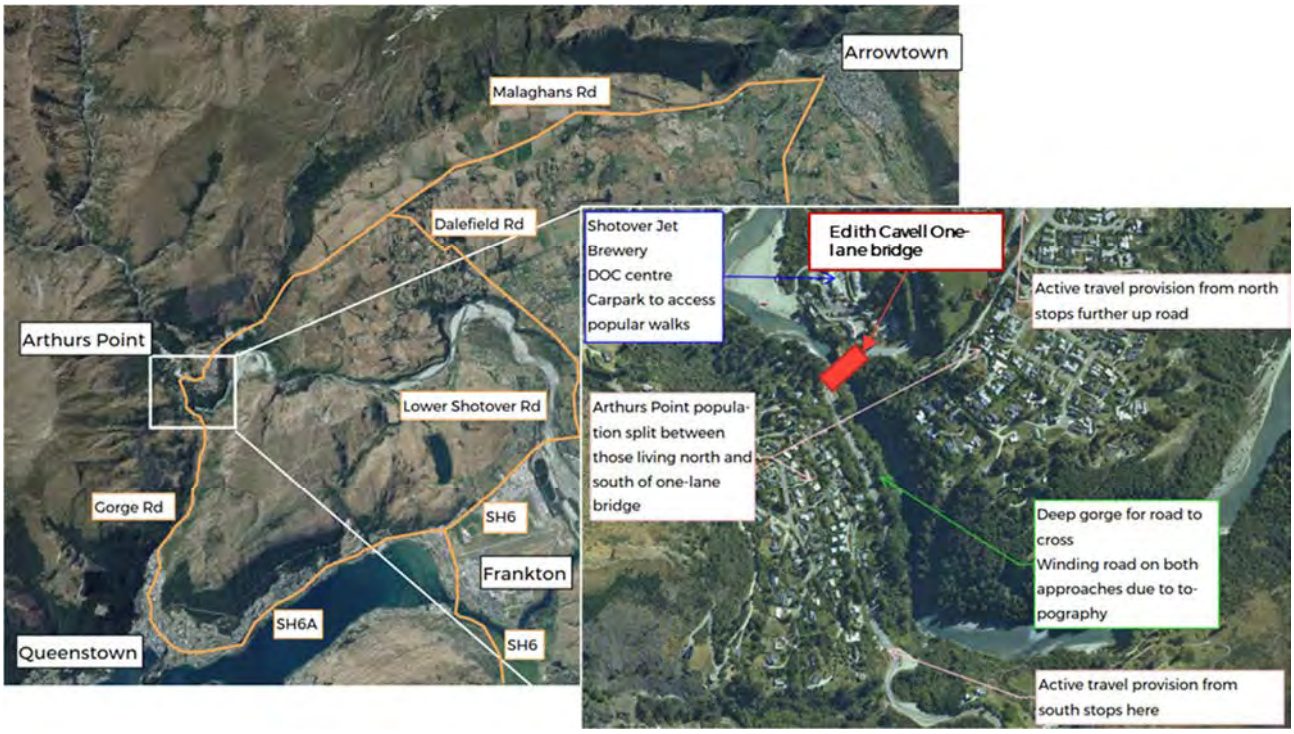


Figure 4 Geographic Context

Walking and cycling over the existing bridge is currently only suitable for very confident users, with 3.1m of carriageway width available (plus 0.4m kerbs on each side) for vehicles and foot traffic. Both real and perceived safety risks associated with the bridge limit use by active modes to almost zero, except for occasional tourists who have been observed stopping mid-span to take photos. At the time of writing, evidence of lack of use by pedestrians and cyclists is largely anecdotal as data collection for the project was restricted by the Covid-19 pandemic. Baseline data is not provided in the WATN SSBC.

Approaches to the bridge from both directions are also not conducive to walking and cycling. To the south, the Gorge Road approach is sided by retaining walls and steep cliffs for approximately 550m from McChesney Road. It has no shoulder and is windy and undulating, limiting sight distance. To the north, the Arthurs Point Road approach is similarly constrained with no shoulder. It also has a gradient between 5% and 10% climbing towards Arthurs Point. The Arthurs Point Community Association highlighted that parents are unwilling to let their children travel by bike due to safety concerns with both the bridge and approaches. The ability of this section of the network to support safe walking and cycling access is a significant constraint on the Arthurs Point to Queenstown route to be delivered under the Wakatipu Active Travel project.

Prior to the Covid-19 pandemic, assessments found that traffic volumes were reaching the capacity of a one-lane bridge. With ongoing growth forecast for Queenstown, this would lead to increasing delays and queueing. The bridge is also a constraint on future growth along the corridor, as well as network resilience to disruption, such as closures on SH6A Frankton Road.

At 101 years old, the existing bridge is reaching the end of its usable life. Maintenance costs will continue to increase with the bridge's age, while the performance of the structure in an earthquake is uncertain.

1.1 Project History

The Arthurs Point Crossing Single Stage Business Case stems from the recommended programme of the Queenstown Integrated Transport Programme Business Case (QITPBC), endorsed by Waka Kotahi and the Queenstown Lakes District Council (QLDC), and supported by Otago Regional Council (ORC) in 2017. The project preceded the current Way to Go partnership between QLDC, Waka Kotahi and ORC.

The project was identified as an activity to be addressed in a Single Stage Business Case. Figure 5 shows where the project (circled red) sits in the overall QITPBC programme. The project is closely linked to the Wakatipu Active Travel Network (WATN) project (circled blue). Crossing the Shotover River was left out of the WATN SSBC on the premise that a separate business case would be produced to justify its need and demonstrate that it could be delivered. The economic case for the Arthurs Point to Queenstown route of WATN Stage 2 is largely contingent on an upgraded Arthurs Point Crossing being in place. The river represents a key barrier to completing the walking and cycling network, with an upgraded crossing critical to achieving the WATN project's Investment Objectives.

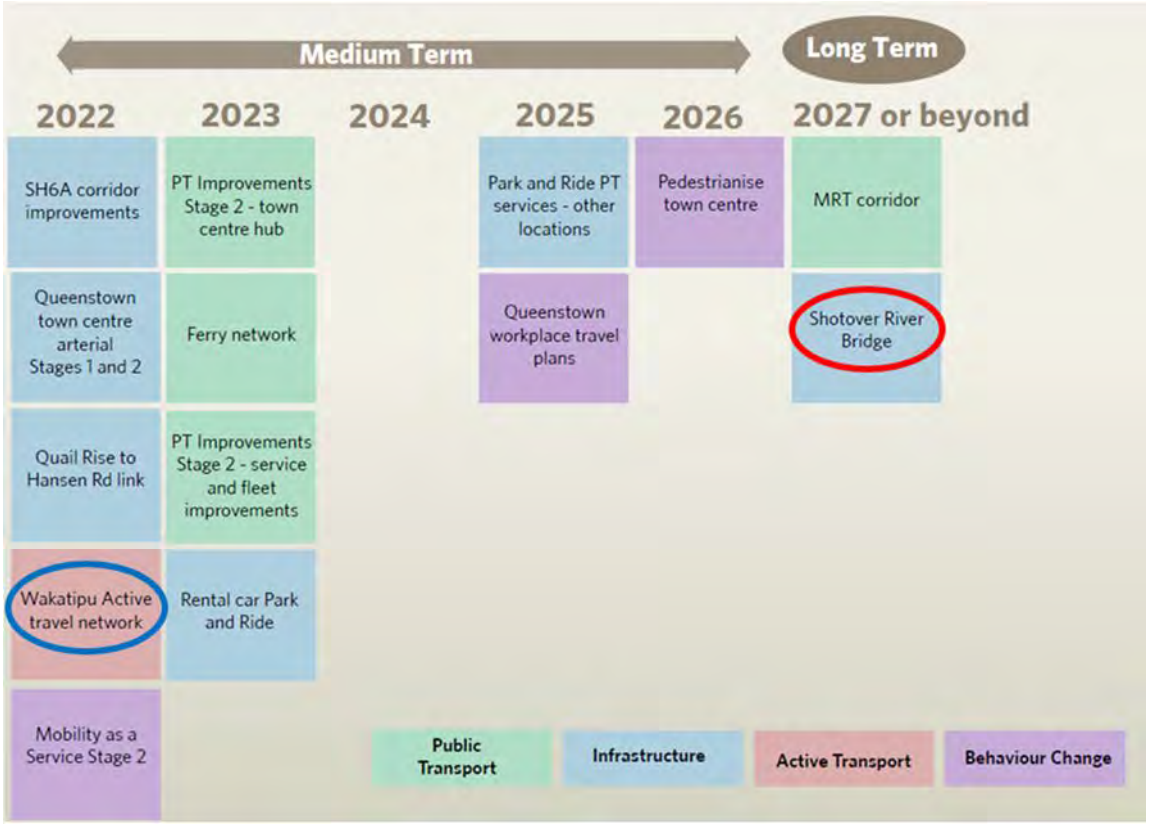


Figure 5 Queenstown Integrated Programme Business Case Recommended Programme

The name of the project has been through several iterations. It was originally named the *Shotover River Bridge* as an activity in the QITPBC and became the *Shotover River Bridge (Arthurs Point) Duplication* for submission in the NLTP. The project's working title (Arthurs Point Crossing) was chosen to simplify nomenclature and avoid perceptions of predetermining the preferred option.

The Point of Entry (PoE) for the project was recommended by QLDC and endorsed by Waka Kotahi on 26 November 2019 with confirmation of the Strategic Context including alignment with safety, access, efficiency and network resilience priorities in the GPS, as well as multi-modal plans recommended by the Waka Kotahi-endorsed QITPBC. The PoE is given in Appendix D1.

1.2 Project Governance

The project falls under the umbrella of Way to Go (W2G) (refer to **Error! Reference source not found.**) and will be delivered by QLDC. Funding will be jointly covered by QLDC and Waka Kotahi. Project governance

will be provided by a QLDC Programme Control Group. The Project Sponsor is Tony Pickard (QLDC) and the Project Manager is Matthew Roberts (QLDC).

The project sponsor is responsible for:

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

The project will regularly check in with funding partners and delivery partners through a series of gateways. There is a chance that this project will be adopted and managed by a proposed W2G delivery alliance. In this instance, project governance will be provided by the Way to Go management team and project managed by a Wakatipu Way to Go project manager.

Funding for the next stage of the project will require approval from the QLDC Programme Control Group and agreement from QLDC's Long Term Plan Steering Committee. Funding assistance from Waka Kotahi will require endorsement from the Delegations Committee.

Way to Go is a collaborative working group, formally launched in February 2019, made up of partner organisations Waka Kotahi NZ Transport Agency, Queenstown Lakes District Council and Otago Regional Council. The partnership is responsible for planning transport improvements for the Wakatipu Basin, including this business case. Organisation responsibilities are summarised in Table 3.

Table 3 Way to Go Partner Organisation Responsibilities

WAKA KOTAHI	QLDC	ORC
Funds, delivers and manages State Highway improvements. Also manages the NLTF, from which funding comes for local projects not on State Highways, such as this one.	Formulates strategic direction for transport in the district. Also funds, delivers, manages and operates transport infrastructure and strategies for local roads.	Funds and operates public transport services in the region.

1.3 Related Projects

The Arthurs Point Crossing project fits in a broader context of strategies, plans and business cases intended to improve the liveability of the area. Table 4 identifies the key interdependent projects and their influence on the Arthurs Point Crossing.

Table 4 Projects Relevant to Arthurs Point Crossing SSBC

PROJECT	RELEVANCE
Queenstown Integrated Transport PBC	Established the strategic case for investment in a series of infrastructure, public transport and behaviour change measures to address increasing congestion and decreasing trip reliability in Queenstown. Arthurs Point Crossing (named as the Shotover River Bridge in the QITPBC) was identified as an element of the recommended programme.
Active Travel Network SSBC	Demonstrated the need for investment for more direct and alternative routes between suburbs and workplaces to encourage mode shift to active travel throughout the Wakatipu Basin. Routes were proposed from Queenstown to the southern edge of Arthurs Point, and from Arrowtown to the northern edge of Arthurs point. This gap connecting the northern and southern parts of Arthurs Point were excluded on the

	basis that they would be covered in a separate business case to address the discrete problems for this area, particularly the Edith Cavell Bridge.
Queenstown Transport Business Case	Developed detail for the options identified in the QITPBC. The emerging preferred package has a public transport focus, including an eventual upgrade to Mass Rapid Transit. The package includes new signal control and bus priority measures through Frankton and on SH6A, which will increase the attractiveness of the Arthurs Point Crossing as an alternative route for general traffic.
Spatial Plan for the Queenstown Lakes	Identifies a strategy for structuring growth in the district in terms of land use and infrastructure development. The outcomes of the plan could influence the Arthurs Point Crossing preferred option and staging of implementation due to changes in population densities, trip patterns and travel demand.
Queenstown Mode Shift Plan	Waka Kotahi's strategy for increasing the pace of change with regard to providing more travel choice and reducing car dependency.
Proposed Pedestrian and Cyclist Improvements – Arthurs Point	Commissioned prior to the APC SSBC, the proposal is to provide cycle and pedestrian improvements linking Packhorse Lane to the Edith Cavell Bridge. The project will be an important link to complete the Arthurs Point to Queenstown route proposed by the WATN SSBC.
Other Assessments	Transport Modelling: Strategic modelling carried out by QLDC has found capacity constraints on SH6 and SH6A will cause greater demand for the Arthurs Point route as an alternative, which will cause the capacity of the bridge to be exceeded by 2028. The assumption in other business cases has been that the Edith Cavell Bridge will have two lanes by 2028. Several other assessments have been carried out on the bridge including the Edith Cavell Bridge Traffic Analysis, the Edith Cavell Bridge Traffic Report, the Safety Review of Arrow Junction to Queenstown Alternative Route and the Edith Cavell Bridge Safety Assessment.

1.4 Existing Asset Condition

An assessment of the condition of the Edith Cavell Bridge was carried out using available drawings, and inspection and maintenance records. It is noted that no previous assessments performed on the bridge were available except for inspection forms. As a result, assumptions and engineering judgement were used in the assessment. The full Existing Asset Condition Report is provided in Appendix C3.

The assessment identifies items of routine maintenance would be required to prolong the structure's remaining useful life. Poor quality concrete was found in the soffit of the deck, but this does not currently pose a structural issue. Under the current conditions and minimal maintenance, the bridge is estimated to have a remaining useful life in the order of 20 years. With an appropriate routine maintenance and inspection plan the remaining useful life can likely be extended well beyond this estimate.

A high-level qualitative seismic assessment of Edith Cavell Bridge suggests that the vulnerability of the structure is moderate to high. While the likelihood of bridge collapse in a strong event is not considered likely it can be expected that it will be damaged beyond repair. Significant risk exists, however, from potentially unstable abutment rock faces. Failure of these could lead to partial and even global collapse of the bridge. Even individual rock falls are risk to the adjacent transverse cross braced frames and could lead to a partial collapse of the bridge superstructure.

While the bridge is expected to continue to provide adequate performance under current loading for the foreseeable future based on this qualitative assessment, a number of seismic vulnerabilities have been identified which may result in the bridge being unusable following a major earthquake. The bridge carries important services and is a key part of the wider transport network and, to ensure ongoing network resilience, it may be reasonable to consider replacement. The bridge could then be repurposed as a pedestrian/cycle bridge and preserved as an important part of Queenstown and New Zealand's heritage.

1.5 Heritage

A Heritage Significance Assessment was carried out and the results provided in Appendix C6.

The Edith Cavell Bridge is a reinforced concrete parabolic twin-arch bridge, completed in 1919 after two years of construction. It replaced an earlier wooden structure (1875), which in turn replaced the first iteration of the bridge built in 1862 - constructed the same year that Arthurs Point was established and allowing goldminers to cross the Shotover River unimpeded for the first time.

The Edith Cavell Bridge is listed as a Category I Historic Place (#4371) with Heritage New Zealand Pouhere Taonga (HNZPT). The bridge is also scheduled as a Category 1 Protected Feature in the Queenstown Lakes Operative District Plan (QLODP). The Edith Cavell Bridge has exceptional overall heritage significance due mainly to its historical, aesthetic, social, and technological value. The bridge is associated with a number of historic high profile individuals and associations including the Public Works Department and its prolific Engineer- In-Chief Frederick Furkert, and internationally renowned WWI heroine Edith Cavell. Its involvement in the development of the township of Arthurs Point is of importance, with the first iteration of the bridge, on the same site, being erected the same year the township was established.

Aesthetically, the bridge creates an exceptional visual composition across the scenic Shotover River, with its simple and elegant arched rib design sitting high above the water below, framing the entrance to the canyons of the fast-flowing Shotover River. The early use of reinforced concrete in the construction of the bridge, and its engineering achievements, give the structure technological significance. The bridge is an icon of the township and is held in the highest regard by the local and regional community, with landmark status as an integral part of the community's identity, giving the bridge exceptional social and cultural value. The bridge has high contextual significance as part of a wider group of heritage structures, sites, and memorials which collectively inform the history of the area as a whole. The bridge also demonstrates exceptional authenticity and integrity, retaining the vast majority of its original fabric from more than a century ago.

1.6 Archaeology

An archaeological assessment was carried out; the full Archaeological Assessment Report is provided in Appendix C5.

The Edith Cavell Bridge abutments were originally constructed in the 1870s the bridge is thus defined as an archaeological site under the Heritage New Zealand Pouhere Taonga Act 2014. Furthermore, the construction of a new bridge may affect features associated with the earlier 1860s bridge which was located downstream of the present Edith Cavell Bridge.

An Archaeological Assessment of Effects will need to be undertaken for the Recommended Option at the pre-implementation stage to determine whether an Archaeological Authority is required. If the option selected will affect the present bridge abutments or involve groundworks around the extant bridge structure or the site of the 1860s bridge downstream, an Archaeological Authority will be required under the HNZPTA 2014. This should be completed during the planning/consenting phase of the project during any future pre-implementation/implementation phase.

1.7 Covid-19 Impacts

Waka Kotahi's strategic Arataki document highlights the following potential Covid-19 impacts on Queenstown's land transport system:

- Pressure on transport revenues, including road user charges, fuel excises and public transport fares, from reduced travel demand
- Increased importance of providing access to employment and essential services by a range of modes
- Transport will need to support the recovery of the tourism industry. The downturn provides an opportunity to re-evaluate what infrastructure is required and where, and the scale and sequencing of growth and investment.

Population and visitor growth projections developed by QLDC indicate that reduced population and visitor growth rates are anticipated to be short-term only, with growth expected to return to pre-Covid levels in 3-5 years[1]. Despite the removal of immediate growth pressures, the case for investment in the Queenstown transport network therefore remains strong. The temporary reduction in demand also presents an opportunity to capitalise on lower traffic volumes, 'catching up' on infrastructure while disruption is minimised.

[1] Queenstown Lakes District Population Projections Post-Covid (September 2020)

2 PROBLEMS, OPPORTUNITIES AND CONSTRAINTS

This section summarises the Problems, Opportunities and Constraints Report (presented in full in Appendix C9).

2.1 Summary of the Evidence Base

The evidence base shows that there is a strategic case for investing in the Arthurs Point Crossing:

- The bridge and the route alignment (steep gradients encouraging high speeds, poor sight distances, hazardous winter conditions) pose a real and perceived crash risk particularly for active mode users, which appears to be suppressing demand
- The lack of a safe crossing arrangement at Arthurs Point is one of the few remaining barriers to the Wakatipu Active Travel Network. The Active Travel Network already has funding committed for pre-implementation, including for the Arthurs Point to Queenstown route, which could be wasted if a crossing is not provided
- Much of the evidence regarding lack of use by pedestrians and cyclists is anecdotal due to the inability to collect additional data as a result of the Covid-19 pandemic. However, in the online survey, 112 (67%) respondents stated they would walk or cycle the crossing at least weekly if a safe facility was available, with only 10% stating they would never use it. 100 said they would use the crossing to access Queenstown Town Centre
- Approximately 10 attendees at the 7 July 2020 Arthurs Point Community Association (APCA) meeting highlighted that the Gorge Road approach in particular is unsafe for walking and cycling and prevents parents from letting their children cycle to school. APCA's official submission on the project noted that the existing bridge has 'regularly and consistently' been noted the by the community as being a concern to residents – improving the crossing is a 'top priority'
- The community ranked 'poor safety for pedestrians and cyclists' (75% said very important) as the most important issue to be addressed by the project, followed by 'no dedicated route for pedestrians and cyclists' (70% said very important). This compares to 'increasing delays for car traffic', which only 30% rated as very important
- The existing bridge has limited traffic capacity, which the evidence base suggests is already being reached at peak times. However, this has been observed only during the 2019 summer holiday period and demand around the district has since subsided due to the Covid-19 pandemic[2]. As traffic growth returns to pre-Covid levels, it is likely to lead to increasing delays and decreasing reliability, though Level of Service F is not expected to be reached until at least 2031 (accounting for the downturn caused by Covid-19). It is also likely to limit the ability to use Malaghans Road/Gorge Road as a secondary route as QLDC seeks to take traffic pressure off SH6A
- The impact of the bridge's limited capacity on the rest of the network is significant in major emergency events, though these have been relatively infrequent over the last 10 years. Temporary traffic management is needed in such instances, but gets held up in congestion caused by the bridge
- The existing bridge has a finite design life and is within 20 years of reaching it. The structure is unlikely to be usable following a large seismic event. However, there is little historical evidence, and therefore certainty, regarding the frequency or consequence of that type of hazard event. Investment in the resilience scope of the project is not supported by funding partners' existing strategies
- Improving the resilience of the single piece of infrastructure to withstand an event of the scale of AF8 would likely be disproportionate considering the residual vulnerability of the rest of the network. While the route provides the only alternative to SH6A, and has caused acute disruption during major unplanned closures, these events are relatively rare and the road has remained open, albeit with poor levels of service.

[2] Queenstown Transport Business Case, Waka Kotahi (2020)

2.2 Current and Projected Demand

Current and projected vehicle counts for the Edith Cavell Bridge, and their relationship to travel times are presented in are presented in Section 5.5 Traffic Modelling.

The WATN SSBC provides forecast cycle trip demand for the Arthurs Point to Queenstown route as summarised in Table 5. Years shown are understood to represent 'do something' model scenarios (2016 is a hypothetical scenario using a historical demand set with option infrastructure in place).

Table 5 Forecast Cycle Trip Demand Arthurs Point to Queenstown (WATN SSBC)

Model Year	2016	2029	2046
Daily Cycle Trips	353	926	1543
Growth	-	162%	337%

It was agreed with stakeholders at the commencement of the project that no further traffic data would be collected for the project due to the Covid-19 pandemic causing atypical travel patterns and restricting the project team's ability to get to site.

2.3 Investment Logic Map

A facilitated Investment Logic Mapping (ILM) workshop was held on 29 April 2020 (online due to Covid-19 restrictions) with Way to Go partners, including representatives from each of QLDC, Waka Kotahi and ORC.

The session began with a discussion framing the problems, objectives and desired outcomes of the project from each organisation's perspective. Based on this discussion, the group then agreed on a series of Problem Statements, Benefit Statements, potential Key Performance Indicators (KPIs) and Investment Objectives. Benefits and KPIs are presented in more detail in Section 3 Strategic Outcomes. The Investment Logic Map is shown in Figure 6.

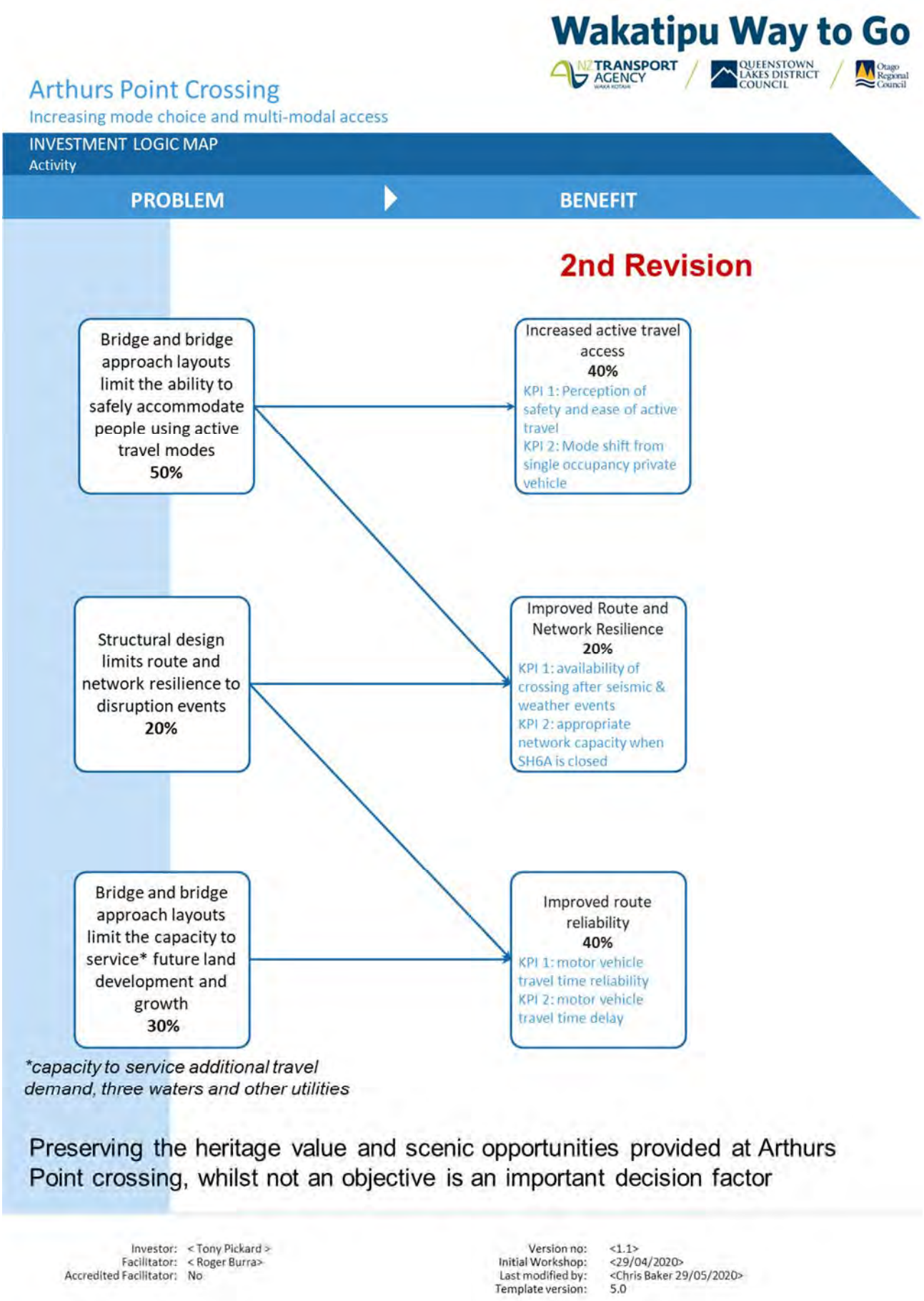


Figure 6 Investment Logic Map

2.3.1 Problems

In the ILM workshop, the following problem statements were agreed:

- **PS1:** Bridge and bridge approach layouts limit the capacity to safely accommodate people using active travel modes (50%)
    - The bridge deck itself is narrow and does not permit safe simultaneous use by motor vehicles and pedestrians/cyclists. Similarly, the carriageway on approach to both sides of the bridge is constrained and does not provide for safe movement by pedestrians and cyclists. This was considered the most important and urgent problem.
- **PS2:** Bridge and bridge approach layouts limit the capacity to service* future land development and growth (20%)

**capacity to service additional travel demand, three waters and other utilities*

    - The bridge in its current form has limited traffic capacity, which was reached during peak season of 2019 (refer to Traffic Modelling), though Covid-19 has since led to reduced demand. Demand is also highly variable through the year, making it challenging to provide consistent levels of service. The existing bridge does not have the structural capacity to provide additional services across the river. Additionally, the alignment of the approaches (sharp horizontal and vertical curves) is substandard for additional water infrastructure. This combination of effects was agreed to limit the potential to service development in the area.
- **PS3:** Structural design limits the route and network resilience to seismic events (30%)
    - The bridge is expected to be unusable by motor vehicles following an AF8 (Alpine Fault magnitude 8) seismic event. Performance under other earthquakes will depend on the characteristics of the event (refer to Existing Asset Condition Report in Appendix C3). The risk remains that in the event of a strong earthquake, the Arthurs Point community will be cut off, and the only alternative route to SH6A will be unusable. Refer to the Problems, Opportunities and Constraints Report in Appendix C9 for commentary on the strength of the case for investing in resilience.

2.3.2 Opportunities

Opportunities to maximise the benefits of investment were also identified including:

- Enhanced visitor experience – the existing bridge already attracts tourists due to the scenic value of the Shotover River canyon. An opportunity exists to enhance the value of the area while addressing the core transport problems
- Demonstration of QLDC's commitment to the Climate Action Plan – the site's iconic location and local reputation, combined with the scale of the project, presents an opportunity to use this as a showcase project to promote sustainable outcomes and set an example for other projects in the district. Sustainability, and in particular carbon emission reduction, was identified as a strong opportunity by project partners. This is discussed in more detail in Section 3.5.
- Completing the active travel network – crossing the Shotover River would remove one of the last barriers to a fully connected walking and cycling network in the Wakatipu Basin, including enabling connection of the existing NZ Cycle Trail Queenstown route behind Queenstown Hill (see last point below).
- Recreational 'canyon loop' walking/cycling trail – The Queenstown Trails Trust have indicated that they would investigate completing a trail around the Arthurs Point gorge, subject to successful landowner negotiations as part of the Arthurs Point Crossing project, to capitalise on the accessibility provided by this project and the inherent attraction of the local scenery.
- Natural screening – while the project area's geography presents technical challenges with construction, it also presents an opportunity to design new structures to be screened by hills, gullies, bluffs and vegetation
- Nga Haerenga NZ Cycle Trail – the route lies between start/end points for the Queenstown Nga Haerenga trail. Providing a connection across the Shotover River would establish a loop around

Queenstown Hill with approximately 8.5km more trail (Figure 7). Signage on existing NZ Cycle Trail routes direction users via Arthurs Point has been agreed with Queenstown Trails Trust

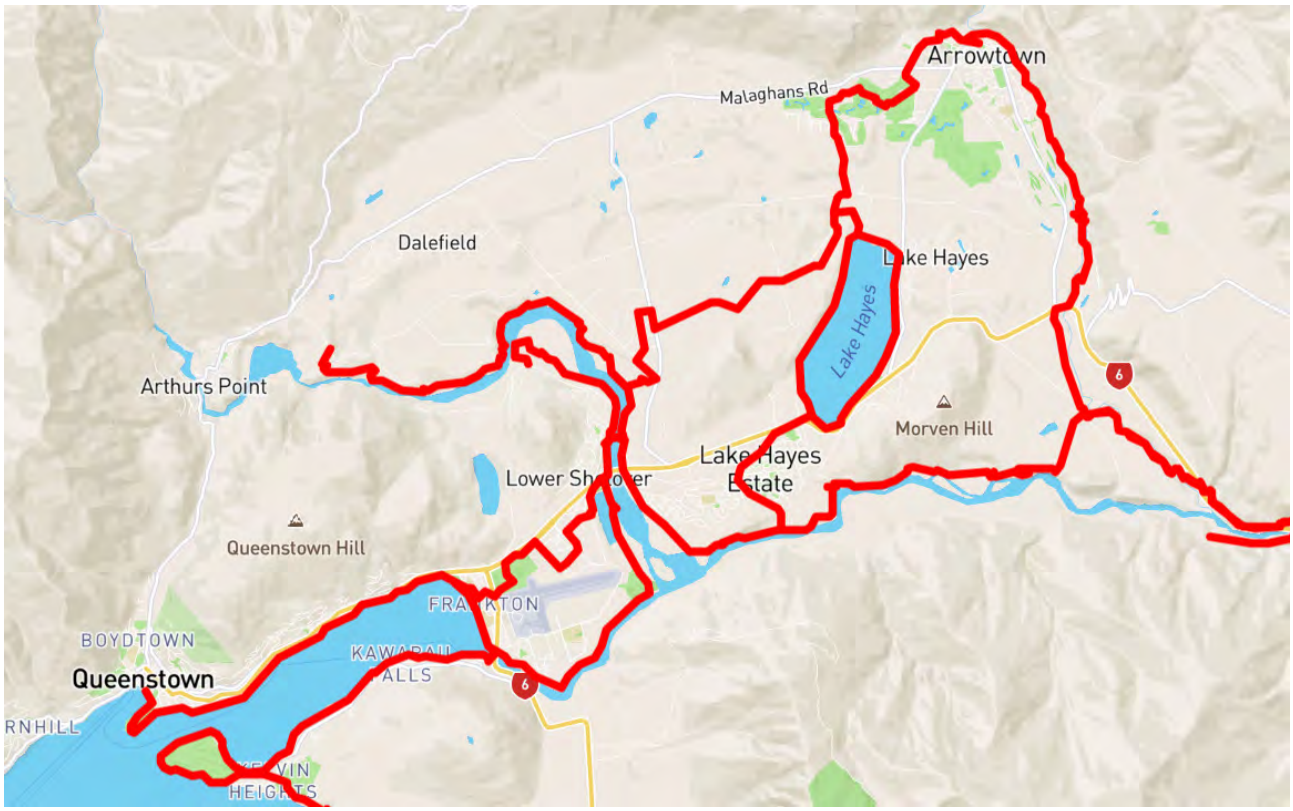


Figure 7 Nga Haerenga NZ Cycle Trail Queenstown

A separate Sustainability in Design workshop was held with the same Way to Go stakeholders on 28 April 2020, which identified further opportunities for emission reduction and sustainability outcomes.

2.3.3 Constraints

The solution would have to work within the following identified constraints:

- The geographical features of the area including the Shotover River canyon width and depth, and geotechnical and hydrological conditions. While not expected to be fatal flaws, these constraints are expected to have impacts on design and construction costs. They also translate to higher contingencies in cost estimates.
- Existing intersections at McMillan Road, McChesney Road, Oxenbridge Tunnel Road and the Shotover Jet complex will need to be kept operational through construction and operation of the preferred option. McMillan Road cannot be closed due to the approach angle of driveways, which if accessed via McChesney Road would require reverse entry to properties. The Shotover Jet complex is busy with access to tourist attractions, DOC centre and Canyon Brew bar & restaurant, though exact volumes are unknown. Access from the road will need to be appropriate for these high demands.
- Road geometric design and minimum curve requirements may reduce the ability to use existing road reserve or Crown land, increasing the likelihood of property acquisition. While not directly an issue itself, property acquisition in a rural area with high scenic value may be challenging, both due to unwilling sellers and potential negative effects on property owners.
- The Edith Cavell Bridge is listed as a Category I Historic Place (#4371) with Heritage New Zealand Pouhere Taonga (HNZPT). The bridge is also scheduled as a Category 1 Protected Feature (Ref. No: 35, Map Ref: 39) in the Queenstown Lakes Operative District Plan (QLODP). The age and structural integrity of the bridge (refer to the Heritage Significance Assessment in Appendix C6). Heritage NZ indicated that they would not support any physical alteration to, or a temporary structure in the vicinity of, the existing bridge, and that any new structures should be as far from the existing bridge as possible.

3 STRATEGIC OUTCOMES

This section sets out what the project will achieve, and how it aligns with existing tiers of strategic objectives. For outcomes specific to the recommended option, see Section 7.2 Project Benefits and Outcomes.

3.1 Investment Objectives

In the ILM workshop, a series of Investment Objectives were agreed. At a shortlist refinement workshop on 7th July 2020 with QLDC, Waka Kotahi and ORC stakeholders, it was agreed that the original Investment Objectives were not sufficiently SMART (specific, measurable, achievable, relevant and time-bound) to enable meaningful assessment of options. Investment Objectives were therefore updated and agreed at a follow-up session on 22nd July 2020, as shown in Table 6.

Table 6 Evolution of Project Investment Objectives

ORIGINAL INVESTMENT OBJECTIVES (29 APRIL)	UPDATED INVESTMENT OBJECTIVES (22 JULY)
1 Provides a safer and more accessible crossing for active modes	1 Provides a safer, more accessible path for all confidence levels of pedestrian and cyclist between existing routes (and planned upgrades) in the short term
2 Ensures level of service and travel times are maintained for general traffic and improved for active modes	2 Ensures travel time reliability is maintained for growing vehicle traffic volumes
3 Improves overall network and route resilience	3 Improves overall network and route resilience to seismic events and closures of SH6A in the long term
4 Enables land use development and growth, while recognising the historical importance of the existing structure	4 Enables future land use development and growth by providing additional traffic and utilities capacity

Updates to the Investment Objectives include:

- Separating general traffic and active mode objectives
- Defining the target market for active modes
- Defining the extent of the area to be addressed for active modes
- Clarifying the intent to maintain travel time reliability, rather than travel times
- Defining the type of resilience sought
- Defining the intended land use development
- Removing reference to historical importance, recognising consideration of heritage is inherent in the business case process
- Defining timeframes for achieving the objectives (albeit to a high level so as to not unfairly prejudice or predetermine any options)

Stakeholders agreed that for Investment Objective 2, it was important to capture the intent of improving travel time reliability rather than travel times. Improving travel times may be counterproductive to mode shift objectives and may attract traffic to the route. However, travel time reliability is more closely linked to liveability objectives (in that it enables road users to plan journeys to get to where they need to be on time) and is anticipated to become a problem as traffic volumes grow.

3.2 Strategic Alignment

The Point of Entry document identifies the desired future state for the project area: to provide a reliable, safe and resilient transport network that services a growing, liveable Queenstown district, while preserving and complementing the iconic status of the existing bridge. These themes align well with local, regional and national strategies and plans, as well as the vision and outcomes from stakeholder workshops throughout the project. Importantly, they also represent a continuation of objectives identified in the PBC (refer to section 3.3 Programme Outcomes). The underlying principles behind the Investment Objectives and option assessment are consistent with the broader transport objectives of the funding partners.

Table 7 is developed from the POE, and summarises alignment with national, regional and local strategy documents. It identifies how, and to what extent, the business case is aligned with each strategy. Alignment with the QLDC Climate Action Plan has also been added. The following scoring system is used:

Strength of alignment	
	Non-essential
X	Minor contribution
XX	Significant contribution
XXX	Essential to objective

Table 7: Initial assessment of strategic fit (Reference: POE document)

STRATEGY AND DIRECTION	OUTCOME AND STRENGTH OF ALIGNMENT			
	MORE ACTIVE TRAVEL	ACTIVE TRAVEL SAFETY	BRIDGE CAPACITY	RESILIENCE
NATIONAL				
Government Policy Statement on Land Transport 2021-2031 **Key strategic priorities:** - **Safety** - **Climate Change** - **Transport choice** - **Improving Freight Connections** **Supporting strategic principles:** - **Value for money** - **Supporting regions (including resilience)**	**XX**	**XX**	**X**	**XX**
Government Policy Statement on Land Transport 2018-28 **Key strategic priorities:** - **Safety** - **Access** - **Transport choice** - **Resilience** **Supporting strategic principles:** - **Value for money** - **Reduced greenhouse gas emissions**	**XX**	**XX**	**X**	**XX**
New Zealand Transport Agency Statement of Intent 2018-22 **Position statements:** - **Transport safety** - **Inclusive access** - **Liveable communities** - **Resilience**	**XX**	**XX**	**X**	**XX**
Regional				
Update of the Otago Southland Regional Land Transport Plans 2015 – 21 **Long term goal: A transport system in Otago and Southland that provides adequately for mobility, economic activity and productivity while minimising road trauma.**	**XX**	**XX**	**XX**	**X**
Local (QLDC)				
Ten Year Plan 2018-28 **Community outcomes include:** - **Appropriate public access** - **Efficient and effective infrastructure** - **Environmental sustainability and low impact living is highly valued** - **Sustainable growth management** - **Partnering for success** - **Investing strategically** - **Communities are resilient and prepared for civil defence emergency events**	**XXX**	**X**	**XX**	**XXX**
Proposed District Plan (7 March 2019) **Chapter 29 (Transport) outlines a number of transport objective, which can be summarised as:** - **Integrated, safe and efficient transport network** - **Provides for future growth needs** - **Promotes shift from car dependency to public transport and active modes** - **Contributes to reducing the effects of climate change**	**XXX**	**XX**	**XXX**	**X**
Land Transport Activity Management Plan 2018-33 **Vision for land transport: To provide a safe, resilient, efficient transport system that supports modal choice and addresses current and future demand for economic and social opportunities**	**XX**	**XXX**	**XX**	**XX**
Added by WSP: Local (QLDC)				
Climate Action Plan 2019-2022 **Sets out a strategy to reduce emissions and address climate change impacts. Key outcomes include:** – **A low-carbon transport system.** **Built environment and infrastructure is climate responsive**	**X**	**XXX**	**XX**	**XXX**
Queenstown Mode Shift Plan Sets out how Queenstown will get more people walking, cycling and using public transport by: – **Investing in new and improved infrastructure and services** – **Pro-actively influencing people's travel choices**	**XXX**	**XXX**	**X**	**X**

3.3 Programme Outcomes

The project is an activity from the recommended programme in the endorsed QITPBC and as such should align with the programme outcomes. Investment Objectives and performance Measures identified in the QITPBC are presented in Figure 8.

Criteria	Investment Objective 1: To improve network performance for private vehicles, public transport and cycling	Investment Objective 2: Improved liveability and visitor experience
Benefit	Improved network performance and customer experience for all modes	Improved liveability and visitor experience
Measure 1	Reduce the proportion of single occupant vehicles into the Queenstown Town Centre by 20% by 2025/2045 *BASELINE: In 2016, between 7-11am 54% of trips into the town centre were made by private vehicle drivers (source MWH May 2016 survey).*	Improve/maintain residents liveability with at least 75% satisfied with their transport experience in Queenstown by 2025/2045 *BASELINE: Over 90% of respondents consider roading, parking and transport as services that need to be improved (source QLDC Rate Payers and Residents survey 2016).*
Measure 2	Increase the number of people moved (aggregated for all modes) along the State Highway 6 and 6a corridors by 30% by 2025/2045 *BASELINE: In 2016, between 7-11am 4729 persons entered the town centre via SH6A (source MWH May 2016 survey).*	Improve/maintain visitor experience with at least 75% satisfied with their transport experience in Queenstown by 2025/2045 *BASELINE:.46% and 33% of respondents' availability of parking and traffic flow experience (respectively) were worse or much worse than expected (source: 2016 Visitor Insights Programme)*
Measure 3	Improve the travel time reliability for general traffic by 2025/2045 with 15th to 85th percentile PM peak travel time being no worse than 5 minutes for key journeys on State Highway 6 and 6a. *BASELINE: PM peak 15%ile to 85%ile travel time range in December 2016 is 7 minutes in SH6 (Beach St to SH6A) and 13 minutes (Lucas Place to SH6) (source: Tomtom GPS data).*	
Measure 4	Improve travel time reliability for public transport with at least 80% of peak period bus services in the Wakatipu Basin operating within 5 minutes of scheduled departure times by 2025. *BASELINE: In 2016, 77% of morning peak and 46% of evening peak services between CBD and the Remarkables Town Centre are within 5 minutes of scheduled departure times (source: ORC 2016).*	

Figure 8 QITPBC Investment Objectives, Benefits and Measures

The project continues the mode-agnostic approach of the QITPBC. It specifically contributes to Measure 1 of Investment Objective 1 by promoting active travel. By the time the road bridge is implemented, it is anticipated that wider behaviour change measures (including parking strategy proposed for the Town Centre) will have been implemented, mitigating the risk of counterproductive effects from improving car travel times on the new bridge.

The project is considered to contribute indirectly to the other Measures under IO1 by encouraging mode shift away from private vehicles. Providing additional safe and convenient transport options is also considered to improve residents' and visitors' perception of liveability, thus contributing to Measures under IO2.

3.4 Project Outcomes

At an activity level, the project seeks to address immediate community concerns regarding the lack of safe active mode facilities, while acknowledging current satisfaction with the performance of the existing bridge from a traffic operations perspective (the community generally indicated that they have no concerns with vehicular traffic).

This conveniently aligns with Waka Kotahi, QLDC and ORC strategies, particularly regarding mode neutrality, enabling transport choice, reducing carbon emissions and delivering value for money. Prioritising active mode improvements and deferring road upgrades until absolutely necessary promotes use of more sustainable travel modes, increases transport options, reduces use of 'carbon budget' and optimises use of existing assets.

3.5 Sustainability

A key commitment of QLDC, and goal of this project, was to demonstrate sustainable design that measurably reduces carbon emissions and climate risk. An initial workshop was held on 28th April to:

- Establish a culture of low-carbon resilient thinking, innovation and delivery

- Explore and establish how the SSBC processes will measurably reduce carbon emissions and climate risk
- Agree to tools, standards and processes to track and assure impact allowing for subsequent design, construction and maintenance stages
- Ideate low-carbon and resilience initiatives. Opportunities and risks to be integrated into the project-wide register.

At the workshop, stakeholders committed to:

- Showcase this project as leading with sustainability in design and show how it will become BAU in all projects.
- Increase possibility of alternative modes.
- Increase sustainability in options development and assessment (i.e. carbon weighting in MCA)

Sustainability, and carbon emission reduction in particular became a key theme throughout the project, featuring at each optioneering workshop and in the assessment of the preferred option.

4 STAKEHOLDER ENGAGEMENT

A comprehensive breakdown of the approach to engagement is presented in the Stakeholder and Community Engagement Plan in Appendix C7. Outcomes of engagement are presented in the Partner, Stakeholder & Community Engagement Report in Appendix C7. Engagement was undertaken with the following groups:

Project Partners

- QLDC
- Waka Kotahi
- ORC
- Ngai Tahu
- Kai Tahu

Targeted Stakeholders

- Arthurs Point Businesses
- Heritage New Zealand Pouhere Taonga
- Department of Conservation
- Arrowtown Business Association
- Queenstown Airport Corporation
- Transport Groups
- Transport Operators
- Queenstown Chamber of Commerce
- Emergency Services
- Tourism Operators-including Shotover Jet and Ngāi Tahu Tourism
- Shaping Our Future
- Wider Community Associations
- Schools
- Disability Groups
- Queenstown Trails Trust
- Other Interest Groups

Community

- Arthurs Point Community Association
- Arthurs Point wider community (drop in session and letter drops)
- Queenstown Lakes District community (online survey and website information)

4.1 Project Partners

Engagement was undertaken on a regular basis with project partners, as the key decision-makers for the project. Several attempts by the project team to contact Kai Tahu and Ngai Tahu representatives via Te Ao Marama and Aukaha were unsuccessful. QLDC have since liaised with Iwi, who stated they could not resource direct involvement with the project at this stage, but informally indicated no issue with the project. Ongoing liaison through pre-implementation will be critical to achieve buy-in and ownership from Mana Whenua. Representatives of each of the partner organisations, except Iwi, attended each of the following project workshops:

- Sustainability Workshop (28 April 2020)
- Workshop 1: ILM and Longlist Development (29 April 2020)
- Workshop 2: Longlist to Shortlist (20 May 2020)
- Shortlist Refinement Session 1 (9 July 2020)
- Shortlist Refinement Session 2 (structures and alignments) (22 July 2020)
- Workshop 3: Shortlist to Preferred (21 August 2020)

Outcomes from these meetings are presented throughout this business case report.

4.2 Targeted Stakeholders

An email was sent to 82 targeted stakeholders (noted above) on 13 July 2020. The email informed these groups of the project, provided a copy of the project booklet and invited stakeholders to provide comments on the proposed alignment options. Follow up meetings were held with Heritage New Zealand Pouhere Taonga (HNZPT) on 5 August 2020 and the Department of Conservation (DOC) on 4 August 2020 with a follow up email on 14 August 2020.

Feedback was received from four stakeholders on the shortlist. The Queenstown Trails Trust provided a very detailed submission outlining their views on the alignment options. For active mode travel, the Trust considered that providing a cycling and pedestrian bridge would bring some significant improvements to the Active Transport network but would also provide great recreational opportunity when combined with Alignment 3 or 5 (C or E). Active mode Alignments 1,2 and 7 were considered to not be suitable locations.

HNZPT were generally supportive of removing vehicles from the Edith Cavell Bridge but would like to see the bridge used for active transport as well as preserving major viewshafts. They were interested in further details on some of the alignment options, particularly the distance between Alignment 3 and the existing Edith Cavell Bridge. HNZPT also indicated that any clip-on bridge to the Edith Cavell Bridge would not be supported.

The Department of Conservation confirmed that the two cycleways with Alignments 6 & 7 are accommodated by the Otago Conservation Management Strategy review.

The Arrowtown Village Association supports the discussion on upgrades to the Arthurs Point Crossing while at this point in time not selecting one of the specific alignment options.

4.3 Community

Table 8 outlines activities undertaken to consult with the community between 13 July 2020 and 10 August 2020. Full analysis of survey results and submissions is provided in the Partner, Stakeholder & Community Engagement Report in Appendix C7. Consultation material provided to the community is presented in Figure 13 in Section 5.2.2.

Table 8 Engagement Activities Summary

Print, Online and E-comms	• Media release (to media contact database) and online: -July 13, 2020 – Engagement to start -July 13, 2020 – Scoop Online Media Article: 'Community Asked to Consider Early Options for a Future Crossing at Arthurs Point' • Website content: https://letstalk.qldc.govt.nz/arthurs-point-crossing • Total Reach: Scoop Readership 500,000 people per month; QLDC Website Total Visits 1,320.
Survey and Submissions	• Online survey on Let's Talk site via Bang the Table community tool: 168 responses • Bang the table visits to Let's Talk site for Arthurs Point Crossing: 1,320 total visits • New Registrations at QLDC Website to undertake survey: 151 new registrations • QLDC Way to Go Arthurs Point Crossing Booklet total downloads: 487 • Total Reach: Survey submissions 168; Let's Talk Website hits: 1,320
Social Media	• QLDC general post and promotion of project for community drop in session 13 July 2020. 27,418 followers to QLDC page, 21 likes, 5 comments and 12 shares • QLDC general post boosted from 6 August 2020: 27,418 reached, 10 likes and 2 shares • Total Reach: 27,382
Letter Drop	• Letter drop to Arthur's Point households with project information booklet. Total reach: Approximately 300 households • Targeted letter drop to 4 properties on Atley Road due to proximity of options to private property • Total reach: Approximately 300 households
Direct Emails	• Email sent to five community associations in the Wakatipu basin. The Arthurs Point Community promoted through membership via Facebook • Total Reach: Hundreds of people via local association databases
Collateral	• Wakatipu Way to Go pull up banner – on display at drop in event • Options for a Future Arthurs Point Crossing project brochure–awareness and informing piece promoted on the letstalk site – distributed to Arthur's Point residents, key stakeholders and at the drop-in event and available to download on the QLDC website. Total document downloads 487

	• Information panels at drop in session. Community feedback via post it notes collected and collated. • Total Reach: Hundreds of people via event attendance and brochure drop.

4.3.1 Submissions on the Shortlist

The detailed submissions outlined widespread support that the crossing at Arthurs Point was being looked at in detail and welcomed the opportunity to provide feedback. General themes that came through included a strong connection with the Edith Cavell Bridge and a desire to use this bridge for active mode travel. There was also a desire to ensure that the vistas of this bridge were protected.

Pedestrian and cycle safety was another key theme that came through from the submissions. Many submitters commented on the need to separate out active mode transport from vehicles and several submitters were supportive of Alignment 6 if a separate active mode transport bridge was to be built. Alignments 1, 2 and 7 were too far away.

Most, if not all the written submissions received strongly opposed Alignment 4. Common themes included the loss of residential amenity and character with creating a main road through a quiet neighbourhood and safety concerns for children and pets as there are lots of young families in the area.

For a vehicle bridge, many of the written submissions were supportive of Alignment 3 or favoured a combination of Alignment 3 and 4 (i.e. starting on the Queenstown side at Alignment 4 and finishing at Alignment 3 on the eastern side).

Other submitters raised the potential issue of light pollution caused by upgraded streetlighting and the impact on the night sky.

4.3.2 Shortlist Option Survey

Many respondents commented that any two-lane bridge needed to be well away from the Edith Cavell Bridge as if the new bridge is built close to the existing bridge then the downstream vistas would be blocked by any new bridge. There was overwhelming desire from respondents to be able to have safe access to the Edith Cavell Bridge and many commented that it made sense to use the existing bridge for active mode transport and a new vehicle bridge needed to be built.

Many survey respondents commented that pedestrian and cycle safety was a significant issue. They also outlined that the community desire more efficient and safer solutions for active transport and this was paramount for the future and for sustainability.

Survey respondents commented that Alignments 1 & 2 would be a nice to have but commented that these alignments were out of the main traffic flow and that it would not be used for active transport in this location as it was not a direct link into Queenstown.

There was strong support from survey respondents of Alignment 3 and many commented that this seemed like the most practical solution in terms of build cost, safety of road users and not adversely impacting on others in the neighbourhood.

Survey respondents were extremely opposed to Alignment 4. Respondents commented that it would turn Atley Road into a busy main road which would have devasting effects on the safety and amenity of the residents on that side of Arthurs Point. Many respondents commented that Alignment 4 would create safety issues as many young families live in the area and there would be negative impacts on locals living in the area.

Survey respondents had mixed comments regarding Alignment 5. Some residents saw this as a good option while others considered that this option would result in a bridge with a big span which would be too expensive and would not help control speed. Others commented that this option could have significant visual impacts on the area.

In terms of Alignment 6, some survey respondents commented that this would be a great option for cyclists and pedestrians and particularly kids on bikes. Some respondents commented that Alignment 6 made sense in the short term, particularly if a long-term solution is years away. Other respondents questioned how this option would link in to the road and other tracks.

Some survey respondents commented that Alignment 7 could be a good option and others commented that it was too far out of the way and would likely be objected due to the Outstanding Natural Landscape values.

4.3.3 Preferred Option Survey

In addition to engagement carried out for the business case, QLDC undertook a second survey to gauge community support for the preferred option. Of the 34 completed surveys, 9 opposed the preferred option.

The main reason (5 responses) for opposing the preferred option was that a third bridge would negatively impact the scenic beauty of the gorge. Three responses were from affected property owners with concerns about the effect on the enjoyment of their property and one response suggested building a new road from Tuckers Beach.

The bridge alignments were selected to minimise the conspicuousness of each structure in viewshafts of the gorge, which is evidenced in the 3D visualisations produced for the project. Discussions to find an amicable solution with affected landowners that meet the project objectives and the community's needs are ongoing. An alternative road route via Tuckers Beach has been investigated previously and found to be infeasible and cost-prohibitive.

5 OPTION DEVELOPMENT AND ASSESSMENT

As this SSBC is developed straight from the QITPBC, option development is presented in more detail than would be the case in a DBC. Option development and assessment followed the following process:

1. Longlist (sieve of options)
2. Longlist to shortlist of structures and alignments (MCA)
3. Refinement of shortlist of combined structures and alignments (MCA)
4. Shortlist to preferred option (MCA)

5.1 Longlist

5.1.1 Formulation

Options were identified via an online spreadsheet populated by project partners following the ILM workshop. Options considered include upgrades to the existing structure, entirely new structures and modifications & strengthening. Alignments were considered separately to enable more efficient assessment. The longlist is presented in Table 9.

Table 9 Longlist Options

Structure
New bridge with 2-way vehicle traffic and active modes on both sides
New bridge with 2-way vehicle traffic, no active modes. Retain old bridge for active modes
New bridge for active modes and utilities
Provide clip on style path for active travel users both sides
Provide clip on style path for active travel users one side only
Sling active travel bridge under existing bridge
New single lane bridge downstream of existing for QT bound traffic. Old bridge retained for AT bound traffic
New single lane bridge with two way active travel provision downstream of existing for QT bound traffic. Old bridge retained for AT bound traffic
Install traffic signals with pedestrian/cyclist phase
New active travel bridge to Watties Track
Limit development of land in the area to minimise traffic and services growth
Strengthen existing bridge for seismic
Replace bridge deck with wider deck to cater for two lanes
Shared space on existing bridge
Viewing platform in centre
Staging
Quick win (traffic signals, shared space or active travel bridge)
Long term (10 years+ based on growth triggers) vehicle bridge duplication
Active travel bridge timed with Active Travel Network Arthurs Point to Queenstown route
Immediate full bridge duplication

Alignment
New bridge to realign main road with Atley Road
Smoothed alignment to south of existing bridge
Active travel bridge at same height as Edith Cavell Bridge
Active travel bridge lower than Edith Cavell Bridge
Active travel bridge linking to existing viewing platform on north-east side of Edith Cavell bridge
New bridge parallel to Edith Cavell Bridge on south side
Active travel bridge from Oxenbridge Tunnel Road to Shotover Jet base
Active travel bridge from Oxenbridge Tunnel Track to Morningstar Track
New bridge at McChesney Road bus stop
New bridge at Watties Track
New active travel bridge Watties Track to Littles Road
Approaches
Separated shared path
Minor road safety improvements on approaches
Extended shared space/greenway
Pedestrian crossing to access Shotover Jet area
Underpass to access Shotover Jet area

Appropriate treatments for bridge approaches (i.e. supporting measures for the crossing solution on Gorge Road and Arthurs Point Road), as well as staging of interventions, are dependent on the preferred option, and would be developed as part of design of the preferred option. They were therefore not considered as standalone options.

5.1.2 Alternatives

Alternatives identified and deemed to be infeasible or outside of the project scope at the longlist stage include:

- Restricting development to minimise growth – outside the scope of the project and Queenstown-Arrowtown is already one of the lowest growth corridors in the district
- Providing a viewing platform in centre of existing bridge – provides a safe area for visitors stopping in middle of bridge but considered to encourage unsafe behaviour
- Active mode bridge alignment to Littles Road – outside the project extents and would not serve the target catchment (would require up to 60 minutes additional walk time compared to existing bridge)
- Alternative road via Tuckers Beach and Watties Track – outside the scope of the project; investigated previously for QLDC and found to have low technical feasibility and be cost-prohibitive

5.1.3 Intervention Hierarchy

Waka Kotahi's Intervention Hierarchy from the Investment Decision Making Framework, shown in Figure 9, was used to inform discussions on appropriate interventions.

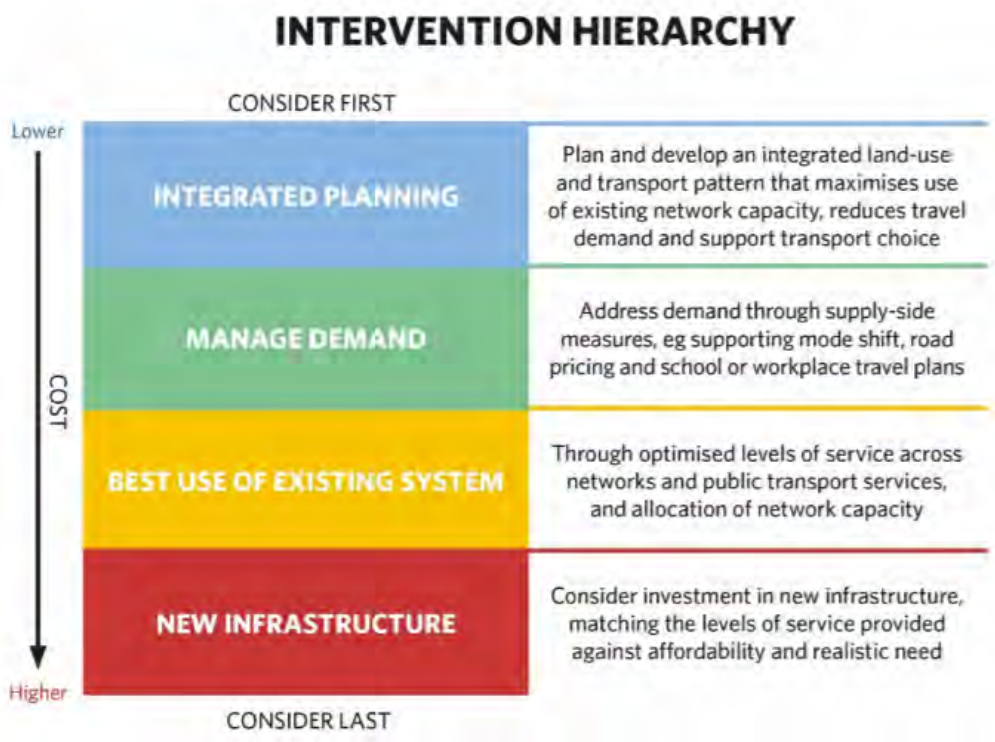


Figure 9 Waka Kotahi Intervention Hierarchy

Pending information on remaining longevity of the bridge from the Existing Asset Condition report (refer to Section 1.4 Existing Asset Condition), the project team sought to extend use of the bridge's capacity, or 'sweat the asset', and promote walking and cycling in order to maximise use of existing network capacity. At just over 5km, the Arthurs Point to Queenstown route is a relatively 'cyclable' commute, presenting an opportunity to promote daily cycling as an alternative to private car use.

Other soft interventions, such as Travel Demand Management and Travel Plans, were considered to be of limited value without complimentary improvements to travel choice and should be part of a wider strategy than the Arthurs Point Crossing project. Alternatives such as limiting development along the corridor were considered but omitted due to already low anticipated growth rates, while improvements to the Arthurs Point bus route are being considered by ORC and other business cases.

Interim traffic control measures such as signals were considered under *best use of existing system* but were found to only partially achieve Investment Objectives. Signals would also become a sunk cost upon implementation of a new structure (which was found to be needed within 20 years from a structural perspective and necessary to achieve all Investment Objectives).

5.1.4 Sieve of Longlist Options

At the longlist assessment stage, a simple 3-point traffic light scoring system (high, medium and low) was used to sieve out ineffective options against the Investment Objectives (red indicates low alignment, not fatal flaw). To enable simpler assessment, options were initially grouped into road and active mode categories:

A. Active modes included with new structure

B. Separate active modes structure

C. Convert existing bridge to active modes only

D. Attach active mode connection to existing bridge

E. Shared space on existing bridge

1. New 2-lane bridge

2. New single-lane bridge, existing bridge becomes opposite direction

3. Upgrade existing bridge with wider deck

4. Install traffic lights on existing bridge

5. Retain existing bridge as is

The initial longlist assessment was carried out by the project team. Options were assessed as ultimate or long-term solutions but some constituted good short-term solutions; staging of the preferred option would be considered later. Results (Figure 10) were shared and agreed at Workshop 2: Longlist to Shortlist.

	Provides a safer, more accessible route for active modes	Ensures travel time reliability is improved for general traffic	Improves overall network and route resilience	Enables land use development and growth
1A				
1B				
1C			Existing bridge at risk from EQ	
2A			Existing bridge at risk from EQ	
2B				
2D				
2E	No improvement on existing for active mode safety, likely infeasible			
3B			Existing bridge at risk from EQ	Difficulty adding weight to existing structure
3D				
3E	No improvement on existing for active mode safety			
4B		Traffic reliability marginally better, *not as good as new bridge*	Existing bridge at risk from EQ and no additional vehicle resilience	Difficulty adding weight to existing structure, could build active mode/services bridge
4D		*Traffic reliability marginally better, not as good as new bridge*		Difficulty adding weight to existing structure
4E	Improvement for active mode safety if separate phase (questionable feasibility)	Traffic reliability likely to worsen, separate signal phase adds to delay		
5B		Traffic reliability likely to worsen as traffic volumes grow	Existing bridge at risk from EQ and no additional vehicle resilience	Difficulty adding weight to existing structure, could build active mode/services bridge
5D		Traffic reliability likely to worsen as traffic volumes grow		Difficulty adding weight to existing structure
5E	No improvement on existing for active mode safety	Traffic reliability likely to worsen as traffic volumes grow		

Figure 10 Initial Longlist Sieve

Key outcomes of the assessment were:

- Options comprising a new road structure were the only interventions assessed to fully satisfy all Investment Objectives.
- A new road structure would be required to satisfy Investment Objective 3 (resilience), primarily because resilience of the existing bridge remains low even with seismic strengthening (refer to Asset Condition Report in Appendix C3). It was agreed that a new road structure would be required to meet all Investment Objectives. **Options that utilised only the existing bridge were therefore omitted at this stage**.
- Constructing a new one-way road bridge was considered a cost-effective (in terms of capex) means of achieving the Investment Objectives. However, as above, continued use of the existing bridge in the opposite direction would not provide resilience benefits. It was agreed that a new one-way structure could be designed with a sufficient cross section to allow two-directional use if needed, **thus a new one-way structure option was taken forward for further assessment**.
- **Installing traffic signals to control traffic on the bridge was omitted as a long-term option** as it would not fully achieve three of the four Investment Objectives. However, it was identified as an appropriate staging option for consideration later. Providing a cyclist and pedestrian phase on the bridge was found to be illegal under current NZ road rules (opposing green and red phases cannot be directed at the same limit line, regardless of whether they include a cyclist or pedestrian symbol)
- It was agreed that a shared space on the existing bridge would be inappropriate given the movement function of the section of corridor and would be difficult to implement safely. Tying in with active mode infrastructure at either end of the existing bridge would also be challenging, particularly on the constrained Gorge Road side.
- Utilising the existing structure for use by active modes was considered feasible, but additional treatments would be required, particularly on the Gorge Road approach. This option would be explored as part of a package later in option development.

5.2 Shortlist

5.2.1 Longlist to Shortlist

An initial MCA was carried out separately for structure (described in Figure 12) and alignment options (shown later in Figure 13) to ensure the right conceptual solution was selected without being prejudiced by perceived issues with alignments, and vice versa (constraints such as cost and property should not be considered fatal flaws until proven so).

This approach also enabled assessment to be carried out without the need to test an unmanageable number of option permutations and combinations (3 potential road alignments, 4 potential active mode alignments multiplied by 6 road cross section options and 2 active mode cross section options).

The MCA assessed options against Implementability Criteria using the 7-point scoring system shown in Figure 11. Scores against Investment Objectives were brought through from the sieve described in Section 5.1.4 Sieve of Longlist Options, retaining the 3-point scoring system used there. Scores were developed by the project team and shared at Shortlist Refinement Session 1 on 9 July 2020. Results and justification from the MCA are presented in Figure 12, while cross sections and alignments are presented later in Figure 13.

All options were assumed to include consistent intersection treatments at the Shotover Jet complex and McMillan/Gorge Road.

Magnitude	Definition	Score
Large positive (+ve)	Strongly achieves Investment Objective; Positive outcome with minimal challenges for Implementability Criteria	3
Moderate positive (+ve)	Moderately achieves Investment Objective; Positive outcome with some challenges for Implementability Criteria	2
Slight positive (+ve)	Slightly achieves Investment Objective; Positive outcome with moderate challenges for Implementability Criteria	1
Neutral	Neutral contribution to Investment Objective; neutral outcome for Implementability Criteria.	0
Slight negative (-ve)	Slightly detracts from Investment Objective; Potential for negative outcome with slight challenges for Implementability Criteria.	-1
Moderate negative (-ve)	Moderately detracts from Investment Objective; Potential for negative outcome with moderate challenges for Implementability Criteria.	-2
Large negative (-ve)	Strongly detracts from Investment Objective; Potential for negative outcome and major challenges for Implementability Criteria.	-3

Figure 11 MCA Score Definitions

Concepts	Stage	Criteria	Do Nothing	Existing Bridge		New bridge						
				Traffic signals & reallocate space for footpath	Traffic signals & clip on active mode bridge	New active mode only bridge	New active mode bridge with services	New 2 lane bridge with active modes	New 2 lane bridge with active modes on separate structure	New 2 lane bridge, active modes on existing bridge	New 1 lane bridge with active modes, existing bridge becomes opposite direction	New 1 lane bridge, existing bridge becomes opposite direction, active modes on separate structure	New 1 lane bridge, existing bridge becomes opposite direction, active modes clipped on existing bridge
Provides a safer, more accessible route for active modes	67%	40%	0	1	2	3	3	3	3	3	3	3	2
Ensures travel time reliability is improved for general traffic	67%	30%	0	1	1	0	0	3	3	3	3	3	3
Improves overall network and route resilience	67%	15%	0	0	0	1	1	3	3	3	2	2	2
Enables land use development and growth	67%	15%	0	0	0	2	3	3	3	3	3	3	3
Consentability	33%	30%	N/A	3	1	2	1	-1	-1	0	-1	-2	-1
Technical	33%	10%		2	2	2	1	0	-1	0	-2	-3	-2
Safety in Design	33%	20%		0	1	3	3	2	2	2	2	2	2
Operational/ Maintenance	33%	10%		1	1	3	2	1	1	0	0	-2	-1
Financial	33%	10%		3	3	2	1	-3	-2	-2	-1	-1	-1
Stakeholder/ Public	33%	20%		-1	-2	1	0	2	2	3	1	0	1
				0.90	0.97	1.80	1.63	2.10	2.10	2.27	1.90	1.63	1.60
				Neither contribute to general traffic IOs, but are a cost-effective way of addressing active mode issues in the short term. Clipping on to existing bridge is allowed, but expected to be opposed by community and heritage due to visual impact. Space available for footpath unlikely to be palatable from road safety perspective		Neither contribute to general traffic IOs, but provide opportunity for more appropriate active mode route. Adding services benefits growth but more prominent structure may be opposed by community		Best achieves all IOs, but expensive and visually dominant structure in difficult terrain	Achieves all IOs, but requires construction of separate structures and leaves 3 bridges across the gorge with higher visual impacts and maintenance	Slightly cheaper than full 2 lane + active modes and better integrates heritage of old bridge	Lower resilience score due to old bridge, could be designed to accommodate 2-way after EQ. Cheaper, but difficult to construct/manage alongside old bridge	Lower resilience score due to old bridge. Cheaper, but difficult to construct/manage alongside old bridge, requires additional construction and maintenance and higher visual impact	Lower resilience score due to old bridge, could be designed to accommodate 2-way after EQ. Cheaper, but difficult to construct/manage alongside old bridge

Alignments	Stage	Criteria	1	2	3	4	5	6	7
Provides a safer, more accessible route for active modes	67%	40%	-2	-1	2	2	2	2	1
Ensures travel time reliability is improved for general traffic	67%	30%	0	0	2	2	2	0	0
Improves overall network and route resilience	67%	15%	0	0	0	0	0	0	0
Enables land use development and growth	67%	15%	0	0	0	0	0	0	0
Consentability	33%	30%	1	1	1	-2	-2	1	1
Technical	33%	10%	-1	-1	-1	1	-1	1	0
Safety in Design	33%	20%	0	0	-1	0	-1	0	0
Operational/ Maintenance	33%	10%	-1	-1	1	1	1	0	0
Financial	33%	10%	0	0	1	-1	-2	0	0
Stakeholder/ Public	33%	20%	-2	-2	0	0	-1	0	0
			-0.63	-0.37	1.00	0.77	0.53	0.67	0.37
			Long way off desire lines, more recreational than origin-destination. Very long spans in currently unobstructed scenery. Difficult access to maintain and poor ground conditions		Challenging construction site and may have visual impacts on existing bridge, but short span, minimal property impacts and simple to tie in with existing	In between 3 and 5, removes further corners from alignment with shorter span, but requires upgrade of Ately Road - property impacts	Straightens alignment, removing section with crash history but long span and visually dominant structure, expensive and impacts property	On desire line for Arthurs Point north - Queenstown, relatively minor impacts, cost and complexity	On desire line for Arthurs Point north - Queenstown, relatively minor impacts, cost and complexity, slight detour from alignment 6

Figure 12 Longlist to Shortlist MCA (top: Structures; bottom: Alignments)

Key outcomes of the MCA were:

- Variants of two-lane road bridge option scored highest as they best contributed to IOs with lesser implementability impacts.
- **One-lane bridge options were omitted** due to scoring lower than all two-lane options, and some scoring lower than active mode-only options. Despite scoring well on capital cost, a new one-lane bridge would: be technically difficult to implement alongside a heritage-listed structure, have high ongoing maintenance costs for the old bridge and not resolve resilience issues due to the age and structural design of the original bridge (providing sufficient width for two-directional use in emergencies was considered significantly less cost-effective than providing a full two lane structure). The visual impacts of a smaller structure were considered only negligibly better than those of a two-lane structure.
- **Active mode alignments 1, 2 and 7 were omitted** due to low alignment with investment objectives and implementation impacts, primarily by being away from known desire lines.
- **Active mode only options were retained** and taken forward for further assessment. Low cost options for the existing bridge were also retained as potential staging solutions.

The only change made to scoring during the workshop was increasing resilience scores for options with three structures (the existing bridge, a new road bridge and new active mode bridge) to +3 as these were considered inherently more resilient.

At this stage, stakeholders agreed that the Investment Objectives should be revisited to make them SMART in order to better differentiate between options (refer to updated Investment Objectives in Section 3.1 Investment Objectives). This would enable consideration of staging and time-bound benefit realisation during option assessment (such as increasing active mode share in the short-term).

5.2.2 Shortlist Refinement

A more detailed MCA was prepared by the project team to assess combinations of remaining structure and alignment options as per the diagrams in Figure 13. Environmental and Social Responsibility Screens were carried out on each of the options and are provided in Appendix C8. Results of the MCA were presented at the Shortlist Refinement Session 2 on 22 July 2020.

Options were scored against Implementability Criteria (Table 10) and the updated Investment Objectives (agreed with project partners at the start of the session). Updates to the Investment Objectives had a moderate impact on determination of the shortlist, as achieving active mode outcomes in the short term became an explicit objective. A description of each combined option, results and justifications from the MCA are presented in Figure 14.

Table 10 Implementability Criteria Definitions

CRITERIA	DESCRIPTION
Consentability	*What is the level of complexity anticipated in gaining statutory approvals and how significant could the costs of mitigation be in order to gain statutory approvals? Is a new designation or alteration to existing designation required in an urban area? Could the option include activities that are prohibited or activities to avoid in policies in a District or Regional Plan?*
Technical	*From a technical standpoint, how straightforward will it be to implement the option including likely social, environmental and cultural mitigation associated with the option? Are any novel/untried/leading edge technologies involved? Are there any risks involved in developing or implementing the option?*
Safety in Design	*Are there any significant hazards associated with the option which may pose a health and safety risk in the design, build and final product? Can safety be developed into the design process to control it?*
Operational/ Maintenance	*Are there any factors which might adversely affect the ability to operate or maintain the option over its projected life without major additional costs?*
Financial	*Can the capital costs of the option be funded and under what methods of funding? Are there potential cash flow risks which affect the desired delivery programme?* *Can the option meet ongoing operating costs? If operating subsidies are required, how will they be funded?*
Stakeholder/ Customers	*Has the option been made public? If so, how acceptable is the option? Are there real or anticipated objections from particular sections of the community or from particular stakeholders?*

What we are considering?

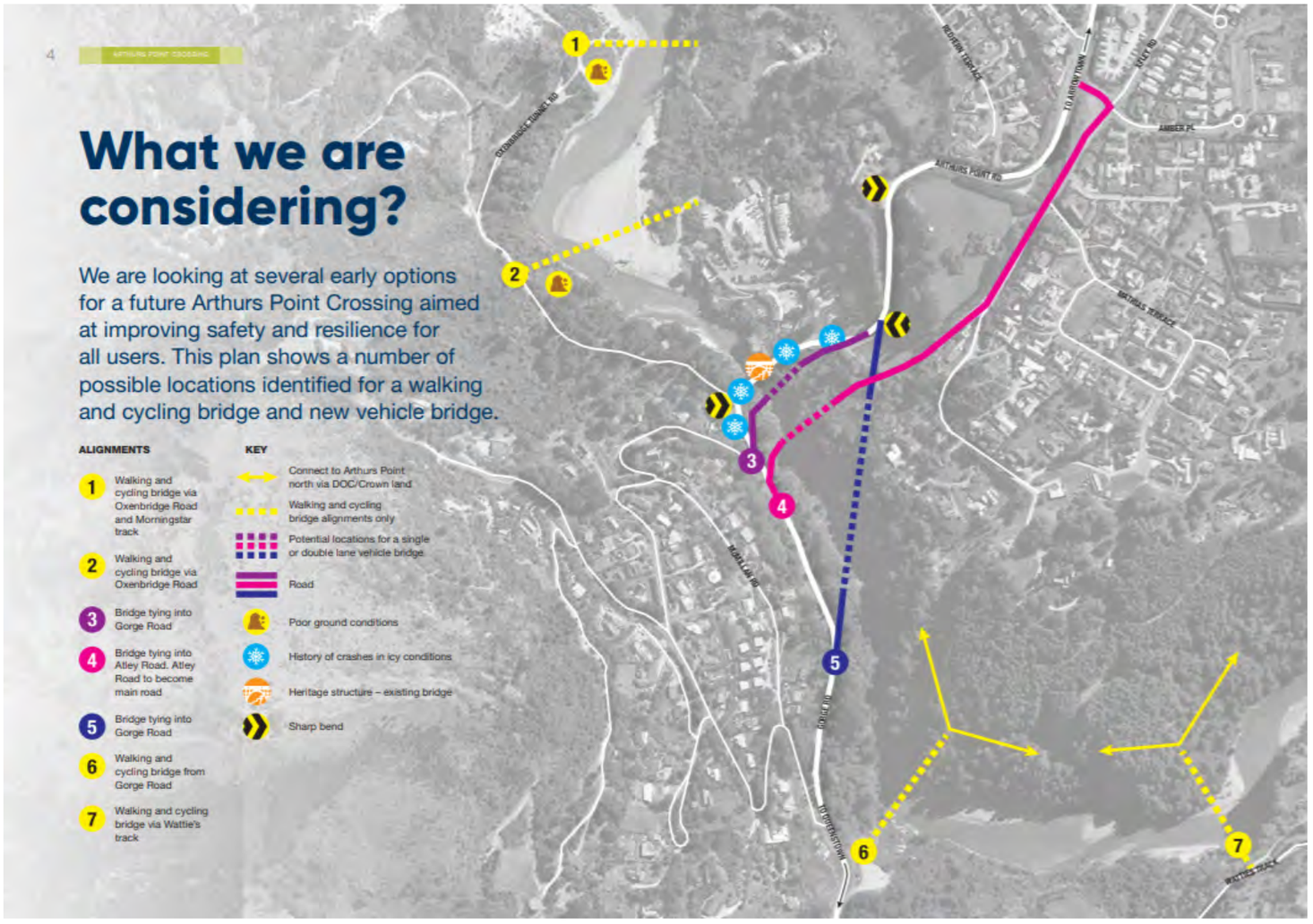
We are looking at several early options for a future Arthurs Point Crossing aimed at improving safety and resilience for all users. This plan shows a number of possible locations identified for a walking and cycling bridge and new vehicle bridge.

ALIGNMENTS

1. Walking and cycling bridge via Oxenbridge Road and Morningstar track
2. Walking and cycling bridge via Oxenbridge Road
3. Bridge tying into Gorge Road
4. Bridge tying into Atley Road. Atley Road to become main road
5. Bridge tying into Gorge Road
6. Walking and cycling bridge from Gorge Road
7. Walking and cycling bridge via Wattie's track

KEY

- Connect to Arthurs Point north via DOC/Crown land
- Walking and cycling bridge alignments only
- Potential locations for a single or double lane vehicle bridge
- Road
- Poor ground conditions
- History of crashes in icy conditions
- Heritage structure – existing bridge
- Sharp bend



A	A	B	B	C	C	D	D	D	E	F	F
New single-lane bridge, existing bridge becomes opposite direction		New single-lane bridge, existing bridge becomes opposite direction		New 2-lane bridge		New single-lane bridge, existing bridge becomes opposite direction			New 2-lane bridge	New 2-lane bridge	
Clip on to existing bridge		Included on new structure		Convert existing bridge		New separate structure			Included on new structure	New separate structure	

Figure 13 Shortlist Options from Community Engagement Booklet

Concepts	IOs	Implementability	Do Min	Existing Bridge		New road bridge									New active modes bridge only	
						Alignment 3			Alignment 4			Alignment 5			Alignment 3	Alignment 6
				0A	0B	3F	3C	3E	4F	4C	4E	5F	5C	5E		6
			Maintain bridge to existing level of service	Traffic signals & reallocate space for footpath	Traffic signals & clip on active mode bridge	New 2-lane road bridge at alignment 3, quick win active modes bridge at alignment 6, existing bridge becomes recreational active modes bridge	New 2-lane road bridge at alignment 3, existing bridge becomes active modes bridge	New 2-lane road and active modes bridge at alignment 3, existing bridge becomes recreational active modes bridge	New 2-lane road bridge at alignment 4, quick win active modes bridge at alignment 6, existing bridge becomes recreational active modes bridge	New 2-lane road bridge at alignment 4, existing bridge becomes active modes bridge	New 2-lane road and active modes bridge at alignment 4, existing bridge becomes recreational active modes bridge	New 2-lane road bridge at alignment 5, quick win active modes bridge at alignment 6, existing bridge becomes recreational active modes bridge	New 2-lane road bridge at alignment 5, existing bridge becomes active modes bridge	New 2-lane road and active modes bridge at alignment 5, existing bridge becomes recreational active modes bridge	Active modes bridge only (assumed quick implementation); existing bridge remains road bridge	Active modes bridge only (assumed quick implementation); existing bridge remains road bridge
Provides a safer, more accessible route for all confidence levels of pedestrian and cyclist between existing routes (and planned upgrades) in the short term	67%	40%	0	1	1	3	2	2	3	2	2	3	2	2	3	3
				Provide quick win partial protection at crossing itself but requires substantial upgrade on approach		Only 3F meets objective of early implementation of active modes bridge. 3C and 3E require potentially challenging work on Gorge Rd approach to provide adequate safety			Only 4F meets objective of early implementation of active modes bridge. 4C and 4E require potentially challenging work on Gorge Rd approach to provide adequate safety			Avoids technically difficult Gorge Road approach but unlikely to meet objective of early implementation				
Ensures travel time reliability is maintained for growing vehicle traffic volumes	67%	35%	0	1	1	3	3	3	3	3	3	3	3	3	-2	-2
				Traffic signals provide some additional capacity											Doesn't address traffic growth, which will lead to less reliable travel times	
Improves overall network and route resilience to seismic events and closures of SH6A in the long term	67%	15%	0	-2	-2	3	1	2	3	1	2	3	1	2	0	0
				Existing bridge becomes more vulnerable with time		Additional structure in 3F provides extra resilience, even if active modes only. 3C relies on existing bridge for active modes			Additional structure in 4F provides extra resilience, even if active modes only. 4C relies on existing bridge for active modes			5C relies on existing bridge for active modes			Provides no resilience for vehicles	
Enables future land use development and growth by providing additional traffic and	67%	10%	0	0	0	3	3	3	3	3	3	3	3	3	3	3
Consentability	33%	20%		3	-1	1	1	1	-2	-2	-2	-1	-1	-1	1	2
				Minor superficial adjustments to provide traffic control. Clip-on unlikely to be supported by Heritage		Benefits of proposal largely outweigh impacts, incorporates heritage structure in solution			Likely to be issues converting Atley Road into a Primary Collector (local roads and community resistance)			Long span, dominating structure difficult to justify when less impact options available			Within view of heritage structure	Ptovides benefits with minimal impact. Structure out of Edith Cavell viewshaft
Technical	33%	10%		2	1	1	0	0	-1	-2	-2	-2	-2	-2	2	2
				Relatively straightforward to implement quickly		3F would avoid the need to upgrade the challenging Gorge Road approach. Constructing across gorge challenging but alignment has shortest span.			4 has topo challenges and requires Atley Rd upgrade. 4F would avoid the need to upgrade the challenging Gorge Road approach. Difficulty maintaining access to local roads			Avoids challenges on Gorge Rd approach and Atley Rd but has topo issues and very long bridge span				Easy to implement quickly
Safety in Design	33%	10%		1	1	0	0	0	-1	-1	-1	0	0	0	1	1
				Less risk than building road bridge in gorge												Less risk during construction and maintenance
Operational/ Maintenance	33%	10%		-3	-3	0	-1	0	0	-1	0	-1	-2	-1	-2	-2
			N/A	Requires ongoing maintenance of existing bridge to remain operational for traffic		Relying on existing bridge for active modes route likely to involve higher maintenance cost			Relying on existing bridge for active modes route likely to involve higher maintenance cost			Substantially longer bridge span requires more maintenance, relying on existing bridge for active modes route likely to involve higher maintenance cost				Requires ongoing maintenance of existing bridge to remain operational for traffic
Financial	33%	30%		3	3	0	1	0	-1	0	-1	-3	-2	-3	3	3
				Same order of magnitude as new active mode bridge		Quick win bridge in 3F likely to be low cost low risk but requires two separate construction periods. 3E is bigger structure. 3C is smallest structure and only one construction period			Quick win bridge in 4F likely to be low cost low risk but requires two separate construction periods. 4E is more substantial structure. 4C is smallest structure and only one construction period. Option 4 also includes Atley Rd upgrade			Quick win bridge in 5F likely to be low cost low risk but requires two separate construction periods. 5E is more substantial structure. 5C is smallest structure and only one construction period. Option 5 has costly long bridge span				Significantly cheaper than road bridge options
Stakeholder/ Public	33%	20%		-2	-2	3	1	1	-2	-2	-2	2	0	0	1	2
				Known community resistance to signals. Doesn't satisfy stakeholder objectives		3F includes quick win for active modes, which is community's main concern, and integrates use of heritage structure. 3C and 3E need costly upgrade of Gorge Road approach and new crossing to satisfy community active mode needs			Strong community resistance to turning Atley Road into main road			As for 3 but some community resistance expected to large span bridge in gorge. 5C amd 5E remove unsafe section on Gorge Road approach but may be years off implementation			Visual impact on heritage structure, doesn't satisfy all stakeholder objectives	Supported by community but doesn't satisfy all stakeholder objectives
				0.67	0.37	2.30	1.73	1.77	1.57	1.13	1.17	1.67	1.13	1.17	1.00	1.13

Figure 14 Shortlist Refinement MCA

Key outcomes from the assessment were:

- **The three sub-options for a road bridge at alignment 3 outscored all other options. These were therefore agreed to be taken forward for further development and assessment to determine the preferred option.** Road bridges at alignments 4 and 5, while providing travel time savings, would be considerably more costly, technically difficult and visually intrusive due to their larger footprints and longer bridge spans. Additionally, travel time savings for general traffic do not align with the Investment Objectives.
- **To fully achieve Investment Objective 1 (i.e. improve active mode access in the *short term*), it was determined that a separate active modes bridge at alignment 6 (option F) would be the only feasible option**. Heritage NZ stated that they would not endorse any attachments to the existing bridge (ruling out clip-on or sling-under options) or any temporary adjacent structures – "the new structure should be as far away from the existing bridge as practicable from a technical perspective" (refer to Heritage Significance Assessment in Appendix C6). All other options to provide a crossing for active modes need a new road bridge to be in place (to either incorporate into the new structure or enable the Edith Cavell bridge to be converted).
- It was agreed that the preferred option should incorporate active modes into the existing Edith Cavell Bridge once the new road bridge is built, regardless of the option selected.

Changes made during the session were:

- Consentability and Safety in Design scores were dropped a point for all alignment 4 options due to concerns around converting the quiet road (Atley Road) currently used by vulnerable users to a main road
- Feedback gathered just prior to the session indicated strong community opposition to repurposing Atley Road (Alignment 4), which led to stakeholder/public scoring lower. Option 4F, the sub-option previously assumed to be supported by the community, dropped the most substantially

As a result of tweaks made to scores for Alignment 4 options, option 4F dropped out of the top 3 (as shown in the final version in Figure 14). The group agreed that Alignment 3 was the most appropriate location for a road bridge, achieving investment objectives with the least implementability impacts. It was acknowledged that geometrics and bridge design would find an optimum route for the preferred option. Options pertaining to active modes were the hardest to differentiate, requiring further detailed analysis and investigation to determine the best option.

5.3 Preferred Option

Given the selection of a two-way road at Alignment 3 as the preferred option for the road component at the shortlist stage, the objective of the preferred option workshop (Workshop 3: Shortlist to Preferred) was essentially to determine the best active travel solution. Options are shown graphically in Figure 15:

- Green – Preferred road alignment
- Orange – Separate early implementation active modes route
- Blue – Existing Edith Cavell Bridge converted to active modes (once new road bridge is built)
- Pink – Active modes are incorporated into new road bridge

Note the blue option would include construction of the magenta section south of the new road alignment if selected. Options on both sides of the river would require new trails and engineering structures due to the challenging terrain. Crossing treatments were assumed to be consistent at the southern end, while the blue option was assumed to integrate un underpass in the northern abutment of the new road bridge (green line) to tie in with Atley Road.

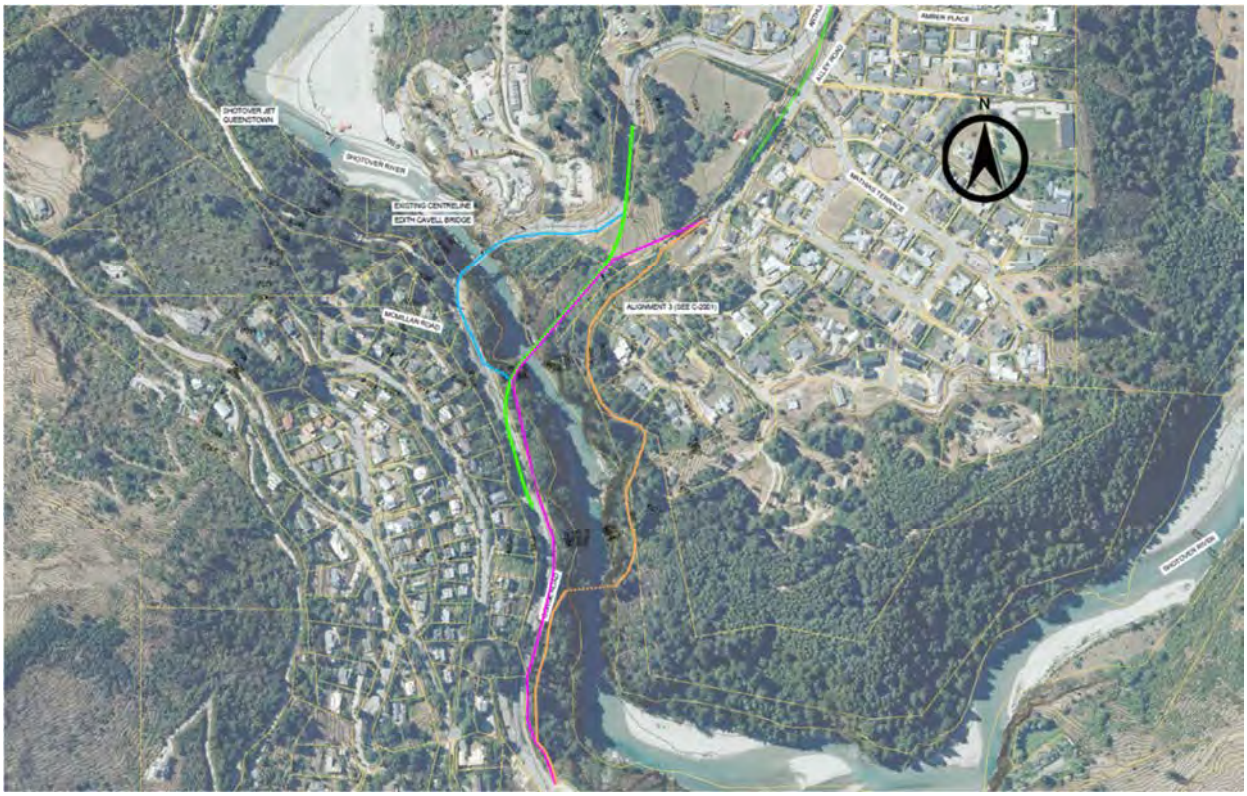


Figure 15 Shortlist Option Alignments

A final MCA was prepared by the project team and shared with project partners on 21 August 2020, incorporating scores from the assessments against Investment Objectives and Implementability Criteria, and adding Assessment of Effects Criteria (Table 11). A Preliminary Carbon Assessment was circulated with the team prior to the workshop and is presented in Appendix C13. Results and justifications from the MCA are presented in Figure 16.

Table 11 Assessment of Effects Criteria

CRITERIA	DESCRIPTION
Safety	*How will the option enhance safety for different types of transport users? Will it involve gainers and losers in terms of safety? Are there impacts on personal safety / security? What will be the impact on fatal and serious incidents'?*
Economy	*How will the option affect traffic volumes, journey times, or the reliability of travel times? Will there be gainers and losers, and if so, what are the impacts on users and operators of different transport modes and in different areas? How might the option help attract new jobs, help existing businesses?*
Integration	*How will the option promote or enhance transport land use integration? Will services be able to function in a more complementary manner? How does the option fit with wider government policy including national transport targets?*
Social	*Does the ESR screen indicate the option could affect accessibility for transport users and for others, including access to jobs, communities, shops, services and other facilities? Does the option support other modes of transport? How does it impact community cohesion? What impacts on communities does the screen indicate? (I.e. construction impacts, access, severance, amenity)? Will access to and enjoyment of community areas be enhanced or reduced?*
Natural Environment	*What type of impacts on the natural environment did the ESR screen (Natural Environment) indicate?*
Human Health	*Does the ESR screen indicate that the option could result in significant risk to human health related to noise, air quality or contaminated land? Will the option reduce noise and air quality effects either through redirecting traffic flow through areas with fewer sensitive receivers or by improving traffic flow or reducing road gradients?*
Cultural	*Does the ESR screen indicate the option could impact on cultural and iwi values? Are there any recorded scheduled or listed sites/areas of historical, cultural or archaeological importance in the area?*
Property	*How does the option impact on property? Will additional property purchases be required? Are there property risks to delivery and can they be effectively managed. Does the option affect other infrastructure providers - will agreements need to be entered into with service providers?*

Concepts	Stage	Criteria	Vehicles Active Modes New 2-lane road bridge at alignment 3, quick win active modes bridge at alignment 6, existing bridge becomes recreational active modes bridge	Two-lane bridge at Alignment 3 Existing bridge New 2-lane road bridge at alignment 3, existing bridge becomes active modes bridge	Two-lane bridge at Alignment 3 New structure (and existing bridge) New 2-lane road and active modes bridge at alignment 3, existing bridge becomes recreational active modes bridge
Safety How will the option enhance safety for different types of transport users? Will it involve gainers and losers in terms of safety? Are there impacts on personal safety / security? What will be the impact on fatal and serious incidents'?	40%	17%	2	1	1
			Alignment 6 active modes route scores higher due to being fully separated from traffic, concerns with CPTED can be mitigated with low level/smart lighting. Other options require road crossings		
Natural Environment What type of impacts on the natural environment did the ESR screen (Natural Environment) indicate?	40%	15%	0	1	-1
			New road-only structure + Edith Cavell option has smallest impacts due to fewer and smaller structures. Alignment 6 is an additional structure but not visually intrustive. Two lanes + active modes would be most visually intrustive		
Integration How will the option promote or enhance transport landuse integration? Will services be able to function in a more complementary manner? How does the option fit with wider government policy including national transport targets?	40%	15%	1	0	0
			Alignment 6 comes online sooner		
Human Health Does the ESR screen indicate that the option could result in significant risk to human health related to noise, air quality or contaminated land? Will the option reduce noise and air quality effects either through redirecting traffic flow through areas with fewer sensitive receivers or by improving traffic flow or reducing road gradients?	40%	15%	0	0	0
			No difference between active mode options		
Social Does the ESR screen indicate the option could affect accessibility for transport users and for others, including access to jobs, communities, shops, services and other facilities? Does the option support other modes of transport? How does it impact community cohesion? What impacts on communities does the screen indicate? (Ie construction impacts, access, severance, amenity)? Will access to and enjoyment of community areas be enhanced or reduced?	40%	15%	2	0	1
			Route via Edith Cavell is less accesible, circuitous, has steeper grades and would require 2 road crossings. Alignment 6 best with desire lines, comes online sooner		
Economy How will the option affect traffic volumes, journey times, or the reliability of travel times? Will there be gainers and losers, and if so, what are the impacts on users and operators of different transport modes and in different areas? How might the option help attract new jobs, help existing businesses?	40%	13%	2	2	2
			No difference between active mode options but overall positive effect		
Cultural Does the ESR screen indicate the option could impact on cultural and iwi values? Are there any recorded scheduled or listed sites/areas of historical, cultural or archaeological importance in the area?	40%	5%	0	1	0
			Edith Cavell option best integrates heritage structure with least visual and construction impact		
Property How does the option impact on property? Will additional property purchases be required? Are there property risks to delivery and can they be effectively managed. Does the option affect other infrastructure providers - will agreements need to be entered into with service providers?	40%	5%	-1	0	0
			Alignment 6 requires agreements with property owners, though low risk. Other options are permitted by DOC's CMS		
Revisited Implementability Criteria					
Technical From a technical standpoint, how straightforward will it be to implement the option including likely social, environmental and cultural mitigation associated with the option? Are any novel / untried / leading edge technologies involved? Are there any risks involved in developing or implementing the option?	20%	10%	-2	-1	0
			Additional width for active modes on new road structure is least challenging; other options require additional structures, adding to complexity		
Financial Can the capital costs of the option be funded and under what methods of funding? Are there potential cash flow risks which affect the desired delivery programme? Can the option meet its ongoing operating costs? If operating subsidies are required, how will these be funded?	20%	30%	-1	-1	-1
			Additional width for active modes on new road structure adds cost commensurate to additional structures costs for other options		
			1.66	1.15	1.17

Figure 16 Preferred Option MCA

Overall the option with a separate active modes bridge at alignment 6 was preferred due to:

- Providing the only feasible option for active modes in the interim of a road bridge being built (dual operation of vehicular and active mode signals from the same stop line not currently legal in NZ)
- Providing a separated active modes route meets the Investment Objective of providing facilities for all user types, particularly when combined with a converted Edith Cavell bridge (which will cater to more recreational cyclists)
- Providing agility in terms of funding and staging, noting the currently constrained funding environment (funding partners indicated a road bridge would be unaffordable in the next 2 funding periods)
- Presenting a strong investment story (addressing the community's immediate active modes needs while optimising existing assets by enabling delayed construction of the road bridge)
- Potential to integrate with the ongoing Active Travel project (Arthurs Point to Queenstown)

In the MCA, the preferred option met Investment Objectives and assessment criteria to the same extent as the other options, with similar or smaller impacts. There are some property risks associated with the trail traversing sections at the back of Atley Road properties, which is addressed in the Property Strategy. This is reflected in scores for the MCA.

During the workshop, the following changes to scores were made:

- The separate active modes bridge option score for Integration was increased from 0 to 1 to better account for the active mode component coming online sooner than other options
- The separate active modes bridge option score for Social was increased from 1 to 2 as it provides a better route on desire lines and would come online sooner than other options
- It was agreed that the Technical and Financial criteria from the previous stage should be revisited due to updated information being available.
    - The separate active modes bridge option score for Technical was reduced from -1 to -2 to better account for the complexity associated with building a new trail through difficult topography
    - The option incorporating active modes into a new road bridge score for Financial was reduced from 0 to -1 to better account for the additional cross section required to accommodate a shared path

5.3.1 Assessment Summary

Table 12 summarises MCA scores and ranking and shows the relative cost between options. The new 2-lane road bridge at alignment 3, quick win active modes bridge at alignment 6, existing bridge becomes recreational active modes bridge option scored higher than the next highest scoring option by 16%. The costs of all options were within 10% of each other. The first option was therefore taken forward as the preferred.

Table 12 MCA Ranking

OPTION	MCA SCORE (OUT OF TOTAL POSSIBLE)	MCA RANK	RELATIVE COST ($M)
1. New 2-lane road bridge at alignment 3, quick win active modes bridge at alignment 6, existing bridge becomes recreational active modes bridge	55%	1	1
2. New 2-lane road bridge at alignment 3, existing bridge becomes active modes bridge	38%	3	0.97
3. New 2-lane road and active modes bridge at alignment 3, existing bridge becomes recreational active modes bridge	39%	2	1.09

5.4 Option Development

5.4.1 Road Bridge

The preferred road alignment (green in Figure 17) was originally designed to keep as close to the existing alignment as possible while meeting design standards for a 60km/h operating speed. This was in order to minimise potential property acquisition (purple) and maximise use of existing road reserve (red) and Crown land (uncoloured). Accounting for cut and fill, the alignment would still require partial acquisition of the two properties shown in purple.

The alignment would also require an embankment up to 10m in height over 60m on the eastern bank (true left), or an equivalent bridge land span, which may be more expensive. Similarly, on the western bank (true right), 40m of 5m fill or equivalent bridge land span may be needed in challenging terrain to land a bridge. This design would result in a 9.5% slope over 80m on the approach to the bridge from the north.

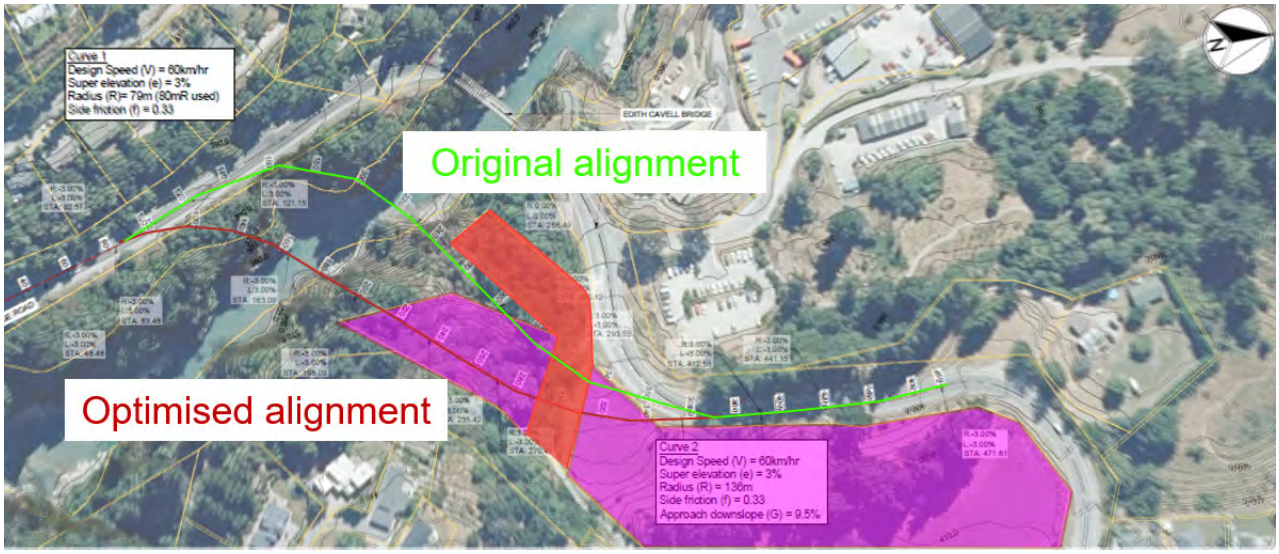


Figure 17 Road Alignment Optimisation

As a result of the shortcomings listed above, the alignment was optimised and shifted approximately 20m downstream (red line alignment) with the following advantages:

- The new alignment is out of the gully affecting the original alignment, all but removing the need for embankments or bridge land spans except some minor fill around the true left abutment. In addition to cost and complexity benefits, this also aligns with sustainability and carbon emission reduction objectives for the project. Refer to Appendix A1 for long sections.
- It also allows better screening from residential properties at the bottom of Atley Road by being tighter to the hill on which they sit and separated by trees and reduces impacts on the existing heritage bridge by being located further away.
- The alignment is straighter, which may have resulted in higher vehicle speeds, but it is also on a much gentler slope at 3% over 175m.
- The additional property purchase required (shown by further encroachment of the red alignment into the purple properties) would be more than offset by the savings generated by the reduced earthworks or engineering structures.

5.4.2 Walking and Cycling

The walking and cycling trail alignment is designed to achieve Grade 1 standard (maximum prolonged gradient of 2 degrees (28:1) and maximum gradient of 4 degrees (14:1)) as per the QLDC Cycle Trail and Track Design Standards and Specifications. However, terrain over the project area only allows for a Grade 2 track to be provided (Maximum prolonged gradient of 4 degrees (14:1) and Maximum gradient of 6 degrees (10:1) for no more than 30m).

Several alignments were considered for the active mode trail as indicated by broken red lines in Figure 18. It was determined that effects on affected properties could not be mitigated as soundly as for the preferred

alignment, Grade 1 or 2 gradients could not be achieved, or the alternative route would be too far off desire lines. In particular, options 1 and 2 would traverse in front of dwellings and require use of private driveways, option 3 would pass through the middle of a private dwelling and would not tie in with existing or planned active mode infrastructure and option 4 would be substantially off desire lines.

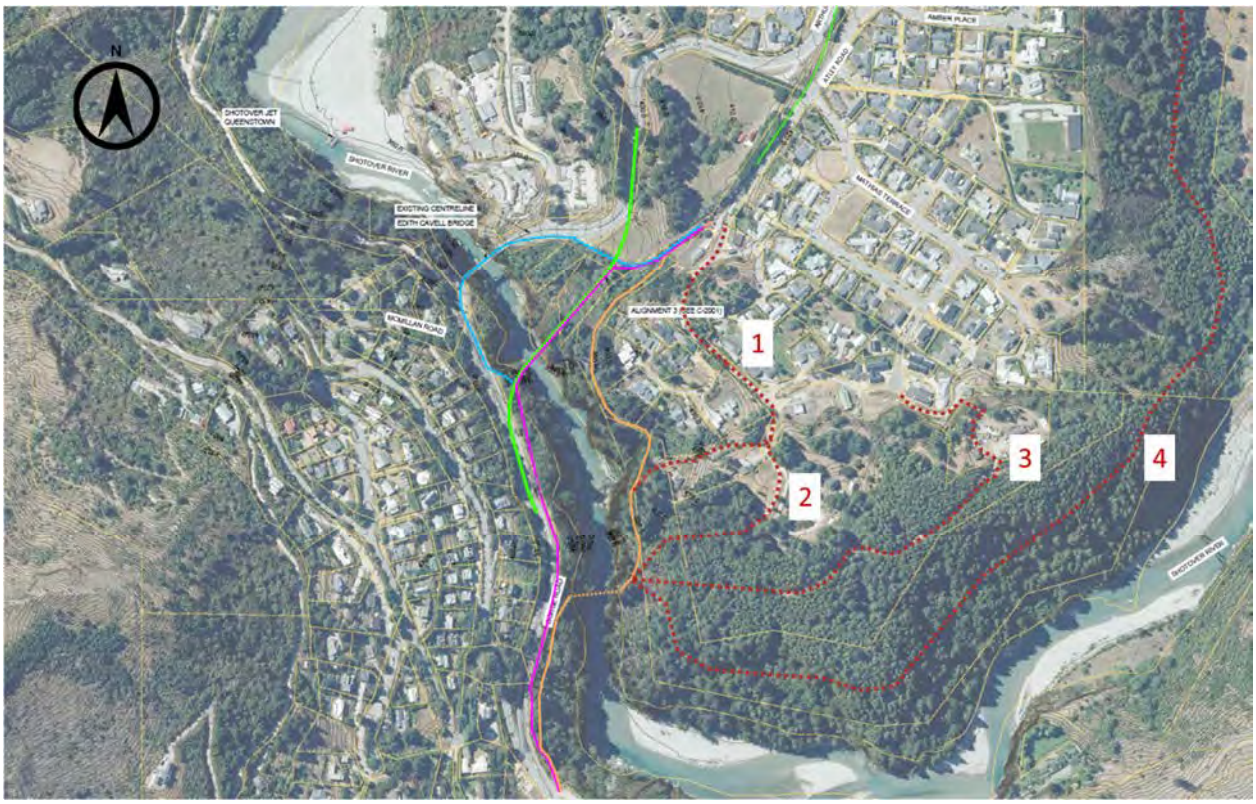


Figure 18 Alternative Active Mode Trail Alignments

The location for the active travel crossing was selected so as to provide the shortest span bridge launching from the same elevation on both sides (to provide a flat bridge deck). This was approximately 160m north of an originally proposed site (as shown in Figure 19) The crossing site was also sought to screen the bridge from sensitive viewshafts of the gorge from both directions, including dwellings on Watties Track and the existing Edith Cavell bridge (and DOC viewing platform by Shotover Jet).

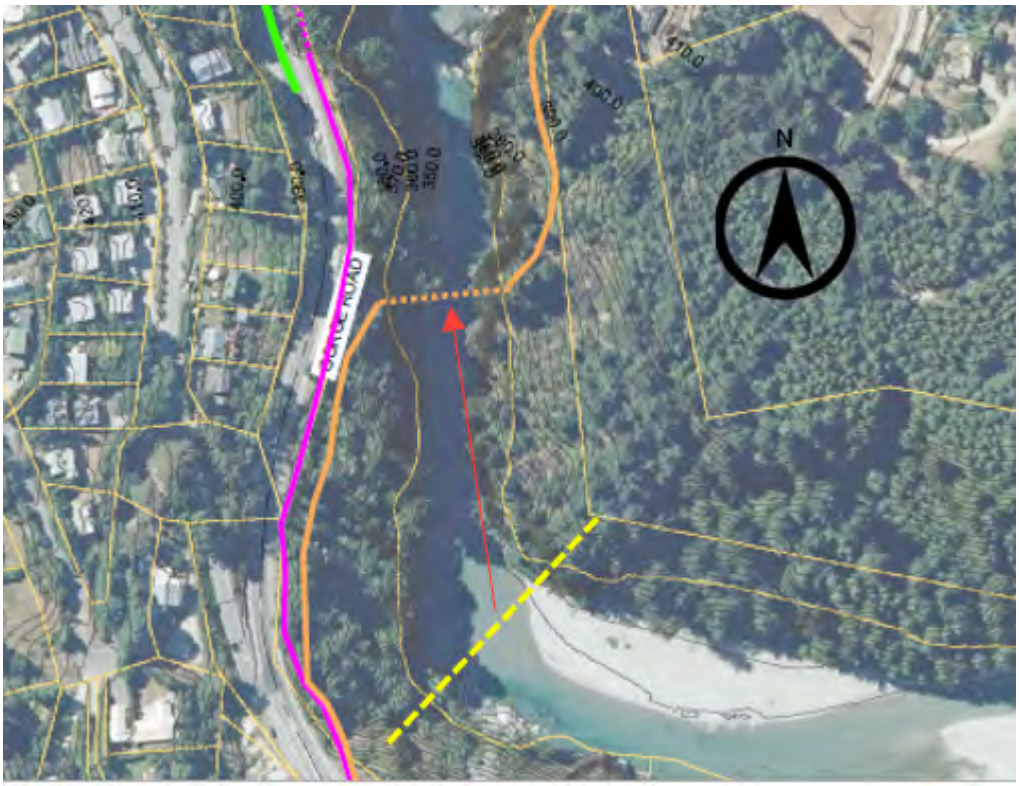


Figure 19 Active Mode Bridge Alignment

5.5 Traffic Modelling

Traffic modelling of the Recommended Option was undertaken using the strategic Queenstown Tracks model, a standard three stage car trips model with three demand years of 2016, 2028 and 2048 and three periods of AM, PM and interpeak. The strategic model was used to ascertain high-level performance measures such as travel times at the three demand years for use in economic assessment. The full analysis is presented in Appendix C1.

Due to uncertainty in future growth and the effects of the Covid-19 pandemic, demand years should be considered to represent traffic volume levels rather than fixed dates. Population and visitor growth projections developed by QLDC indicate that reduced population and visitor growth rates are anticipated to be short-term only, with growth expected to return to pre-Covid levels in 3-5 years[3]. However, modelled years should be interpreted as volume trigger points due to remaining uncertainty.

The strategic model calculates travel time based on parameters averaged over links and nodes and as such, is limited in the granularity of its outputs. A Vissim microsimulation model, which calculates outputs by accounting for the movement of individual vehicles, was developed to validate the economic analysis derived from the Tracks model (as well as feed into visualisations developed for community engagement).

5.5.1 Calibration

Local area traffic validation was undertaken to check the 2018 model against directional traffic flows on the Edith Cavell Bridge and against travel time surveys along the Gorge Road/Arthurs Point Road corridor.

The traffic count across the Edith Cavell Bridge was surveyed in January 2019 and the five day weekday average for Tuesday 29th January through Monday 4th February 2019 was calculated and compared to the model as shown in Table 13.

[3] Queenstown Lakes District Population Projections Post-Covid (September 2020)

Table 13 Modelled and Observed Traffic Volumes

	Northbound				Southbound			
Period	Model	Observed	%age	GEH	Model	Observed	%age	GEH
8-9am	158	339	-53.40%	11.5	463	412	12.40%	2.4
12-1pm	278	329	-15.50%	2.9	287	241	19.20%	2.8
5-6pm	453	610	-25.80%	6.8	229	321	-28.70%	5.5

	Northbound				Southbound			
Period	Model	Observed	%age	GEH	Model	Observed	%age	GEH
8-9am	158	339	-53.40%	11.5	463	412	12.40%	2.4
12-1pm	278	329	-15.50%	2.9	287	241	19.20%	2.8
5-6pm	453	610	-25.80%	6.8	229	321	-28.70%	5.5

5.5.2 Validation

Given the coarse granularity of the strategic model, validation of travel times was carried out using Vissim. The Tracks model is a lot less sensitive to the effect the changes in traffic volume has on travel time differences, due to the coarser nature of the model – and is more related to the relative volumes experienced in each period. The full analysis is provided in Appendix C2.

Overall, however, the differences in travel times between the two models are reasonably in line. The VISSIM model is showing a lower time saving in the quieter Interpeak period, but significantly more delay in the critical PM peak period.

Consequently, it has been concluded that the travel time benefits forecast by the Tracks model are generally of a similar order to those in the VISSIM model, and therefore the economic analysis using Tracks output is considered a reasonable and robust approach.

5.6 Staging of Preferred Option

An analysis undertaken by Abley in 2019 (documented in Edith Cavell Bridge Analysis Summary Technical Note, Abley 2019) found a strong relationship between traffic volumes and travel times through the project area.

The analysis found a two-way capacity of approximately 950vph. Above this threshold, flow becomes unstable and delays are highly sensitive to directional proportionality (depending on user behaviour and adherence to give way rules, delays could increase significantly). However, it should be noted that the directional proportion of the two-way flow has a substantial effect on travel times due to the give way priority at the bridge (northbound traffic should give way, meaning a higher proportion of northbound vehicles during a period of time should lead to increased travel times).

Additionally, as traffic volumes increase, it is expected that the local 'courtesy' give way behaviour currently observed (i.e. southbound traffic voluntarily gives way) would diminish due to more visiting drivers in the traffic stream and queues forming on both sides of the bridge. Therefore, the capacity of the bridge is dynamic and may be higher or lower than 950vph depending on the changing flow profiles over time.

A plot of measured travel time against two-way volumes is shown in Figure 20.

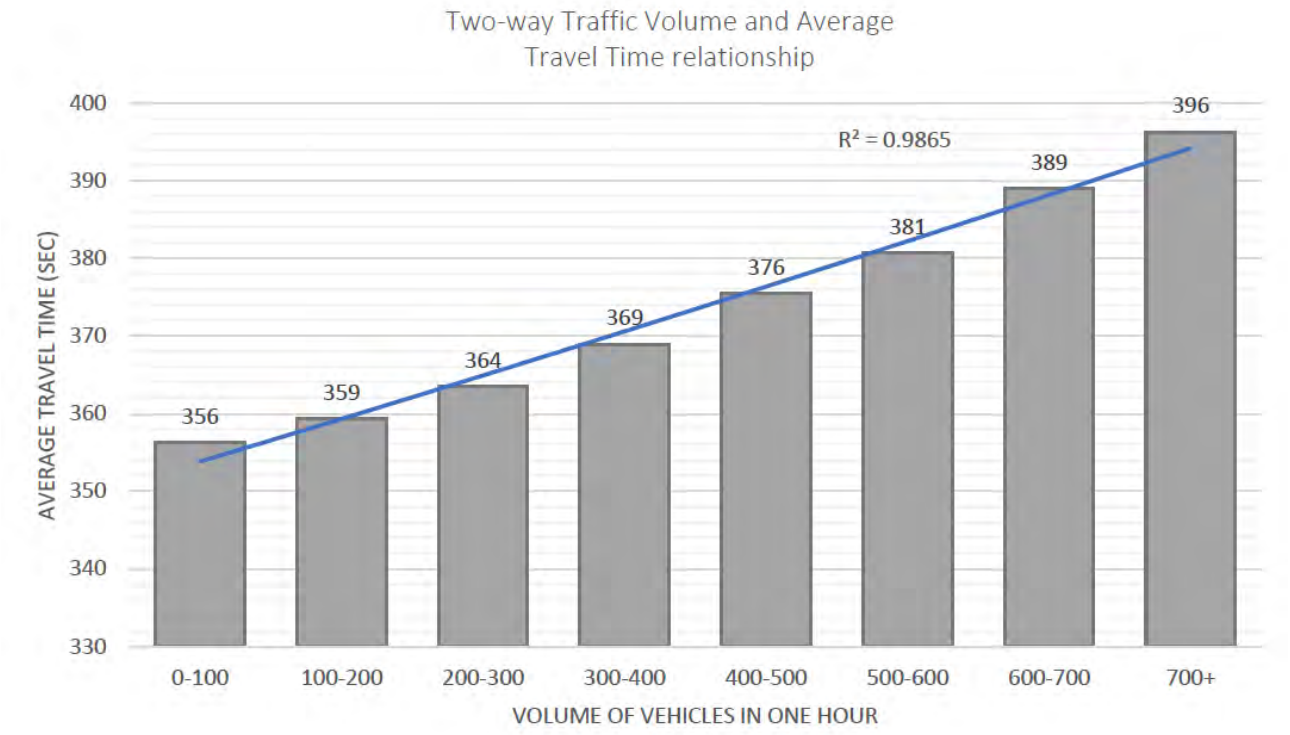


Figure 20 Traffic Volumes vs Travel Times (source: Edith Cavell Bridge Analysis Tech Note, Abley 2019)

Due to the limitations of the strategic model, delays at the bridge are averaged over the length of the link within which it sits, smoothing out the effect of localised changes (such as increasing the bridge to two lanes) and increases in traffic volumes. Additionally, delay at the bridge may result in clearway 'ahead' of the bridge meaning that once across the bridge users may make up the delay incurred An analysis was therefore carried out using the more granular Vissim model to determine when intervention would be needed to accommodate growing traffic volumes, summarised in Figure 21.

The analysis suggested that the bridge is already operating at Level of Service (LOS) F (forced or breakdown flow – an indication of the relationship between LOS and delay is given in Figure 21) in the northbound direction (accounting for growth between pre-Covid 2018 and 2028 model demand sets). However, growth on the Arthurs Point to Queenstown corridor is forecast to be relatively low through to 2048, and demand has dropped to levels seen approximately 3 years prior to Covid-19.

The model cannot accurately depict the informal give way rules observed at the bridge, and volumes used in the assessment do not account for the impact of Covid-19, resulting in higher than observed delays. Considering both directions as a weighted average, LOS F is reached in 2026, at which point signals could be implemented to balance delays further.

For the purposes of this assessment, Level of Service F is considered to be the critical criteria from a performance perspective. Economic benefit may be provided by implementing a solution sooner (benefits of upgrading the bridge are considered in 7.1 Economic Analysis). Signals would provide interim capacity until such time that a bridge upgrade can be built; however, in the engagement survey, 7 respondents indicated that they opposed implementation of signals as an interim measure, compared to 46 in support. Community support for signals is likely to increase as traffic volumes grow and delays worsen.

Direction	Year	AM peak		Interpeak		PM peak	
		Delay	LOS	Delay	LOS	Delay	LOS
NB	2018	16	C	3	A	36	E
	2020	21	C	5	A	51	F
	2022	26	D	6	A	66	F
	2024	31	D	8	A	80	F
	2026	36	E	9	A	95	F
	2028	42	E	11	B	110	F
SB	2018	4	A	2	A	4	A
	2020	4	A	2	A	5	A
	2022	4	A	2	A	5	A
	2024	4	A	3	A	5	A
	2026	4	A	3	A	5	A
	2028	4	A	3	A	6	A

Figure 21 Existing One-lane Bridge Vissim Traffic Model Results

A corresponding analysis was undertaken to test signal control on the existing one-lane bridge. The analysis found that signals would provide lower delays and better Levels of Service in the northbound direction in the peak hours, but higher delays and worse Levels of Service in the southbound direction and interpeak.

The higher delays in some periods would result from traffic stopping at a red light when they previously would have right of way, which would be particularly prevalent in the interpeak (the period constituting the majority of the day). This generates economic disbenefits through additional travel time. Economic analysis presented in Section 7.1 found that disbenefits would be in the order of $5m per year at 2028 (when peak period travel time benefits are highest). At this point it is anticipated that the new road bridge would be under implementation and signals would not be needed.

Notably, interpeak volumes in 2048 are higher than the AM peak volumes at 2028. Therefore, it would be expected that delay in this period at 2048 would be significantly higher and would represent better justification of implementing signals. However, signals would still generate disbenefits in the off-peak direction and it is considered highly likely that a new road bridge will have been built by this time.

Direction	Year	AM peak		Interpeak		PM peak	
		Delay	LOS	Delay	LOS	Delay	LOS
NB	2018	15	B	12	B	18	C
	2020	16	C	13	B	18	C
	2022	16	C	13	B	19	C
	2024	17	C	14	B	20	C
	2026	17	C	14	B	21	C
	2028	18	C	15	B	22	C
SB	2018	24	C	20	C	27	D
	2020	24	C	20	C	27	D
	2022	25	C	21	C	28	D
	2024	25	D	21	C	29	D
	2026	25	D	21	C	29	D
	2028	26	D	21	C	30	D

Figure 22 Signal Controlled One-lane Bridge Vissim Traffic Model Results

While signals would improve performance in the peak periods and provide better control of traffic by balancing peak demands, it is unlikely that an economic case can be made for their implementation. Traffic volumes, and therefore delays, forecast through the off-peak periods are too low to justify signals. Additionally, the new bridge is proposed to be implemented not long after signals may provide benefit. Implementing signals in 2026 would represent a sunk cost to the ultimate solution just a few years later.

6 RECOMMENDED OPTION

The Recommended Option comprises two discrete parts:

- **APC Stage 1**: a separate active modes bridge approximately 400m downstream from the existing Edith Cavell bridge (with connecting trail tying in around the old Arthurs Point pub car park to the south and Atley Road to the north)
- **APC Stage 2**: a new two-lane road bridge approximately 100m downstream from the existing Edith Cavell bridge. The heritage Edith Cavell Bridge will be converted to a walking and cycling bridge once the road bridge is built

APC Stage 1 is intended to be implemented within 2 years to achieve Investment Objective 1: *Provides a safer, more accessible path for all confidence levels of pedestrian and cyclist between existing routes (and planned upgrades) in the short term*.

An economic case exists to build APC Stage 2 from a transport perspective (refer to 7.1 Economic Analysis); however, discussions with funding partners indicate that it is unaffordable in the current climate and modelling shows it is not needed from a traffic operations perspective in the short term. .

Exact timing of the need to replace the existing bridge from a structural perspective will become clearer as the bridge nears the end of its useful life, and a regular inspection and maintenance programme is implemented. As identified in Section 1.4 Existing Asset Condition, the bridge is expected to have at least 20 years remaining useful life, which could be extended with preventative maintenance. QLDC have indicated a desire to improve the resilience of their assets, which may necessitate acceleration of the project, but no formal policy is yet in place.

Feedback from the community was that performance of the existing bridge is not a major issue (refer to Section 4 Stakeholder Engagement) as locals adhere to 'courtesy' give way rules, and that the existing road function of the bridge should be utilised for as long as practicable.

The Recommended Option therefore includes deferring implementation of the road bridge for reconsideration in the next realistic funding horizon, expected to be the QLDC Long Term Plan 2031-2041, which corresponds with the 2030-2033 NLTP.

6.1 Scope

A plan of the ultimate Recommended Option is shown in Figure 23 and a 3D visualisation is shown in Figure 24.

Stage 1 comprises a 2.5m wide, approximately 680m long gravel path (though allowance has been made for potential chip sealing) between Atley Road and the old Arthurs Point Pub car park, crossing the Shotover River by a 60m long suspension bridge.

Stage 2 comprises a new two-lane, two-way partially curved road bridge structure approximately 80m in length (between abutments) with 3.5m wide lanes, 1.5m wide shoulders and 0.5m wide TL-5 barriers on both sides (Figure 25). The walking and cycling bridge will be 2.5m wide and approximately 65m long. The walking and cycling trail is 2.5m in width to allow for side by side riding, except for localised narrowing to cater for obstacles such as the protected trees in the vicinity of McChesney Road.

NOTES:

1. EXISTING CENTRELINE, PROPOSED TIE IN LOCATIONS AND PAINT MARKINGS ARE APPROXIMATE BASED ON AERIAL PHOTOGRAPHY.
2. AERIAL PHOTOGRAPHY FROM BETWEEN 2017-2019 SOURCED FROM LINZ

LEGEND:

- PROPERTY BOUNDARY
- PROPOSED BARRIER
- MINOR RETAINING (0.5-1.5m)
- RETAINING (1.5-5m)
- CANTILEVERED BOARDWALK BOLTED TO SCHIST BLUFF
- TIMBER BOARDWALK

Figure 23 Recommended Option Plan

Figure 24 Recommended Option Visualisation Looking Upstream

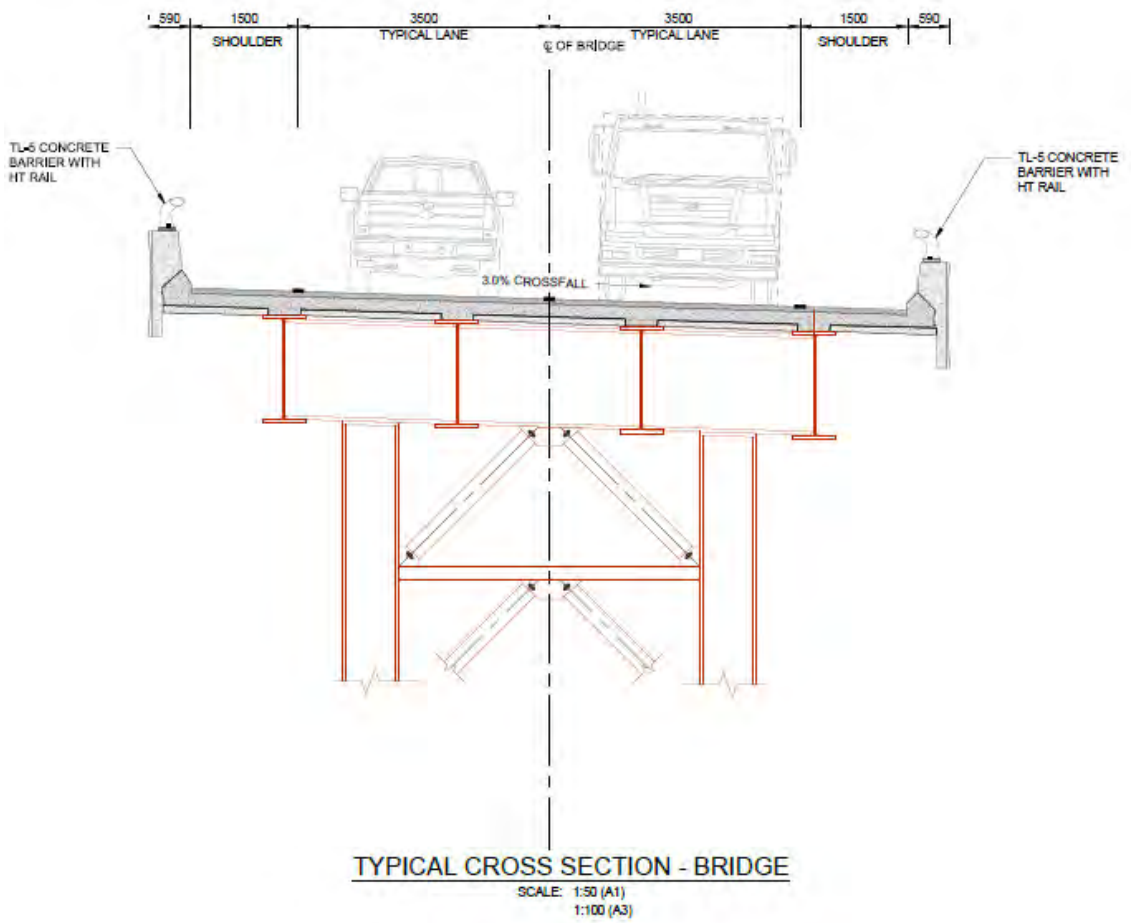


Figure 25 Recommended Option Road Bridge Cross Section

Refer to Preliminary Design Drawing sets in Appendix A1 and the Preliminary Design Philosophy Statement in Appendix A3 for further detail on the Recommended Option.

6.1.1 Stage 1 Crossing Improvements

As shown in Figure 28, APC Stage 1 ties in directly with the Arthurs Point Pedestrian and Cyclist Improvements project at Atley Road and does not need a crossing treatment. The tie in with the Wakatipu Active Travel Network at the southern end requires a crossing on Gorge Road. Abley's Pedestrian Crossing Facility Selection Tool was used to determine the most appropriate type for this location, considering the recently-lowered speed limit (now 50km/h) and the lack of sight distance to the south. The assessment is provided in Appendix A8.

Grade separation was identified as providing the best safety and travel time benefits, but was deemed technically infeasible, expensive and unnecessary for the environment. An option was assessed to bring the trail round to McChesney Creek and under the bridge to the south, to tie in with the existing active modes bridge, but there is insufficient clearance between the creek and bridge soffit.

Median refuge and signalised crossings were identified to have the same crash reduction, but the perceived safety for pedestrians of signalised crossings was higher. A signalised crossing was determined to best meet Investment Objective 1 (i.e. provide a facility for all user types) and be well received by the community. Adopting Waka Kotahi's Safe Systems Approach, a raised platform is recommended to be implemented alongside the signals to achieve safe speeds of 30km/h. The crossing is shown in Figure 26 and in the Preliminary Design Drawing Set in Appendix A1.

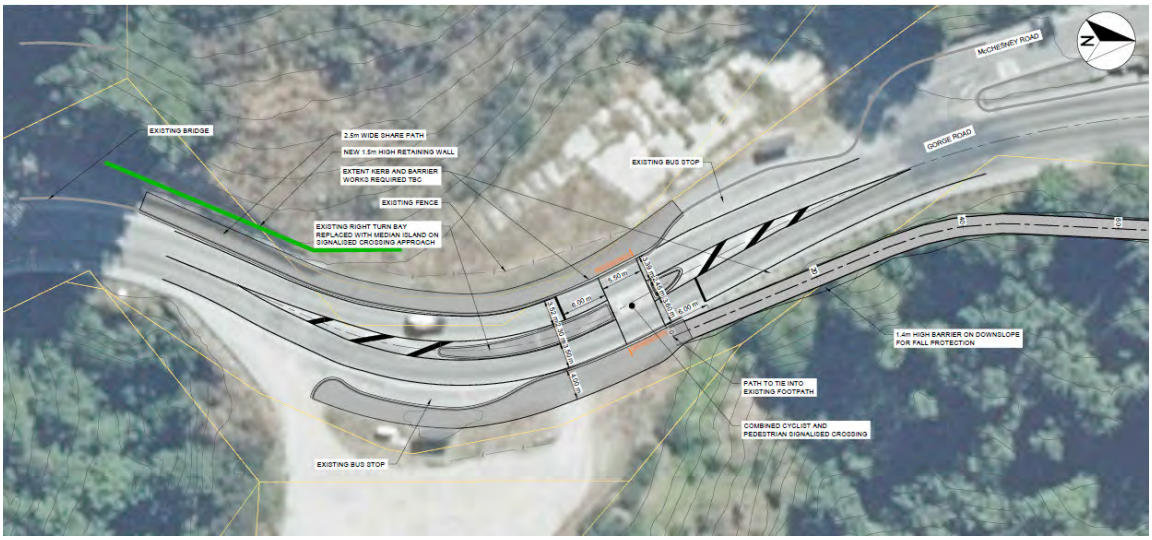
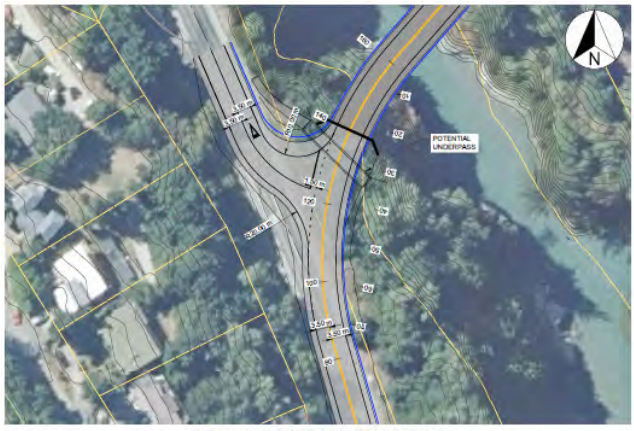
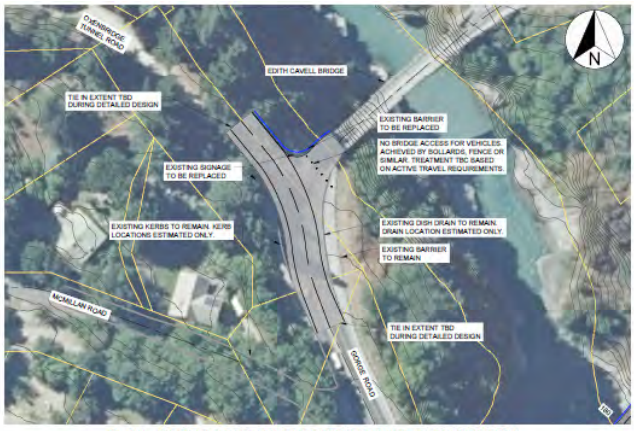


Figure 26 Recommended Option Crossing on Gorge Road at Project's Southern Extent

6.1.2 Stage 2 Intersection Improvements

Figure 27 shows proposed intersection layouts to enable continued access to McMillan Road, Oxenbridge Tunnel Road and the Shotover Jet complex as part of APC Stage 2. The top right layout indicates how the Edith Cavell bridge is proposed to be repurposed for active modes.





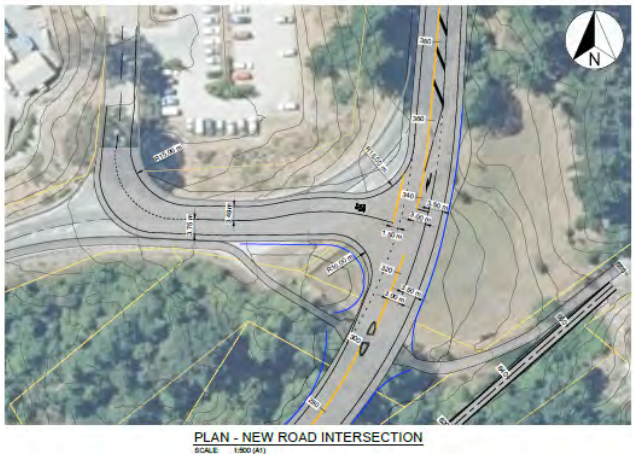


Figure 27 Recommended Option Intersection Treatments

6.2 Safety in Design

Safety in Design was considered during the design process by the project team. An internal Safety in Design workshop was held on 31 August 2020, with outputs presented to the client team on 6 November 2020.

The risks identified are considered standard for a bridging project in challenging terrain. The Safety in Design register is presented in Appendix A4.

6.3 Integration with Other Projects

At the time of writing, APC Stage 1 is proposed to tie in with the Arthurs Point to Queenstown route of the Wakatipu Active Travel Network (WATN) Stage 2 project to the south (left in Figure 28) and the Arthurs Point Pedestrian and Cycling Improvements project to the north (right in Figure 28).

Pre-implementation is already underway for the Arthurs Point to Queenstown WATN route, with detailed design scheduled to be delivered in April 2021. The scope is anticipated to be expanded to incorporate detailed design of the Arthurs Point Crossing component, subject to Waka Kotahi and QLDC approval (refer to 10.1 Implementation Strategy), which would ensure a complete route is provided. QLDC have indicated that minor improvements budget may be available for localised upgrades to the Arthurs Point route, which would enable the crossing to be implemented with sufficient safety and levels of service, if not incorporated with WATN Stage 2.

Figure 28 Interaction with Other Projects

An additional project has been agreed to address gaps in the Arthurs Point Pedestrian and Cyclist Improvements to the north in order to ensure a fully connected, high quality and safe route is provided between Arthurs Point and Queenstown.

6.4 Preferred Option Community Engagement

Community consultation was undertaken by QLDC on the preferred option (refer to 4.3 Preferred Option Survey), including a follow-up survey asking whether respondents were in support or opposition to the preferred option, what the option got right and what the option got wrong. Of total respondents, 75% indicated support of the preferred option.

Of the 25% in opposition, 66% were concerned with the visual impact of 3 bridges in the gorge; however, visualisations undertaken for the engagement show that visual intrusion has been minimised by spacing the road bridge and active modes bridge such that both cannot be seen from any one viewpoint (Figure 29). One respondent suggested a new road should be built around Queenstown Hill instead and another two were concerned with the general approach to engagement (so were not opposing the option specifically).

Figure 29 Visualisation of Downstream View from DOC Viewing Platform at Morningstar Beach

6.5 Preliminary Design Philosophy

A Preliminary Design Philosophy Statement is provided in Appendix A3. This should be read in conjunction with the Safety in Design register, presented in Appendix A4.

7 RECOMMENDED OPTION – ASSESSMENT

This section identifies impacts and outcomes of the proposal in order to fulfil QLDC and Waka Kotahi requirements for appraisal. Waka Kotahi's Non-monetised Benefits Manual was released after the commencement of this business case. Given the relatively small scale of the project costs, particularly for the active modes component, non-monetised benefits were not included in the economic assessment.

This section assesses the performance of the recommended option against four key criteria:

- Project outcomes
- Implementing ability
- Wider project impacts, and
- Cost optimisation.

7.1 Economic Analysis

Economic analysis has been undertaken on the Recommended Option outlined in Section 6 Recommended Option. The approach used in the project economics is unorthodox from an SSBC perspective due to:

- The Recommended Option comprising two discrete activities (walking & cycling and roading)
- Stage 1 and Stage 2 having different delivery timeframes (immediate and 10 years)
- Strong interdependency with WATN Stage 2 (benefits realisation for that project is contingent on a crossing being provided)

As a result, economic appraisal was carried out on Stage 1 and Stage 2 separately. A programme BCR does not precisely convey the relative benefits and costs of each project stage but is presented here for context. The programme BCR is summarised in Table 14.

Table 14 Project Benefit Cost Summary

STAGE	BENEFITS* ($M)	COSTS* ($M)	BCR
1	10.6	9.7	1.1
2	37.2	18.6	2.0
Project	47.8	28.3	1.7

*Benefits and Costs for Stage 1 include the WATN Stage 2 Arthurs Point to Queenstown Route

7.1.1 Guidance on Approach to Economics

As the project evolved into two discrete stages, it was determined that a combined project economic appraisal was illogical; the scales of costs and benefits of the two stages are so different that benefits from the roading improvements (Stage 2) could easily mask a weak case for the active mode improvements (Stage 1).

Additionally, it was identified that the economic case for APC Stage 1 is inextricably linked to the WATN Stage 2 Arthurs Point to Queenstown route. For the crossing to attract users (thereby achieving benefits), it would need to be part of a full route connecting origins and destinations (i.e. Arthurs Point and Queenstown). Equally, the economic justification for implementing WATN Stage 2 was predicated on a safe and attractive crossing of the Shotover River being in place, meaning benefits identified for that project will not be realised without APC Stage 1.

The economic case for Stage 1 is therefore based on an update to the WATN Stage 2 economics, incorporating the additional cost of the active modes bridge and trail.

Wider economic benefits, including those associated with Queenstown Trails Trust plans to integrate a 'canyon loop' around the gorge (refer Section 2.3.2 Opportunities), have not been considered to ensure consistency with the previous assessment.

7.1.2 Cost Estimates

Cost estimates used in the economic analysis represent the expected amount to implement the preferred option, as summarised in Table 15. Full cost estimates are provided in Appendix A2.

Table 15 Summary of Project Costs

	ROAD BRIDGE ONLY COSTS	ACTIVE MODES ONLY COSTS	COMBINED PROJECT COSTS (ROAD AND ACTIVE MODES)
Consultancy Fees	$1,288,400	$263,100	$1,551,500
Property	$1,778,600	$375,100	$2,153,700
Physical Works	$14,666,500	$1,548,500	$16,215,000

Construction Monitoring Fees	$540,000	$60,000	$600,000
Way to Go Managed Costs	$298,600	$26,500	$325,000
Total P50 Project Costs	$18,572,100	$2,273,200	$20,845,200

7.1.3 Do Minimum

The Do Minimum represents the minimum level of expenditure required to maintain a minimum level of service.

Discussions with QLDC and Waka Kotahi indicate that both organisations recognise the importance of long-term resilience of the crossing to different degrees (refer to Problems, Opportunities and Constraints Report in Appendix C9). The Do Minimum is therefore assumed to include seismic strengthening to enable continued use of the route in the event of an earthquake. Standard ongoing maintenance is also included in the Do Minimum.

If the Recommended Option is implemented, the Edith Cavell Bridge will be converted to an active mode bridge, which would mean the structure was no longer lifeline infrastructure. The requirement for seismic strengthening and stringent ongoing maintenance would then be removed.

The Do Minimum scenario includes implementation of traffic signals on the existing bridge to retain existing levels of service control for growing traffic volumes.

The net present value of ongoing maintenance and improvement costs for the existing structure over the foreseeable future (i.e. the Do Minimum) have been calculated at $816,960 including:

- Concrete repairs every 15 years at $50,000
- Seismic strengthening in 2024 at $500,000
- General maintenance every year at $1,000
- Implement signals in 2027 at $400,000

7.1.4 End of Life of Existing Bridge

As bridges near their economic end-of-life, their condition deteriorates and defects requiring significant maintenance or renewal become apparent. At this stage, options for continued maintenance/renewal and bridge replacement need to be assessed and a decision made as to whether it is more economical to continue maintaining the existing bridge or build a replacement. Waka Kotahi's Investment Assessment Framework identifies that, in assessing end of life of a structure, least whole-of-life economic cost should inform the investment decision rather than a benefit cost appraisal.

No significant maintenance or renewals have been identified for the Edith Cavell bridge at this stage. Ongoing maintenance costs for the Do Minimum scenario have been calculated at $816,960, significantly lower than the expected cost of a replacement bridge (likely to be in the order of millions). It is therefore concluded that there is no economic case for investing in a replacement bridge from an end of life perspective at this stage.

However, without detailed seismic and load assessments, the exact condition of the bridge (and therefore scale of maintenance requirements) is uncertain. Monitoring of the bridge, as recommended as part of the Preferred Option, may identify the need for a more costly maintenance regime than assessed here. This may bolster the economic case for a replacement bridge from an end of life perspective.

7.1.5 Stage 1 Economics

Waka Kotahi's Non-monetised Benefits Manual was released after the commencement of this business case. Given the relatively small financial scale of the project, non-monetised benefits were not included in the economic assessment. However, Stage 1 is expected to deliver:

- Improved perception of safety and ease of walking and cycling
- Improved physical health from active modes
- Reduction in embodied carbon
- Reduction in severance
- Improved amenity and landscape, and heritage and cultural values

As described in 7.1.1 Guidance on Approach to Economics, this assessment was based on the existing economic assessment from the endorsed WATN SSBC, amended to incorporate the cost of the new bridge and trail. The original Economics Memo from the WATN SSBC is provided in Appendix C14.

Limitations of the WATN SSBC projections are acknowledged, in that they were based on high level strategic model demands, coarse mode share assumptions and limited baseline data without modifications for difficult topography. However, the WATN business case and economics were endorsed by Way to Go partners, while the Covid-19 pandemic restricted the APC project to using existing data. Considering the lack of new information, remodelling and assessing the WATN SSBC Arthurs Point to Queenstown route was deemed to not be 'right sizing' the business case and outside the scope of the project.

The Arthurs Point to Queenstown route is intended to be delivered under Stage 2 of the WATN (between 2021 and 2024), which is consistent with the PV costs calculated for the Recommended Option. An updated summary of the economic analysis for the Arthurs Point to Queenstown Route is given in Table 16.

Table 16 Updated Economic Analysis Summary for WATN Arthurs Point to Queenstown Route

PV Route Benefits	WATN SSBC PV Costs	Combined Route PV Costs	WATN SSBC BCR	Combined Route BCR (+20% APC cost/-20% APC cost)
$10.6m	$7.4m	$9.7m	1.4	1.1 (1.04/1.15)

Overall, the effect of adding the estimated cost of the active mode bridge and trail to the economic analysis from the WATN SSBC reduces the BCR from 1.4 to 1.1.

An updated economic summary of the full Arthurs Point to Queenstown route of the WATN is presented in Table 17.

Table 17 Updated Economic Summary of Arthurs Point to Queenstown Route

Timing	
Earliest Implementation Start Date	2021
Expected Duration of Implementation	6 months
Economic Efficiency	
Time Zero	1 July 2019
Base date for Costs and Benefits	1 July 2018
Present Value of Total Project Cost of Do Minimum	N/A
Present Value net Total Project Cost of Recommended Option	$9.7m
Present Value net Benefit of Recommended Option (exc. Wider Economic Benefits [WEBs])	$10.6m
Present Value net Benefit of WEBs of Recommended Option	$0
BCR (exc. WEBs)	1.1
BCR (inc. WEBs)	N/A

First Year Rate of Return (FYRR)	4%

7.1.6 Stage 2 Economics

The analysis was based on Waka Kotahi Economic Evaluation Manual (EEM) procedures and used the latest update to July 2019 costs. The model outputs that feed into the economic evaluation are shown as part of the Strategic Modelling Tech Note in Appendix C1.

Adjustments were made to the peak period benefits to scale up the results based on the lower-than-observed traffic volumes within the transportation model. Benefits extracted from the model are summarised in Figure 30.

Benefits	Scenario	Year	Total Vehicle Operating Costs	Emissions Benefits (4% of VOC)	Total In Vehicle Time Cost	Total Additional Congestion Costs	Travel Time Reliability Costs (5% of TTC)	Total Network Operating Cost Benefits
	Option vs Do Min	2018	$ 174,401	$ 6,976	$ 1,134,293	$ 142,543	$ 56,715	$ 1,514,928
	Option vs Do Min	2028	$ 168,028	$ 6,721	$ 1,017,550	$ 161,265	$ 50,878	$ 1,404,442
	Option vs Do Min	2048	$ 228,170	$ 9,127	$ 1,655,156	$ 351,904	$ 82,758	$ 2,327,115

Figure 30 Tracks Model Economic Benefits

After applying full discounting procedures, the Benefit Cost Ratio (BCR) results are shown in Table 18 with a broad range of sensitivity tests to demonstrate the robustness of the assessment. These are based on an indicative construction year of 2030, lower cost of $14 million (base estimate) and upper cost of $23 million (P95 estimate). The results are inclusive of maintenance costs based on 5% of the full cost every 10 years. Not accounting for Do Minimum costs is a conservative assumption.

Table 18 Tracks Model Economics BCR Summary

Scenario	Lower Cost Estimates		Upper Cost Estimate	
	BCR	FYRR	BCR	FYRR
Base BCR	2.0	11%	1.2	7%
Base+30% Benefits	2.6	14%	1.5	9%
Base-30% Benefits	1.6	8%	1.0	5%
Delay build by 10 years	2.3	25%	1.4	15%
Base with 4% discounting	2.7	8%	1.5	5%
Base with 8% discounting	1.6	14%	1.0	8%
Growth delayed by 10 years	1.7	10%	1.1	7%

The BCR analysis shows a range of 1.2 through 2.0 based on costs in the range of $13-22 million. The sensitivity tests deliver BCRs in the range of 1.6 - 2.7 for the $14 million cost estimate and 1.0 – 1.5 for the $23 million cost estimate. This assessment does not include changes in crash costs which may provide additional benefit.

The impact on the Arthurs Point corridor of a closure of SH6A was also investigated. If a crash or other incident occurs on SH6A between Queenstown and Frankton on the portion of the corridor between Goldfield Heights

and Yewlett Crescent, the only alternative route is via Arthurs Point. The addition of a new two-lane two-way vehicle bridge provides significantly more capacity to accommodate any such diverted traffic.

To investigate this, a one hour 2028 interpeak closure of SH6A was modelled. This re-routed traffic based on least generalised cost so assumes that vehicles have perfect visibility that SH6A is closed and therefore this is likely to provide a highly conservative assessment. Regardless, the current bridge operates with a modelled average 14 minute delay and the Road User Charge (RUC) benefit of installing the new two-lane bridge is $29,000 per hour.

If there was one closure every two years which resulted in four hours of disruption, this would be an additional $58,000 of benefits per annum, which would add about 4% to the BCR noted above. Longer closures, such as those caused by a landslide on SH6A, would provide further benefits depending on their frequency and duration. For example, one full closure of two weeks duration on SH6A over the course of the 40 year assessment period would lead to another $40,000 in benefits per annum. However, given the infrequency of such events, lack of evidence supporting their likelihood and projects underway elsewhere that will increase resilience of the route, there is limited justification of the economic case for investing in upgrading resilience of the crossing at Arthurs Point.

An economic case exists to build the new road bridge from a travel time savings and vehicle operating cost perspective. However, this outcome does not align with Investment Objectives or the strategic case, which set out a need to prioritise active modes and reliability above travel times. Discussions with funding partners indicate that the road bridge will be unaffordable in the current climate and modelling shows that it is not needed from a traffic operations perspective in the short term. Similarly, while there would be resilience benefits brought by upgrading the crossing, evidence for the magnitude and frequency of emergency events is relatively weak, and so too therefore is the economic case for investment. Exact timing of the need to replace the existing bridge from a structural perspective will become clearer as the bridge nears the end of its useful life and a regular inspection and maintenance programme is implemented. As identified in Section 1.3 Existing Asset Condition, the bridge is expected to have at least 20 years remaining useful life, which could be extended with preventative maintenance.

The Recommended Option is therefore to defer implementation of the road bridge for reconsideration in future funding periods (namely QLDC's 2031 Long Term Plan and the 2030-2033 NLTP).

7.1.7 Interim Measures (Signals) Benefits

Travel time benefits were calculated for signals on the existing bridge in the interim of the new road bridge being built (refer to Section 5.6 Staging of Preferred Option). The assessment is summarised in Table 19. Crash cost savings were not calculated due to signals not addressing the crash history identified in the crash analysis (13 of 14 crashes were loss of control type). Refer to Problems, Opportunities and Constraints Report in Appendix C9.

The assessment found that there would not be an economic case to justify implementing signals due to significant disbenefits in the off peak direction and interpeak. Low projected growth means it is unlikely that off-peak demand will reach a level to reduce disbenefits sufficiently to provide a strong economic case.

The community has indicated opposition to signals being added to the bridge over concerns that off-peak delays will be increased unnecessarily, stating satisfaction with current levels of service (the traffic assessment in this report found that capacity was reached refers to the summer peak only). Heritage NZ have also indicated opposition to any physical alteration to the existing bridge (refer to 1.5 Heritage).

Perception of congestion is typically weighted towards peak hours (which are currently relatively uncongested). As peak hour delays increase, and trip reliability worsens with increasing traffic volumes, community support for signals is expected to increase. Furthermore, QLDC as the Road Controlling Authority may wish to address increasing queues from a safety perspective, while signals would provide permanent control for high demand situations such as closures on SH6A (currently manual stop/go has to be set up, with controllers getting stuck in traffic on the way to site). A trial with temporary signals with follow up survey would provide more accurate data on the issue.

Given the weak economic case, low community support, risk of objection from Heritage NZ, limited growth anticipated on the corridor and uncertainty caused by Covid-19, an appropriate course of action would be to allocate funding in the 2021-2031 Long Term Plan and then monitor traffic volumes, delays, queues and community satisfaction, and delay or implement signals as required. This would provide QLDC with the agility to

respond quickly and efficiently as procurement, construction and commissioning of signals could be delivered under the low cost, low risk programme.

Table 19 Economic Summary of Interim Measures (signals)

		AM	INTERPEAK	PM
Hours per year		245	2,450	245
Composite values of travel time ($/hr)		15	17.95	15
Hourly Demand (veh/hr)	**Northbound**	390	328	525
	Southbound	341	249	318
Travel Time Saving (s/hr) from Vissim model	**Northbound**	1	-9	18
	Southbound	-20	-18	-23
Annualised Benefits		**-$787,675.00**	**-$5,448,812.25**	**$261,660.00**

7.2 Project Benefits and Outcomes

Outcomes of the proposal will be measured as set out in the benefit map (Figure 31). Benefit statements were agreed with stakeholders as part of the ILM workshop. Appropriate measures and targets were developed by the project team based on data collected for the business case.

The benefits realisation presented here accounts for individual Stages 1 and 2 as well as the ultimate Recommended Option. Benefit statements for Stage 1 assume the full Arthurs Point to Queenstown route of WATN Stage 2 will be in place, as per the discussion in 7.1.1 Guidance on Approach to Economics.

Benefit statements regarding resilience and reliability were carefully worded to focus on improving longevity of the crossing and route availability in emergency events, as opposed to promoting the route as an attractive alternative to SH6A. It was agreed with stakeholders that significant safety concerns along the Malaghans Road corridor (as identified in Safety Review of Arrow Junction to Queenstown Alternative Route, Abley 2018) would need to be addressed to make it a suitable alternative route.

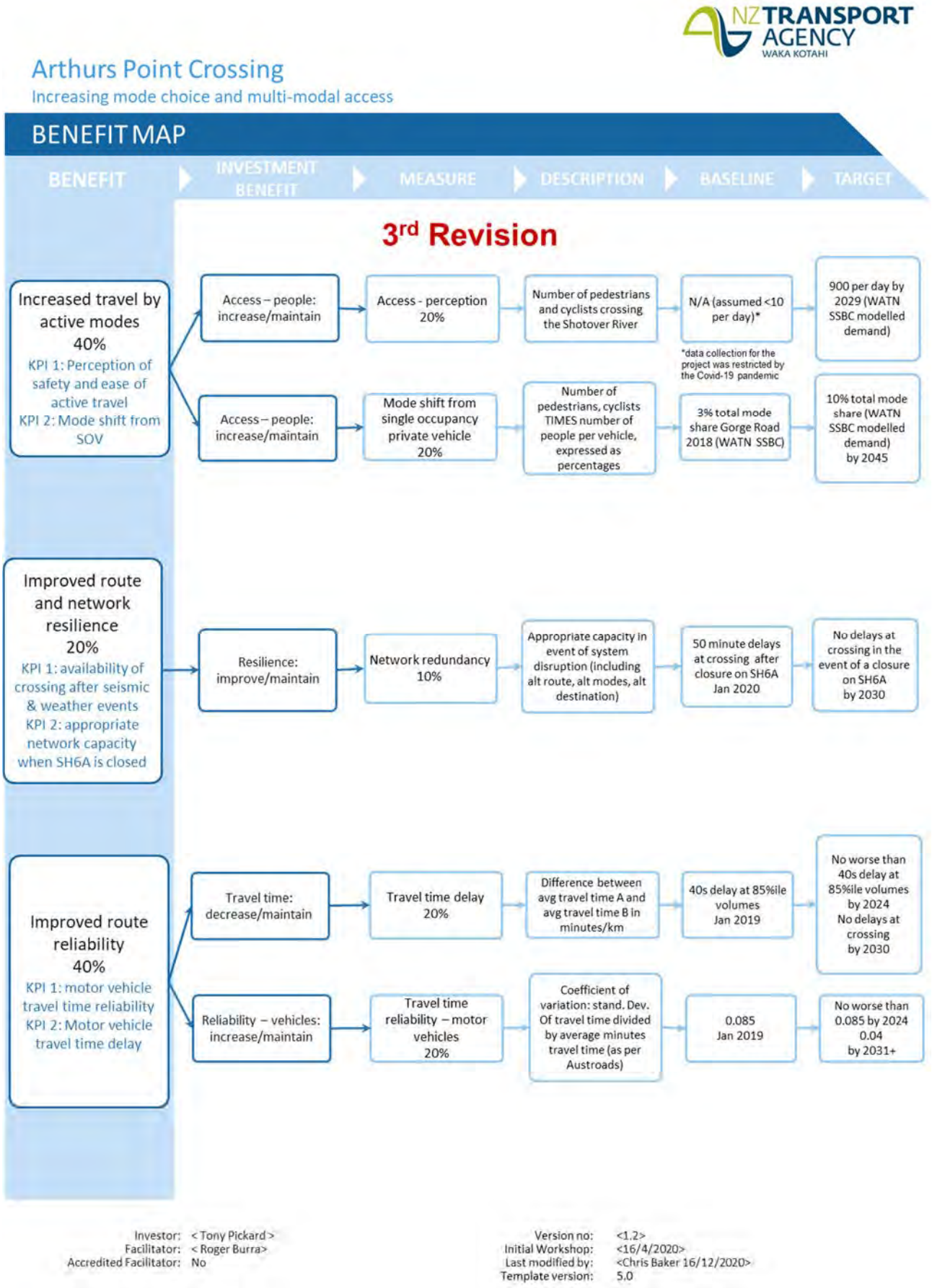


Figure 31 Benefit Map

7.3 Assessment Against Investment Objectives

Table 20 provides an assessment of the Recommended Option against the project's Investment Objectives.

Table 20 Assessment of the Recommended Option against Investment Objectives

INVESTMENT OBJECTIVE	ALIGNMENT
Provides a safer, more accessible path for all confidence levels of pedestrian and cyclist between existing routes (and planned upgrades) in the short term (40%)	• The recommended option effectively provides a walking and cycling bypass of the unattractive and unsafe section of road 500m either side of the Edith Cavell Bridge. • The route connects upgrades from the Arthurs Point Pedestrian Improvements project with the Arthurs Point to Queenstown route of WATN Stage 2. • A Grade 1 trail would provide for the broadest spectrum of cycling abilities but is infeasible due to physical constraints at the site. The Grade 2 trail is a necessary trade-off. • A separate walking/cycling bridge and trail was found to be the only feasible option to implement for active modes crossing in the short term.
Ensures travel time reliability is maintained for growing vehicle traffic volumes (35%)	• The new road bridge will remove travel time reliability issues at the crossing. However, it was agreed with stakeholders that improving travel times may be counterproductive to mode shift objectives. Delaying implementation of the road bridge means reliability improvements can be provided when needed without prematurely making the route more attractive to cars. • Due to a weak economic case, opposition from the community and opposition from Heritage NZ for physical alterations to the Edith Cavell bridge, traffic signals are not recommended to be implemented on the existing bridge in the short term. However, higher than anticipated growth in delays and queueing may lead to increasing community support and provide justification for their construction prior to the new road bridge. This would enable better management of travel time reliability in the interim.
Improves overall network and route resilience to seismic events and closures of SH6A in the long term (15%)	• The recommended option includes a new two-lane bridge structure (once justified by infrastructure resilience policy, escalating maintenance costs and traffic level of service) that will be designed with appropriate seismic strength. • The bridge will also provide an increase in capacity to accommodate additional traffic in the event of closures on SH6A.
Enables future land use development and growth by providing additional traffic and utilities capacity (10%)	• The new road bridge will provide additional capacity to support development along the Queenstown to Arrowtown route, though not much is forecast in the Spatial Plan. The project does not preclude or enable development currently proposed south of Atley Road. • Requirements and plans for future utilities on the corridor have not yet been established but the new road bridge will be designed with capacity and means for carrying additional services such as water and power. Services can also be slung under the active modes bridge, though this is not anticipated to be needed in the short term.

7.4 Implementability

This section considers the technical feasibility of delivering the project. A construction methodology will be developed with early contractor involvement during pre-implementation. The Preliminary Design Philosophy (refer Section 6.5 Preliminary Design Philosophy) provides high level direction on project delivery.

7.4.1 Constructability

The active travel bridge is expected to be a suspension bridge. These structures are commonplace in challenging terrain throughout New Zealand, such as on DOC hikes, and can be constructed relatively

straightforwardly. A suspension bridge can accommodate the required span of the gorge while using materials that can be easily transported to the difficult site. The active travel route has been specifically chosen to remain clear of the work zone required for the road bridge implementation. The active travel route is expected to remain open during construction of the road bridge.

The recommended road bridge is expected to be a composite steel and reinforced concrete design, with common and widely-used detailing. The space restrictions of the site are expected to present the greatest challenge to constructability with the river gorge and existing road alignment dominating the site.

Staging of construction activity and temporary traffic management provisions are likely to be critical to programming the works, and off-site staging areas are also likely to be required. These activities should be carried out as part of the construction methodology and detailed design (preferably with early contractor involvement) through the project's next stage. A staging area could be established on the eastern side of the river using property acquired at the bottom of Atley Road for construction of the road bridge and the adjacent unused road reserve, though the site would require clearing and levelling.

Construction of the western abutment of the road bridge will be complicated due to the proximity of the existing carriageway and the steep slopes of the gorge.

It is expected that the active travel route can be implemented with small machinery with the larger retaining wall at the McChesney Road end able to be accessed from Gorge Road. The bridge for the active travel route is expected to be a simple suspension bridge. A suspension bridge has small relatively simple components that can be transported to site via the new trail or by helicopter.

7.4.2 Operability

The active travel bridge has no special operational requirements and will be designed to have no load restriction, meaning the number of users will not have to be limited. Maintenance vehicles (assumed to be ATVs) will also be able to use the structure. Turning around of such vehicles will be challenging due to terrain but manoeuvring points could be built into areas around the bridge abutments.

The new road bridge will operate as a typical two-lane bridge and no extraordinary operations activity is expected. The bridge will have a 50km/hr regulatory speed limit; however, the geometrics have been designed for an operational speed of 60km/h.

Operational requirements for QLDC will be straightforward relative to other bridges on the network. The new structures will require less frequent maintenance for a shorter span than the Dart and Rees bridges and are easier to access than the Skippers Canyon bridge. Access to bridge abutments and structural elements will be no more challenging than for the existing Edith Cavell bridge. An Asset Owner's Manual will be provided at the end of construction.

7.4.3 Statutory requirements

Alteration to the existing designation, and resource consents for construction will be required for the road bridge and active travel route. It is recommended that geotechnical testing (as proposed in the Preliminary Geotechnical Appraisal Report in Appendix C4) be completed to confirm the exact alignment prior to property being acquired and designations being sought.

Assessments of environmental effects will be required to provide the necessary supporting information to the resource consent applications including archaeological, cultural, ecological, noise, and vibration assessments and these have been allowed for in the pre-implementation phase.

7.4.4 Property impacts

The preferred option has geometric constraints that have resulted in the requirement for property purchase or easements. However, both Stage 1 and Stage 2 alignments have been chosen to mitigate against impact on neighbouring properties. There is still risk of objection and a lengthy legal process to purchase land, which could lead to a delay in completion of pre-implementation for the WATN Stage 2 Arthurs Point to Queenstown route (refer to 10.1 Implementation Strategy). The property strategy is presented in Section 10.3.

The alignment for the active travel route has been chosen to mitigate the extent of possible impacts on property. The route utilises existing road reserve and DoC land but also skirts along the riverside boundary of 102, 104 and 106 Atley Road. However, a site visit indicated it is well screened from the dwellings. The trail passes in

front of the property of 119 Atley Road in full view of the dwelling, however, at this location the trail will be on DoC land and has potential to be screened from the property. 119 Atley Road appears to have made improvements on the DoC land in front of the property in the form of a shed that will clash with the trail alignment.

Several alignments were considered for the active mode trail as described in Section 5.4.2. It was determined that effects on affected properties could not be mitigated as soundly as for the preferred alignment, Grade 1 or 2 gradients could not be achieved, or the alternative route would be too far off desire lines

The new road bridge will require the purchase of at least two blocks of land on the eastern approach, the bottom paddock of 44 Arthurs Point Road and the plot of land owned by Shotover Jet. The new road alignment will also traverse land administered by the Department of Conservation (DoC).

The new road alignment on the eastern approach will be closer to the base of the slope and allow it to be more readily screened from the properties of 94, 106 and 108 Atley Road. Access to the businesses at Morning Star Beach has been retained with sight distances at the intersection improved. Access to Oxenbridge Tunnel Road and McMillan Road have also been retained. This is intended to reduce opposition from neighbouring property owners as far as practicable.

7.4.5 Asset management

The active travel bridge is likely to have timber elements. These elements shall be carefully specified and detailed to prolong design life. The expected suspension bridge shall consider future inspection and maintenance during the design and detailing phases as there will be limited access to many elements of the structure.

The recommended option for the new road bridge is expected to be a composite steel and reinforced concrete design, with typically low maintenance costs for the majority of the life of the asset. As the bridge will be over a deep gorge the ability to inspect and maintain the structure or services across the structure should be a key consideration during pre-implementation. As such it is expected that weathering steel or similar be considered as a construction material.

Consideration should be given through pre-implementation towards the use of integral abutments to remove the requirement for expansion joints and bearings which can be expensive to maintain and replace.

7.4.6 Project Delivery Risks

The preceding sections demonstrate that the technical elements of the project can be delivered. However, the funding and implementation pathway for APC Stage 1 is time-constrained and therefore poses a risk to delivery. The pre-implementation stage of the project is dependent on property acquisition, statutory approvals and decision-making timeframes, and is tied to WATN Stage 2 deadlines.

The key project risk is insufficient time to complete pre-implementation in the current NLTP period and the potential for programme delays on the Queenstown to Arthurs Point route of WATN Stage 2, with which APC Stage 1 is proposed to be delivered (refer to Section 10.1 Implementation Strategy). Achieving the current deadline of May 2021 for pre-implementation is contingent on business case and funding approvals, as well as property acquisition. The timeline for the preparation of applications for statutory approvals will also be constrained. While this poses a risk to the project, delivery of technical inputs by May 2021 is feasible.

The programme risk is partially mitigated by the contract for WATN Stage 2 already having been let. The time required to procure professional services for delivery of APC Stage 1 can be bypassed if the projects are combined. The project manager of WATN Stage 2 has indicated that pre-implementation for both projects can be delivered concurrently.

APC Stage 1 was initially earmarked as a low-cost low-risk (LCLR) quick win project. As the project has progressed, the complexity has increased, and cost estimates currently sit above $2m. While above the typical threshold for a LCLR project, risks are considered to be sufficiently mitigated:

- QLDC have allocated funding for APC Stage 1 in their Long Term Plan
- High contingencies have been applied in the cost estimates (averaging at 25%), so outturn costs are unlikely to exceed the estimates
- QLDC have identified the project as a priority within the WATN and have indicated willingness to reprioritise projects within the programme to ensure delivery

7.5 Wider Project Impacts

7.5.1 Environmental Impact

The gorge is lined with trees and other vegetation that are generally not desirable species to be maintained in the area long term. While there are considerable mature trees and other undergrowth, especially on the tops of the steep banks of the Shotover, on closer examination this vegetation is almost entirely composed of species considered to be 'weeds' in the area, including wilding pine, sycamore, willow, hawthorne, broom, hemlock, blackberry, old man's beard and buddleia.

A large amount of vegetation will require to be cleared for construction of both Stage 1 and Stage 2 of the preferred option. However, landscape enhancement opportunities are evident and could arguably improve the visual amenity of the land surrounding the river. Mature trees have the potential to screen the new bridges and its approaches from adjacent landowners, but these are generally not desirable species to maintain in the area long term. There would therefore be potential value in staged removal of the current vegetation in the area (the currently proposed approach), to eventually replace with plants from the original native ecosystem palette, which would have considerable ecological value as well as aesthetic. These changes may form part of the mitigations required as part of the consenting process.

The river environment at the bridge site is natural with river flowing through the incised gorge. The gorge itself is an Outstanding Natural Landscape (ONL) and acts as a buffer between existing residential developments on both sides of the river. Through Stage 2, it is expected that improvements can be made to several aspects including the quality of stormwater runoff into the Shotover River, and modest improvements in noise and vibration.

A high level landscape concept plan is provided in Appendix A7.

Stage 1 Visual Impacts

The visual impact of three separate structures in the gorge was raised as a concern by the community and considered throughout optioneering. The active modes bridge alignment was chosen downstream of a bluff on the true right of the gorge to take advantage of the natural screening it provides. As demonstrated in Figure 29, the active modes bridge would not be visible from Morningstar Beach or the Edith Cavell Bridge. Figure 24 provides more network context of how the three bridges will work together with respect to visual impacts. The bridge structure is proposed to be a steel cable suspension bridge, which is visually permeable and low impact (the visualisation incorrectly shows a concrete structure to demonstrate indicative alignment only).

The trail itself would be bedded in the hill below properties on the true left side, screened by the slope and existing vegetation. The trail alignment runs close to dwellings at 102-108 and 119 Atley Road and some mitigation against visual and noise impacts may be required – these will be identified as part of the Assessment of Environmental Effects during pre-implementation.

No major issues were identified with respect to visual impacts in the Environmental and Social Responsibility Screens (Appendix C8).

Stage 2 Visual Impacts

The proposed road bridge would be visible from various areas, including the existing bridge, especially if eventually the existing bridge is retained as an active transport connection and viewing platform. It would additionally be viewed in juxtaposition with the form of the historic Edith Cavell Bridge from at least 3 popular viewing points around Morningstar beach (3D visualisation shown earlier in Figure 24) and its surrounding commercial activities. The alignment on the true left at the base of the hill makes the new structure more recessive from viewpoints of the houses on Atley Road above.

It is essential for detailed design of the new structure to carefully consider suiting the context of the area. This would include complementing both the local geology in colour/texture and ensuring a new structure does not visually clash with the surrounding landscape. The new structure should be designed in such a manner that any views where the two bridges are seen together (Edith Cavell bridge and proposed new crossing), they appear to be of the same "family" (as recommended in NZTA "Bridging the Gap"). For this reason, it would be advantageous for the form to be slender and incorporate curved forms and tones reflective of the surrounds. These considerations have been applied to the preliminary design and should be continued further through the project's next phases.

7.5.2 Heritage Impact

The Edith Cavell Bridge is a Class A heritage item and is protected under the QLODP. The bridge has exceptional overall heritage significance due mainly to its historical, aesthetic, social, and technological value with the structure being one of the first of its kind in New Zealand following international trends. The bridge is associated with a number of historic high profile individuals and associations including the Public Works Department and its prolific Engineer-In-Chief Frederick Furkert, and internationally renowned WWI heroine Edith Cavell.

The Edith Cavell Bridge is one of the few Category 1 bridges listed by Heritage New Zealand Pouhere Taonga (HNZPTA) that remain in active use on the road network.

A Conservation Management Plan that identifies and documents the historical context of the structure is attached in Appendix B4. The document will, amongst other things, detail the activity that is required to preserve the structure and provide guidance on any future use in order to maintain its historical value.

The proposed road alignment will require relocation of the cairn commemorating Thomas Arthur at the eastern approach. The exact location should be determined once the road alignment has been confirmed with geotechnical testing. It currently sits in an obscure and relatively inaccessible location so opportunity exists to enhance cultural values of the area by incorporating it with the active travel route around Atley Road.

7.5.3 Social Impact

The existing Edith Cavell Bridge forms a vital link between Arthurs Point and Queenstown and has done so for over 100 years. The bridge is visible from Morning Star Beach, from which the Shotover Jet departs. The place is held in high regard by both the local and regional community and is an integral aspect of community identity. Standing for more than a century, the bridge epitomises the development of the small community over time and has become an icon representing Arthurs Point and its industrious people. The bridge also provides an opportunity to inform the wider community, and visitors, about the history of the region through educational means.

The preferred option builds social connection by providing a safe active travel route connecting the Active Travel Network between Arthurs Point and Queenstown. It also provides opportunity to enhance the place function of the area through:

- Conversion of the heritage Edith Cavell bridge, allowing the community to interact with it more closely
- Creation of a new node in the active travel network (including potential for new Canyon Loop) and focal point for the community
- Providing cultural and historical information
- Replanting with native flora

The new road bridge will not create any change in highway traffic volume or traffic composition but may affect speeds and noise generation. The project may reduce some traffic platooning, so it is possible that road crossing opportunities will be modestly reduced. However, any possible adverse social impacts to the community are expected to be minor.

7.5.4 Cultural impact

The location has no known political or spiritual significance and the importance of the place to Tangata Whenua is not known, though Aukaha have informally indicated that there are no concerns with cultural impacts in the project area (see Section 4 Stakeholder Engagement). Iwi are understood to be more concerned with tangible aspects of design and construction than the project's planning phase. It is highly unlikely that the project would be rejected for resource consent on the grounds of Wahi Tupuna (Cultural Environment) as iwi would be meaningfully consulted with as project partners, helping to identify necessary mitigations, through pre-implementation.

There is a strong post settlement cultural importance to the area with early goldmining operations in Arthurs Point, and the route being on the pack track into the far reaches of the Shotover River. The area is known to have been occupied as early as 1862, with remains of water races, huts and tailings within the area. Therefore, the entire project area has archaeological potential and shall be considered an Archaeological Site as defined in Section 6 of the HNZPTA. Under this definition, any works that will break ground at the project site may require

an Archaeological Authority. This requires further investigation and advice should be sought from an appropriately qualified archaeologist in the project's pre-implementation stage.

Any development within this landscape must take into account and if possible enhance the cultural landscape. As research to date on this project has not been focused on this or uncovered existing information in this area, mana whenua consultation early in any design process would be recommended. Methods for expression of cultural narrative in any development and surrounds can include patterns, form, specific planting and/or naming. This can be part of the overall process of ensuring any new structure recognises and responds to surrounding context and ecology, with development contributing to liveability, vitality, social and cultural expression. Any such development would also aim to maintain but in this case preferably improve ecological function and amenity.

7.6 Carbon Emissions Impact

The carbon emission impact of the preferred option (including the road bridge) is estimated to be about **3,484 tCO_2e**. This assessment is detailed in Appendix A6 and includes scope 1 and 3 emissions from the design and construction stages of the preferred option bridge, road pavement, footpath and shared user trail. This emission impact can be used as the preliminary base case emission scenario for this option. This means that these carbon emissions are what QLDC would emit under their business-as-usual scenario. Should QLDC seek emissions reduction performance from this project, the measurement and tracking of emissions as the project progresses through design and construction phases can be compared to this base case amount. This allows the nett and proportional change in emissions to be known and used to inform and guide design and construction decisions.

The global Science Based Targets Initiative (SBTI) is considered best practice guidance on setting carbon emission reduction targets to ensure a safe global climate and delivery of the Paris Agreement. SBTI broadly recommends that all activities deliver a 50% reduction in scope 1 and 2 emissions, and a 30% reduction in scope 3 emissions. If this approach were applied here, the targeted sum of carbon emissions at completion of the preferred option would be about 2,356 tCO_2e. How the preferred option remains within this carbon budget and constraint is the remaining challenge.

Importantly, this SBTI target and constraint is only relevant if works start in the near term. The target emission reductions will change, and need to be updated, if the project is not delivered in the near term. If this is the case, then it may also be that the NZ Climate Change Commission has delivered firmer guidance to Councils on their carbon budgets and the reductions expected from each sector so that Aotearoa is consistent with its Paris Agreement commitments. Regardless, these are not expected to be drastically different to the guidance from the SBTISBTI.

7.7 Cost Optimisation

Cost optimisation has been considered as part of the option assessment in conjunction with the multi-criteria analysis. Estimated cost values for property purchase and bridge construction have been used to inform the MCA scoring as discussed further in section 5.

Property purchase and bridge construction together comprise 48% of the project cost (4% and 44% respectively). Both of these aspects of the project can be quantified in terms of anticipated cost (i.e. land purchase costs, compensation costs, and construction costs), although these are subject to risks in regards to property purchase complexity and uncertainty around likely compensation costs.

95th percentile cost estimates have been used in the value analysis to reflect the conceptual nature of the alignment design and the risks inherent to acquisition of property.

8 INVESTMENT APPRAISAL

As a QLDC-led project with funding assistance from Waka Kotahi, the investment has been appraised against both organisations' requirements and objectives. From QLDC's perspective, this means assessing against transport strategies, plans and policies, and establishing activities in the Long Term Plan and Regional Land Transport Plan. From Waka Kotahi's perspective, this means assessing the investment using the Investment Assessment Framework (for activities in the 2018-21 NLTP) and Investment Prioritisation Method (for activities in the 2021-24 NLTP). The Investment Prioritisation Method was published after commencement of this project but has been included here to cover the transition between NLTP periods.

8.1 QLDC Appraisal

At the time of writing, QLDC did not have an official framework for appraising infrastructure investments. Figure 32 summarises the current pathway for endorsement of activities by QLDC in the Long Term Plan and Regional Land Transport Plan.

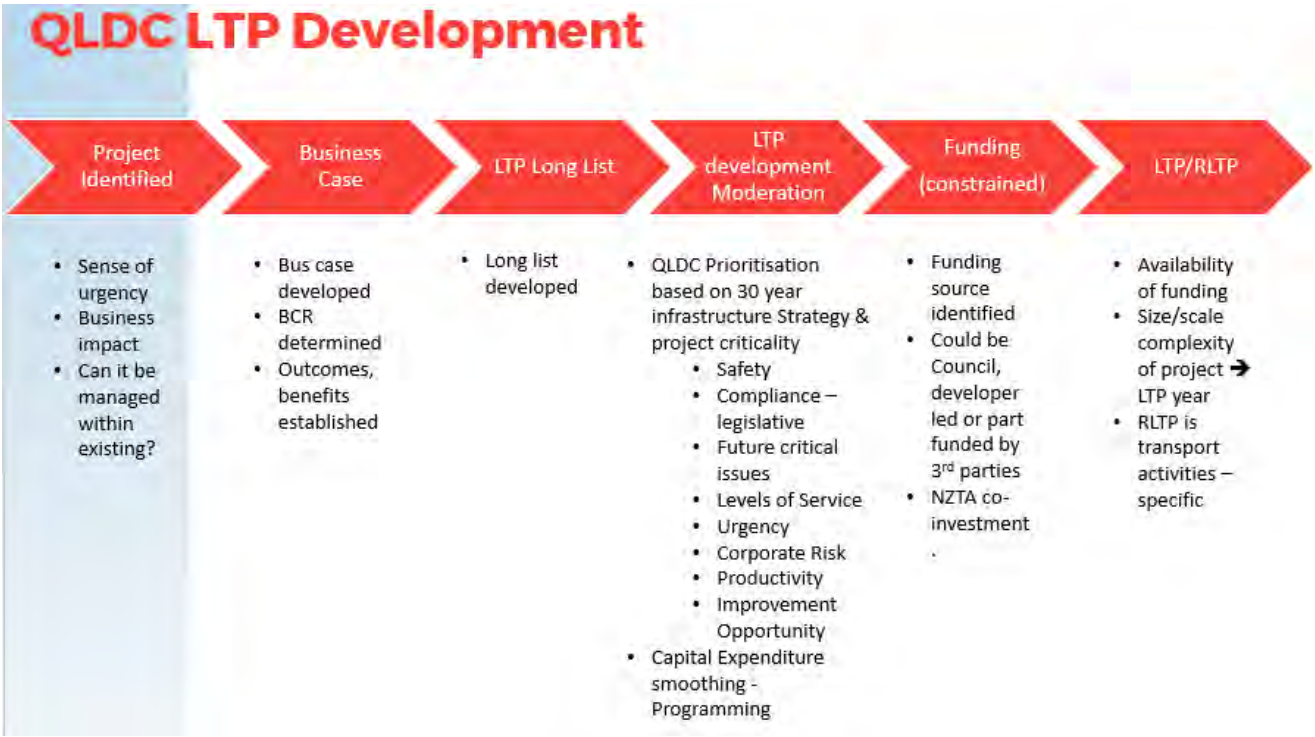


Figure 32 QLDC Long Term Plan Development Requirements

This process includes development of a high level BCR to allow comparison across activities up for inclusion in QLDC's infrastructure programme. To facilitate the development of a high level BCR, a business case is usually undertaken internally (utilising QLDC internal resources) or externally through the procurement of professional services.

Once an initial assessment is made the activity can continue to be assessed using Council assessment criteria, these usually consist of:

- Alignment with the QLDC 30-year Infrastructure Strategy and criticality of projects
- Safety
- Compliance with legislation
- Future critical issues
- Level of service or opportunities to improve.
- Urgency
- Corporate Risk
- Productivity

An illustrative diagram of the current QLDC Infrastructure Strategy (2015-2045) is shown in Figure 33.

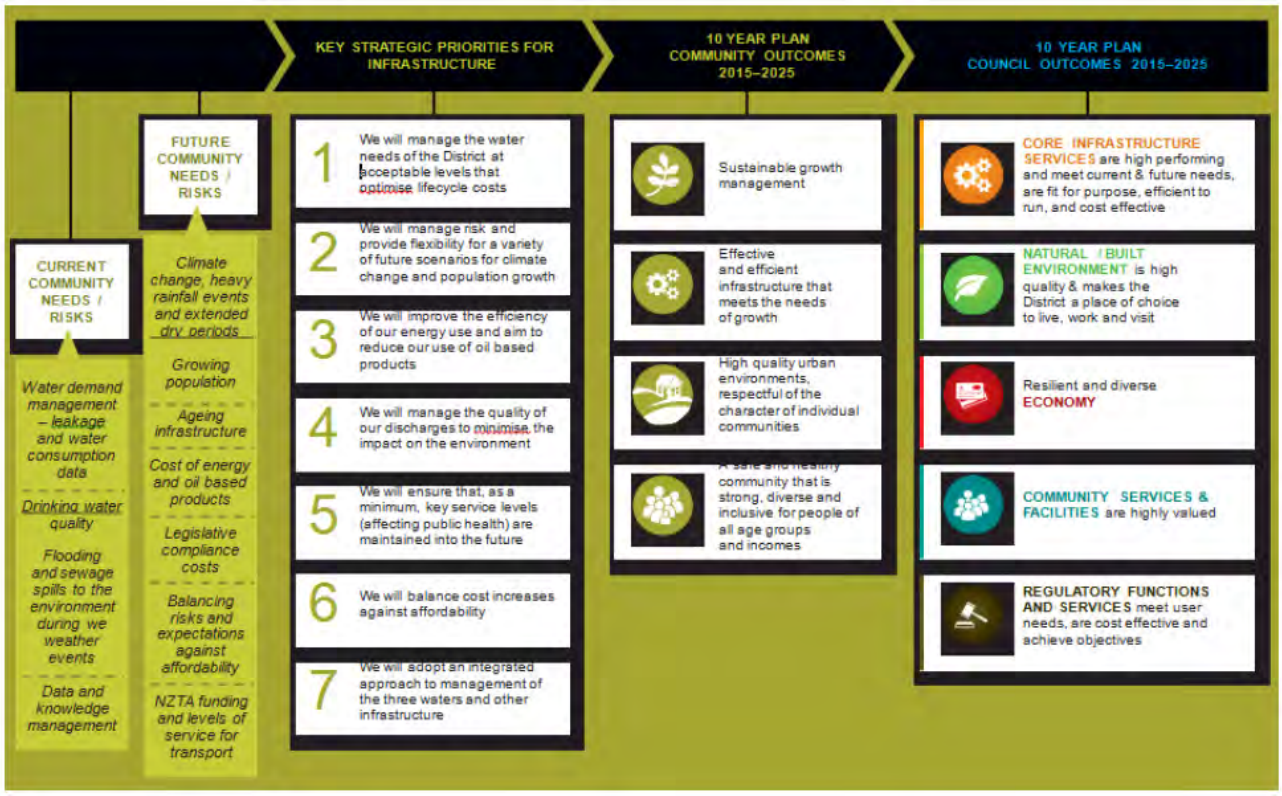


Figure 33 Summary of QLDC Infrastructure Strategy (2015-2045)

With respect to the Arthurs Point Crossing and the existing Edith Cavell Bridge, the QLDC infrastructure strategy identified the project for its potential to contribute to improving network resilience and improvements to attract and increase the number of walking and cycling trips as well as improve traffic wait times and safety related to vehicle queuing (see excerpt in Figure 34 below).

Assets critical to service delivery – resilience issues *(When should we invest?)*	Principal options (most likely scenario) for response	Implications
Historic Edith Cavell Bridge over Shotover River at Arthurs Point (Heritage New Zealand Category 1) provides only alternative access into Queenstown. This historic bridge is one lane with limited driver visibility and tight horizontal and vertical alignment onto/off the bridge and no provision for pedestrians or cyclists.	Add cycleway and footbridge. Earthquake strengthening and new bridge. Capital expenditure required: cycleway and footbridge $750,000 and +$1m for earthquake strengthening. The new bridge is beyond the 30 Year Strategy.	Traffic wait times increasing and safety issue around vehicles queuing.

Figure 34 APC Project in QLDC Infrastructure Strategy

The QLDC proposed District Plan (7 March 2019, Chapter 29, Transport) outlines a number of transport objective and are summarised as:

- Integrated, safe and efficient transport network
- Provides for future growth needs
- Promotes shift from car dependency to public transport and active modes
- Contributes to reducing the effects of climate change

In developing an assessment of the Arthurs Point Crossing, Investment Objectives (3.1 Investment Objectives) and multicriteria assessment (5 Option Development and Assessment) were developed in accordance with direction and guidance from QLDC project sponsors. Tracking the preferred option back to the QLDC desired future state in the Point of Entry, assessment of the recommended option against QLDC objectives is summarised in Table 21.

Table 21 Assessment of the Recommended Option against QLDC Objectives

Desired Future State		
Criteria	**Stage 1** **(Active Modes)**	**Stage 2** **(Roading)**
Is safe for all modes	Improves immediate walking and cycling safety issues by providing a fully separated route, removing the need to travel on the dangerous bridge and Gorge Road section	Improves safety for general traffic by eliminating vertical and horizontal curves on an ice-prone section of road with 13 loss of control crashes in the last 5 years
Caters to demand for all modes, supporting access and providing a viable alternative route to Queenstown	Enables travel between Arthurs Point and Queenstown by walking, cycling and micromobility on a previously underutilised route	Provides future capacity for residential and visitor growth and removes the capacity constraint on the only alternative route to SH6A
Provides a resilient alternative land access to Queenstown with a structure built to modern standards	Aligns with climate change objectives by offering sustainable transport choice on the route with a simple, low-risk and low emission structure	Provides resilience and redundancy in the network by reducing the risk of the only alternative route to SH6A being closed
Protect and compliments the iconic status of the existing bridge	Avoids detracting from the heritage bridge by utilising natural screening provided by the gorge geography. The steel rope structure will also be visually permeable	Sympathetic to the existing bridge, the new structure is proposed to have slender structural elements that mimic the Edith Cavell bridge's arch
Supports changes in three waters infrastructure	Allows conveyance of water infrastructure if deemed necessary	Allows conveyance of water infrastructure on a more favourable alignment if deemed necessary
Outcomes Sought		
Increased active travel between Arthurs Point and Queenstown by addressing a key gap on the network. This mode shift will lead to a reduction in emissions and congestion	Contributes to a safe and attractive active modes route between Arthurs Point and Queenstown that would otherwise be severed by the Shotover River	Delays capacity improvements and therefore unnecessary travel time improvements, prioritising investment in active modes in the interim. This signals a change in mode hierarchy to the community and should lead to travel behaviour change

Reduced travel time and improved travel time reliability by providing fit-for-purpose infrastructure with appropriate capacity for demand. **This will facilitate more travel route options across the Wakatipu Basin, removing pressure on the rest of the network.**	Encourages mode shift, thus reducing traffic volumes and congestion	Provides appropriately staged capacity improvements by waiting until traffic performance triggers are met, reducing the risk of unnecessarily improving travel times and inducing demand

8.2 Investment Assessment

As Stage 2 of the project is to be deferred by two funding periods, it has not been assessed against current GPS priorities. However, under the latest available assessment framework (the 2021-24 Investment Prioritisation Method), Stage 2 would likely be rated LLL (Low Low Low) as the project does not align with GPS priorities, is not currently urgent or critical to a wider programme and is expected to provide a BCR below 2.9.

Stage 1 falls within *Prioritisation for improvement activities* under *Walking and cycling improvements*, as defined in the Investment Assessment Framework (IAF) for the 2018-21 National Land Transport Programme. As the investment will likely be implemented during the 2021-24 NLTP period, assessment is also provided using the Investment Prioritisation Method (IPM). The assessments consider the complete Arthurs Point to Queenstown route rather than the crossing in isolation.

8.2.1 Cost Benefit Appraisal

The Transport Agency is required to prioritise investments made through the NLTP and ensure that these achieve value for money. The GPS emphasises value for money to maximise the impact of money spent to achieve the government's outcomes.

For improvement activities, the cost–benefit appraisal assessment methodology requires determination of a BCR. As shown in Section 7.1, an updated BCR of 1.1 was estimated for the full Arthurs Point to Queenstown route of the Wakatipu Active Travel Network, indicating that the benefits for the combined WATN Stage 2 and APC Stage 1 project will provide a return on the expected cost over the life of the project.

8.2.2 2018-21 Investment Assessment Framework Results Alignment

Using the 2018-21 NLTP IAF, Stage 1 is considered to achieve a High categorisation as demonstrated in Table 22.

Table 22 Stage 1 IAF Results Alignment

GPS Priority	Objective	Assessment	Evidence
Safety	A safe transport system free of death and serious injury	**High** - addresses a high perceived safety risk to use of the mode	Pedestrians and cyclists can currently only cross the river sharing the 3.1m wide live lane. Of all survey respondents, 66% indicated they rarely walk or cycle the crossing; 66% stated they would if it was safe to do so.
Access	Access to opportunities, enables transport choice and access, and is	**High** - supports development of the connections to the NZ	NZ Cycle Network routes currently terminate at Queenstown Bay and Littles Road. Signage to direct users from existing routes via Arthurs Point has been agreed with Queenstown

	resilient, thriving regions	Cycle Network and Te Araroa Trail Supports increasing the uptake of children using walking and cycling especially to and from school Addresses a very high resilience risk in a corridor	Trails Trust. The crossing will enable connection between these points. The crossing also lies between two points on the Te Araroa trail, though there are no indications the route will change as a result of the project. The community identified the existing approach on Gorge Road as a barrier to children cycling to school in the Town Centre. The Existing Asset Condition Report identified that the heritage bridge is unlikely to be in usable condition following an earthquake
	Access to opportunities, enables transport choice and access, and is resilient, Liveable Cities		
Environment	Reduces the adverse effects on the climate, local environment and public health.	**Medium** - enables a modal shift from private motor vehicles to active modes	In combination with the proposed parking strategy for the town centre, targets for alternative mode shares are 40% by 2028 and 60% by 2048. The new crossing offers transport choice not otherwise available.

8.2.3 2021-24 Investment Prioritisation Method Results Alignment

Using the 2021-24 NLTP IPM, Stage 1 is considered to achieve a High categorisation as demonstrated in Table 19. The IPM also considers scheduling of the investment, rating interdependency and criticality. Assuming APC Stage 1 is amalgamated with WATN Stage 2 (refer to Section 10.1 Implementation Strategy), the activity achieves a High scheduling rating as non-delivery would impact negatively on benefits realisation and hold up delivery of the full package. Pre-implementation of APC Stage 1 needs to be undertaken in order for WATN Stage 2 to be implemented in 2021-24.

Table 23 Stage 1 IPM Results Alignment

GPS Priority	Benefit	Assessment	Evidence
Safety	Impact on social cost and incidents of crashes	**Medium** – Investment supports behaviour change to improve road safety outcomes. Reduces perceived and actual safety risk.	The recommended option encourages active travel by providing a safe and attractive route between Arthurs Point and Queenstown. In combination with delaying roading improvements, more people are expected to walk and cycle. No crash history for active modes exists but this is understood to be caused by a high perceived safety risk discouraging walking and cycling
Better Travel Options *and* Climate Change	Impact on mode choice	**High** – 4-5% shift from private passenger vehicle-based trips to other modes	10% shift to alternative modes on the Arthurs Point to Queenstown route forecast by 2045 in the WATN SSBC
Better Travel Options	Impact on access to opportunities	**High*** – New walking/ cycling link forms part of regional or metro network and improves connections to nationally significant tourism destinations/ attractions	The crossing of the Shotover River is required to enable the Arthurs Point to Queenstown route of the Wakatipu Active Travel Network. The route will provide an alternative means for accessing key tourism destinations such as Shotover Jet,

			Skippers Canyon, Coronet Peak and Arrowtown * the route lies between two sections of both the NZ Cycle Network and Te Araroa Trail, and could form part of both routes (Very High alignment) in the future, but has not formally been included in any plans
Improving Freight Connections *and* Climate Change	Impact on mode choice	**Low** – will make no significant difference to freight mode choice	
Improving Freight Connections	Impact on network productivity and utilisation	**Low** – will make no significant difference to productivity and utilisation of freight networks, except for an improvement through the removal of heavy vehicles from the former SH1 corridor	
Climate Change	Impact on GHG	**Medium** – will reduce emissions through mode shift resulting from targeted safety interventions for cyclists and pedestrians, as well as reducing vehicle speeds and unpredictable vehicle behaviour	10% shift to alternative modes on the Arthurs Point to Queenstown route forecast by 2045 in the WATN SSBC
	Impact of air emissions on health/impact of noise and vibration on health	**Medium** – reduction of vehicles on corridor through mode shift will have an impact on local emissions and community health, and will reduce noise and vibrations.	

8.3 Priority Order

The results alignment and cost benefit appraisal results in a combined rating of High/Low in the IAF, which establishes this as a priority order 5 project (Figure 35).

RESULTS ALIGNMENT	COST BENEFIT APPRAISAL	PRIORITY ORDER
Very high	L/M/H/VH	1
L/M/H	Very high (BCR 10+); PV_EoL	2
High	High (BCR 5-9.9)	3
High	Medium (BCR 3-4.9)	4
Medium	High (BCR 5-9.9)	4
High	Low (BCR 1-2.9)	5
Medium	Medium (BCR 3-4.9)	5
Medium	Low (BCR 1-2.9)	6
Low	High (BCR 5-9.9)	7
Low	Medium (BCR 3-4.9)	8
Low	Low (BCR 1-2.9)	Exclude

Figure 35 IAF Priority Order

The results alignment and cost benefit appraisal results in a combined rating of High/High/Low in the IPM, which also establishes this as a priority order 5 project (Figure 36).

Proposed 2021-24 NLTP Priority Order						
GPS alignment	Scheduling	Efficiency				
		VL* (BCR<1.0)	L (BCR 1.0-2.9)	M (BCR 3.0-5.9)	H (BCR 6.0-9.9)	VH (BCR>=10.0)
VH	H	7	3	2	1	1
VH	M	8	3	2	1	1
VH	L	9	4	3	2	2
H	H	9	5	4	4	3
H	M	10	6	5	5	3
M	H	10	7	6	6	4
M	M	11	9	8	6	5
H	L	11	8	8	7	7
M	L	11	10	10	9	9
L	H/M/L	12	12	12	12	12

Figure 36 IPM Priority Order

8.4 Appraisal Summary

An Appraisal Summary Table for the project, as set out in the Waka Kotahi Investment Decision-Making Framework, is presented in Figure 37.

New Zealand Government

Summary Description						
Option Name	Arthurs Point Crossing Stage 1 (active modes)				**Date and Appraisal Period**	Year zero 2020/21
Problem statement	Bridge and bridge approach layouts limit the ability to safely accommodate people using active travel modes					
Investment objective	Provides a safer, more accessible path for all confidence levels of pedestrian and cyclist between existing routes (and planned upgrades) in the short term.					
How project gives effecct to GPS	Project confirmed to align with GPS priorities and contribute to GPS outcomes, specifically by reducing the risk of ped/cyclist crashes while providing better travel options. The project also presents a low-carbon solution to the problem and integrates further carbon reduction thinking through design.					
How the project gives effect to local community outcomes	The community responded clearly that a safer, more attractive crossing for active modes was needed. Prioritising investment in active modes over roading also aligns with the community's assertion that the current one lane bridge meets their needs.					
Key modelling assumptions, QA	Appraisal is based on benefits of the full AP-QT route and is therefore heavily dependent on modelling and route economics from the WATN SSBC. That analysis used strategic model outputs as well as published mode share and route count data, and has been endorsed by QLDC and WK.					
Transport Outcomes Name of Benefit	**Non-monetised Impact**				**Monetised Impact**	
	Name of Measure	**Baseline**	**Do Minimum Impact**	**Preferred Option Impact**	**Do Minimum Impact**	**Option Impact**
Healthy & safe people						
Impact on perceptions of safety and security	Access - perception	Poor - no active mode crossing facilities currently provided	No change - no benefit to active modes possible	66% of survey respondents indicated they would use the crossing; 400 daily cyclists forecast by 2028	No change	N/A (combined with other measures)
Impact of mode on physical and mental health	Physical health benefits from active modes	N/A	No change - no benefit to active modes possible	66% of survey respondents indicated they would use the crossing; 400 daily cyclists forecast by 2028	No change	A measure for active modes in relation to liveability and urban development and has not yet been defined but is an important social and community benefit of investment in active mode programmes and infrastructure
Economic prosperity						
Impact on network productivity and utilisation	Access to key economic destinations	Cycling to Queenstown only viable for Strong and Fearless cyclists	No change - no benefit to active modes possible	Cycling to Queenstown attractive for all cyclist confidence levels; <20 minute journey	No change	$10.6M (combined benefits, including full AP-QT route)
Wider economic benefit (regional economic development)	-	Zero - no active mode crossing facilities currently provided	No change - no benefit to active modes possible	Potential to form part of NZ Cycle and Te Araroa trails	No change	N/A (not assessed)
Environmental sustainability						
Impact on greenhouse gas emissions	Mode shift from single occupancy private vehicle	Zero - no active mode crossing facilities currently provided	No change - no benefit to active modes possible	5% forecast by 2028; 10% forecast by 2048	No change	Research is required into the best measures to provide evidence of impact of changing mode on greenhouse gas emissions.
Impact on resource efficiency	Embodied carbon	N/A	No change			
Inclusive Access						
Impact on Te Ao Maori	Te Ao Maori	No-minimal significance to Maori	No change	Opportunity to integrate Maori cultural influences and acknowledge Maori history in the area	N/A	N/A
Impact on user experience	People - throughput	Zero - no active mode crossing facilities currently provided	No change - no benefit to active modes possible	400 daily cyclists forecast by 2028; 1,200 daily cyclists forecast by 2048	No change	$10.6M (combined benefits, including full AP-QT route)
Impact on mode choice	People - mode share	Zero - no active mode crossing facilities currently provided	No change - no benefit to active modes possible	5% forecast by 2028; 10% forecast by 2048	No change	$10.6M (combined benefits, including full AP-QT route)
Impact on community cohesion	Social connectedness	Shotover River currently severs connection between new and old Arthurs Point	No change	Connects 'Old' Arthurs Point with 'New' Arthurs Point, including community hubs like Gantleys pub, the Shotover Jet/DOC complex, Bowling and eateries	N/A	N/A
Impact on landscape, heritage and cultural values	Amenity, heritage and cultural values	Invasive species, minimal acknowledgement of historical and cultural significance - heritage structures and cairn currently inconspicuous	No change	Opportunity to re-plant landscape with native flora, promote historical and cultural significane with educational information boards and relocate cairn to more prominent site	N/A	N/A
Summary of Benefits			**Summary of Monetised Option benefits and costs**			
Monetised benefits provide return on investment, albeit not with a strong BCR. Option enables a wider project's benefits to be realised (WATN Stage 2 Arthurs Point to Queenstown) and contributes to broader programme mode shift and travel choice objectives. WEBs provided through cultural, historical and environmental enhancements and potentially through addition of route to NZ Cycle Trail.			**Total monetised benefits (no WEBs)**	$10.4M (including AP-QT route)		
			Total monetised costs	$9.7M (including AP-QT route)		
			BCR (no WEBs)	1.1		
Rationale for selecting preferred option The preferred option was chosen as the only feasible way of providing safe active mode access across the Shotover River in the short term (as per Investment Objectives). It was also preferred over, for example, adding active modes to a new road bridge due to its lower cost and more direct alignment with gentler gradients.						

Figure 37 Appraisal Summary Table

9 FINANCIAL CASE

This section outlines the financial affordability of the proposal, the funding arrangements and outlines possible funding sources. Resources available between project partners have been discussed at a high level.

This part of the financial case provides assurance that the recommended option, with particular focus on the preferred way forward, are affordable to the sponsoring organisations.

The financial case for the project is predicated on the basis that funding partners' financial constraints (Section 9.6 Financial Risk and Opportunity) are not insurmountable, and that by delaying Stage 2 while prioritising investment in active modes, the project is affordable and can be delivered. This approach provides ample lead-in time to prepare and allocate funding for the road component when needed.

9.1 Project Delivery Costs

As described in Section 6 Recommended Option, the project will be delivered in two stages:

- Stage 1: A new walking and cycling bridge approximately 400m downstream from the existing Edith Cavell bridge, with connecting trail between Atley Road and the old Arthurs Point Pub car park. This is proposed to be implemented in 2021/22
- Stage 2: A new 2-lane road bridge approximately 100m downstream from the existing Edith Cavell Bridge. The existing Edith Cavell Bridge is to be converted to active modes when the new road bridge is in place. This is proposed to be implemented after 2031

The active mode bridge is planned to be delivered over the next two years, utilising funding from QLDC's Long Term Plan (2021-2031) for pre-implementation and implementation, as well as the current RLTP/NLTP period (2018-2021) for pre-implementation and the next RLTP/NLTP period (2021-2024) for implementation. It is noted that the Investment Prioritisation Method for the 2021-24 NLTP period states that the walking and cycling activity class has a $2m threshold for low cost, low risk programmes.

Project delivery costs for property, pre-implementation and implementation presented in Table 24 are based on the cost estimates for each project element detailed in Appendix A2. Costs include administration, management, planning, property design, designation, construction and MSQA. The cost estimate has been developed under Waka Kotahi's Cost Estimation Manual (SM014) using the elemental cost database, recent similar projects and professional experience.

Table 24: Summary of estimated financial costs of 2-lane road bridge and active mode bridge.

Summary of estimated financial costs	2020/21	2021/22	2031/32	2032/33
	Stage 1		Stage 2	
Net Project Property Cost (P50)	**$ 375,100**		**$ 1,778,600**	
Pre-implementation phase (P50)	**$ 277,000**		**$ 1,414,500**	
Implementation phase (P50)	**-**	**$1,621,000**	**-**	**$15,379,000**
TOTAL	**$652,100**	**$1,621,000**	**$3,193,100**	**$15,379,000**
	$2,273,100		**$18,572,100**	

In addition to the costs, QLDC will be responsible for funding ongoing maintenance of the existing bridge and the update to the business case prior to pre-implementation of Stage 2 in 2031. Interim traffic control measures such as signals may also be required (refer to Section 11.4 Project Staging Triggers), which QLDC would be responsible for funding. These costs are summarised below:

- Maintenance of Edith Cavell bridge
    - $50,000 every 15 years for concrete repairs
    - $1,000 per year for general maintenance
- Update of Business Case for Stage 2 (refer to Section 11.4 Project Staging Triggers)
    - $30,000 in 2030 (or sooner depending on triggers)
- Implementation of signals on Edith Cavell bridge (refer to Section 11.4 Project Staging Triggers)
    - $400,000

The following assumptions have been used to develop the cost and assess affordability of the preferred option. These assumptions are typical for those used in the suite of current business cases being progressed through the Way to Go partnership.

Table 25: Summary of financial assumptions.

Financial and cost assumptions	Comments
Lead Delivery Agency – Queenstown Lakes District Council (QLDC)	QLDC is the client for this business case and the road controlling authority for the proposed interventions.
Investment and Funding – QLDC and Waka Kotahi	Proposed interventions will be part of the general roading and walking and cycling infrastructure improvements owned and managed by QLDC. QLDC is able to apply for co-investment from Waka Kotahi using the Financial Assistance Rate (FAR) at the time of application. The current FAR for QLDC is 51%; that is, Waka Kotahi will co-invest 51% of the agreed cost and QLDC through its local share will contribute 49% of the agreed cost.
Active mode bridge – 2021-2022	The active mode bridge is recommended for construction over the 2021-2022 period. A funding application from QLDC to Waka Kotahi will need to be initiated after the completion of the Arthurs Point Crossing business case to secure appropriate co-investment. It is understood that the NLTF, from which Waka Kotahi investment will be allocated from, has budget to support an application in the 2018 – 2021 NLTP. Deferring the application would push the allocation into the next NLTP funding period and it is understood that the walking and cycling work category is oversubscribed nationally and co-investment may therefore be much more difficult to secure.
New 2-lane road bridge – 2031-2032	The new road bridge is indicatively programmed into the 2031 – 2032 financial year which will coincide with the 2031-2034 LTP and 2030 – 2033 RLTP/NLTP period. Prior to applying for co-investment of the road bridge, additional cost refinement and value engineering is recommended.
Investment proposal scope – New 2-lane road bridge and Walking & Cycling (active mode) bridge	The recommended option package includes: 2 – lane road bridge: – A deferred new two-lane road bridge to be implemented in the 2031-2034 LTP and 2030-2033 period – Location: approximately 100m downstream (closer towards Queenstown) from the existing Edith Cavell bridge – Two-lane, two-way partially curved structure approximately 80m in length (between abutments) with 3.5m wide lanes

	1.5m wide shoulders and 0.5m wide TL-5 barriers on both sides Walking & Cycling (active mode) bridge: – A separate active modes bridge to be implemented in 2021/2022 – Location: approximately 400m downstream from the existing Edith Cavell bridge – Bridge will connect trails tying in around the old Arthurs Point pub car park to the south and Atley Road to the north. – The walking and cycling bridge will be 2.5m wide and approximately 65m long The walking and cycling trail is Grade 2 and 2.5m in width to allow for side by side riding, except for localised narrowing to cater for obstacles such as the protected trees in the vicinity of McChesney Road.

9.2 Ongoing maintenance and operations costs

Maintenance costs for the Preferred Programme are identified below based on the following assumptions:

The active mode bridge is likely to require the decking replaced at the end of the 40-year period and the cost of this is estimated to be $50,000.

The two-lane vehicular bridge will be maintained in the way of a resurfacing every 20 years, at a cost estimated to be $160,000/20-year period based on maintenance schedules of similar bridges.

For a span of 40 years, this equates to an undiscounted cost of $320,000.

9.3 Project revenues

There are no project revenues expected as an outcome of implementing the active modes bridge or replacing the vehicular bridge.

9.4 Funding options

Funding has been approved for pre-implementation of the Wakatipu Active Travel Network (WATN) activity (which has already been tendered), including the Arthurs Point to Queenstown route. A snapshot of phase budgets from Waka Kotahi's Transport Investment Online (TIO) is given in Figure 38.

Detailed design for WATN Stage 2 is due in April 2021 and pre-implementation is scheduled to be complete in May 2021. The recommended approach is therefore to incorporate pre-implementation of APC Stage 1 into WATN Stage 2 (refer to 10.1 Implementation Strategy). Given the relative simplicity and cost of APC Stage 1 (circa $2M), implementation funding could also be sought from existing WATN budgets with appropriate reprioritisation of individual activities, or listed as a separate implementation phase within the overall programme.

Phases Summary

Phase	Status	Last Review	20/21 FAR	Total Budget	Start	Final	Activity Listing Tab
Pre-implementation*	Funding Approved	Cash flow adjustment approved	51	2,393,397	2019/20	2020/21	Approved
Implementation	Included in NLTP 2018-21			3,730,811	2023/24	2023/24	Not Yet Approved
Detailed Business Case	Included in NLTP 2018-21			400,000	2018/19	2018/19	Not Yet Approved
Implementation	Draft			1,462,961	2023/24	2023/24	Not Yet Approved
Implementation	Draft			7,674,414	2023/24	2023/24	Not Yet Approved
Implementation	Draft			3,911,099	2023/24	2023/24	Not Yet Approved
			Total budget:	**19,572,682**			

Figure 38 TIO Phase Summary for Wakatipu Active Travel Network Activity (as at 28 July 2020)

The WATN Arthurs Point to Queenstown route will need a crossing of the Shotover River to be in place to attract users to the route (and thereby achieve economic benefits), and vice versa. That is, in isolation neither project would achieve its respective objectives. There is therefore a risk that the benefits associated with the funding already committed for the WATN Stage 2 activity will not be realised if not supplemented by the Arthurs Point Crossing. The broader benefits of the Arthurs Point Route are therefore contingent on funding and implementation being approved for the crossing, and vice versa.

Given the interdependency between these projects, it is recommended that the APC project's active modes component is incorporated into the WATN Stage 2 project. There is a risk that delayed approval would lead to this opportunity being missed due to constraints on the 21-24 National Land Transport Fund (NLTF) (refer to 9.6 Financial Risk and Opportunity).

There are therefore two investment streams identified and recommended for the full Recommended Option. The investment streams comprise capital expenditure from QLDC and co-investment from Waka Kotahi.

The QLDC component is assumed to be 49% of the total investment, referred to as local share. The Waka Kotahi investment is assumed to be the standard Funding Assistance Rate (FAR) of 51% of the total cost and is expected to be funded from the NLTF.

Each organisation has its own set of requirements to qualify for funding and the first step is the inclusion or naming of the proposed investment in their respective future planning budgets. For QLDC, the activity is listed in its Long Term Plan (LTP) for 21/22 and 22/23. For Waka Kotahi, the activity will need to be included in the National Land Transport Program (NLTP).

The recommended approach to funding the APC Stage 2 is therefore:

1. Request its inclusion as an addition to the committed **pre-implementation** phase of WATN Stage 2 via a Cost Scope Adjustment (CSA), such that Waka Kotahi increase funding to allow for the active modes bridge and connecting trail, under the walking and cycling improvements activity class.
2. Request funding for the **implementation** phase of both the WATN Stage 2 Arthurs Point to Queenstown route and the Arthurs Point Crossing active mode bridge jointly as a single project.
3. Revisit the business case to confirm the case for APC Stage 2 for pre-implementation in QLDC's 2031 Long Term Plan and the 2030-2033 NLTP period.

The proposed funding option is summarised in Table 26 below.

Table 26: Summary of funding options

Element	Lead Organisation	Activity Class	Funding assumptions
Stage 1	QLDC	Walking and cycling improvements	QLDC (local share, 49% + Waka Kotahi NLTF, 51%)
Stage 2	QLDC	Local road, regional and state highway improvements	QLDC (local share, 49% + Waka Kotahi NLTF, 51%)

9.5 Alternative funding sources

Suitable alternative funding sources have not been secured for this activity. Several were identified and investigated early in the project but were ruled out. Those sources identified and investigated are noted below.

Queenstown Trails Trust

The trails trust is a charity committed to developing and supporting additional connections to the existing network of recreational trails supporting commuter and recreational walking and cycling, making it easy to walk and ride in Queenstown. The Arthur's Point crossing will serve as a strategic link connecting Arthur's Point to Queenstown, providing a commuter route that previously didn't exist. QTT have also stated that the APC project would enable a 'canyon loop' that would be a 'jewel in the crown' of Queenstown's trails, the other half of which they would seek to construct. Furthermore, the Trails Trust is currently actively involved in developing, maintaining and promoting trails that will connect to the proposed Arthurs Point Crossing walking and cycling bridge, such as the Arthurs Point to Tuckers Beach trail.

Proposed Visitor Levy

QLDC have proposed a Visitor Levy of 5% applied to the cost of all short term accommodation in Queenstown. The intention of the collected funds is to reinvest within the Queenstown Lakes District, offsetting the capital investment in infrastructure required to continue to support the growing population and demands on the small ratepayer base. The visitor levy, although initially supported regionally, is yet to be enacted and the recent downturn in visitor numbers as a result of COVID-19 means it is unlikely to be supported in the short term. Regardless, the levy is yet to be implemented and therefore this option is not yet available.

Tourism Infrastructure Fund

Through the Tourism Infrastructure Fund (TIF), the Ministry of Business, Innovation and Employment provides up to $25 million annually to develop tourism-related infrastructure that supports regions facing pressure from tourism growth. The fund was initially considered as a source for the APC project but dismissed as a result of Round Five being postponed until further notice due to the Covid-19 pandemic. A successful application to the TIF is considered more likely for the wider 'canyon loop' prospect as this will be less commuter-driven and more focussed on recreation and tourism.

9.6 Financial Risk and Opportunity

Both QLDC and Waka Kotahi are currently operating in a constrained funding environment. QLDC have been doubly impacted by a reduction in revenue (reduced residential rates, business rates and airport revenue caused by the Covid-19 pandemic) and increase in capital costs for the local share of the New Zealand Upgrade Programme and Covid-19 Economic Response packages. Meanwhile, NLTP funding is constrained due to a large forward workload throughout the country and the impact of Covid-19 on central Government budgets. The Walking and Cycling activity class is oversubscribed for 2021-24, making funding unlikely for that period.

This risk can be mitigated by incorporating APC Stage 1 into the already-funded the pre-implementation phase of WATN Stage 2 as a Cost Scope Adjustment. This will provide efficiencies between the two projects and would make the project eligible for implementation funding in the following period. It would also enable QLDC to re-prioritise projects within the WATN activity

Additionally, although QLDC funding constraints represent a risk, the QLDC Long Term Plan Steering Committee have agreed to the local share of costs for APC Stage 1.

There is understood to be a significant underspend of the Walking and Cycling activity class budget for the current period (2018-2021), which could be capitalised on if the project can be confirmed as ready for implementation in this period. However, even under an accelerated programme, APC Stage 1 is unlikely to be delivered in the current period due to timeframes for property acquisition and consenting. Additionally, Waka Kotahi are reluctant to commit more funding to projects that may not be delivered and could stretch resources in the next period.

Identifying the need for the new 2-lane vehicle bridge now presents an opportunity to plan and set aside funding in advance. The investment proposal will need to be revisited and assessed based on the priority and funding requirements at the time. However, early identification of the need for investment in the future provides time to plan and allocate funding.

PART B – READINESS AND ASSURANCE

10 COMMERCIAL CASE

Through the business case process, the project has morphed into a two-stage scheme. The recommended option is a new walking and cycling bridge and trail to be implemented in 2021 as part of the Wakatipu Active Travel Network Stage 2 project, followed by a new road bridge beyond 2031.

Stage 1 could be taken through pre-implementation and implementation in isolation but incorporating with WATN Stage 2 will provide substantial efficiencies. It is acknowledged that the timeframes set out below pose a risk to programme in terms of getting approvals in time. However, as the crux of the WATN Stage 2 Arthurs Point to Queenstown route, it is recommended that pre-implementation of that project be delayed if necessary to accommodate APC Stage 1, which the project manager of WATN Stage 2 has indicated is feasible. Given the discrete nature of the two projects, it is not considered a problem to have the two projects finish pre-implementation at different times.

10.1 Implementation Strategy

A summary of the recommended approach to implementation is given below:

1. QLDC and Waka Kotahi endorse the SSBC and approve funding for pre-implementation of APC Stage 1 at the Business Case and Funding Decisions Delegations Committee in **early 2021**
2. The pre-implementation phase of APC Stage 1 is added to the scope of WATN Stage 2 as a Cost Scope Adjustment. WATN Stage 2 is scheduled to complete detailed design in **April 2021** and pre-implementation in **May 2021**. However, property acquisition negotiations for APC may take up to 6 months, which could delay completion of pre-implementation (risk mitigations are presented in 7.4.6 Project Delivery Risks). APC Stage 1 is expected to be complete by June 2021 at the latest.
3. As part of pre-implementation of APC Stage 1, geotechnical investigations and topographical survey will be completed. These technical investigations should be carried out for the APC Stage 2 scope concurrently to confirm the appropriateness of the Recommended Option alignment.
4. Following confirmation of the Recommended Option alignment, property acquisition and designation is undertaken for APC Stage 1; property acquisition is completed and applications for statutory approvals and designations are jointly submitted for WATN Stage 2 and APC Stage 1 **mid-2021**.
5. WATN Stage 2 (now including APC Stage 1) goes to Waka Kotahi Business Case and Funding Decisions Delegations Committee for funding approval to proceed to Implementation.
6. WATN Stage 2 and APC Stage 1 are implemented as one project in **2021/2022**. If funding is not approved for implementation of the full WATN Arthurs Point to Queenstown route, APC Stage 1 is implemented with interventions for key gaps on the route funded through Low Cost Low Risk budgets.
7. The business case for APC Stage 2 is revisited to reconfirm the economic case with updated traffic data as well as the strategic justification for investment (including end-of-life assessment and confirmation of resilience strategy) in 2030/31 or earlier as indicated by triggers (refer 11.4 Project Staging Triggers).
8. APC Stage 2 is taken through pre-implementation in 2031/2, subject to approval of the business case update and funding availability
9. APC Stage 2 is taken through implementation in 2032/33

10.2 Procurement Strategy

The proposed Procurement Strategy follows the Queenstown Lakes District Council (QLDC) Procurement Policy and Guidelines (adopted by Council on 6 October 2016) (latest). It is noted that Council are currently reviewing the Procurement Policy & Procurement Guidelines as per the report to the Audit, Finance and Risk

Committee meeting on 2 July 2020, with the new policy expected to be adopted in December 2020 (following this business case).

The Strategy also follows the Waka Kotahi NZ Transport Agency Procurement Manual as it is expected that this activity will be wholly or partly funded through the National Land Transport Fund. The QLDC Procurement Guidelines state that "All procurement activities in relation to roading should comply with the NZTA (sic) requirements…". For the purposes of this Procurement Strategy it's considered that "roading" relates to "transport" and covers the proposed active travel elements.

As the new road crossing is recommended to be deferred until the next QLDC Long Term Plan (2031-2041) and beyond the next two National Land Transport Plan (NLTP) periods, it does not form part of this Procurement Strategy. A Procurement Strategy will be developed at the time it is progressed under the relevant policies and guidelines at that time (the approach to procurement could change drastically over 10 years due to changes in policies, construction methodologies, costs and assumptions).

However, the scale, cost ($18.6M), low complexity and risk for design and construction of the road bridge (relative to bigger programmes of infrastructure works that necessitate more complex contract types) are best suited to pre-implementation and implementation phases being procured through the Price Quality Method (PQM). A recent example of this is the SH8 Beaumont Bridge, which is estimated at $16.8M and has been procured through PQM. Early contractor involvement is recommended to avoid constructability risks through implementation posed by the Shotover gorge's challenging construction terrain.

PQM is designed to evaluate tenders when the quality of the supplier is important for successful delivery of the project. In such instances, the client should be prepared to pay a premium for that quality. For a project with a regional and potentially national profile such as this one, PQM is recommended over Lowest Price Conforming as it is less likely to lead to issues and variations through the course of the project. PQM also enables the client to determine the premium they are willing to pay for each tenderer and encourages innovation as a differentiator between bids.

The next phase of APC Stage 1 being recommended for funding is pre-implementation. The fee estimate value for the pre-implementation phase is $277,000.

APC Stage 1 is proposed to be incorporated as part of Stage 2 of the Active Travel Network, which is currently in the pre-implementation phase. The Arthurs Point Crossing pre-implementation could be added to the Active Travel Stage 2 Pre-Implementation Contract as a Cost Scope Adjustment. This will include procurement of the suspension bridge structure and traffic signals for the crossing on Gorge Road. Standard QLDC and Waka Kotahi procurement procedures should apply as there are no special technical requirements. WATN Stage 2 is likely to be delivered by the Alliance if funding is secured.

The Queenstown Transport Alliance request for proposals are currently being assessed for the design and construction of:

- Queenstown Town Centre Street Upgrades
- Arterials Stage 1
- WATN Stage 1 (Construction Only)
- NZ Upgrade Programme

The Alliance programme is expected to continue through until at least 2024, though there is potential to add other packages of work as funding is secured during this period. The Queenstown Integrated Transport Business Case is currently being finalised for approval by the Waka Kotahi Board. Utilising the Alliance presents opportunity for efficiencies, with a highly qualified and experienced team available to deliver.

The QLDC Project Management Office (PMO) is understood to be prepared to deliver both APC Stage 1 and APC Stage 2. However, the PMO has delivered only water infrastructure projects to date. As such, suitably experienced and qualified engineers should be engaged to provide professional services if this route is taken.

Currently implementation funding for WATN Stage 2 has not been confirmed. Should implementation funding for WATN Stage 2 and APC Stage 1 be confirmed, these could be added to the Queenstown Transport Alliance for design and construction.

10.2.1 Assessment of Contractors

Introduced in 10.2 Procurement Strategy, the Queenstown Transport Alliance (QLDC, Waka Kotahi, Beca, Downer, Fulton Hogan and WSP) established to deliver NZUP and CIP infrastructure programmes presents an

opportunity to utilise a highly qualified and experienced team, available during proposed project implementation to assist with procurement and delivery of infrastructure not regularly built in Queenstown. It is recommended that QLDC use the existing Alliance mechanism to deliver the project.

Alternatively, the area has a healthy market of contractors capable of delivering this scale of project, as demonstrated by ongoing upgrades to the Queenstown Trails network and around the district. Stage 1 is of relatively low complexity with an appropriate construction methodology. Contractors delivering Stage 2 should be pre-qualified under Waka Kotahi's procurement manual to at least bridge construction 3B. There are currently 17 providers qualified to this standard serving the South Island with 3 located in Christchurch, Greymouth and Oamaru.

10.3 Property Strategy

A Property Strategy was developed by QLDC's Property Agent, APL, with inputs from the project team including Land Requirement Plans. The Strategy is presented in Appendix B2. In total, 11 private and government held land parcels have been identified as affected by the project, 6 to enable Stage 1 and 5 to enable Stage 2.

Temporary use of land such as staging, set down areas and access to land to enable construction have not been prescribed at this stage as they will be determined by the contractor during pre-implementation (though high level commentary on construction feasibility is provided in 6.5 Preliminary Design Philosophy). Room is available for these areas between existing road reserve and property to be acquired on the true left side around Atley Road. Temporary property occupation may also be sought during pre-implementation to provide required space depending on the likely construction methodology.

Land Requirement Plans are presented in Appendix B3.

10.4 Consenting Strategy

The project's consenting strategy is presented in Appendix B1 and summarised below:

- Two separate crossing combinations (Options A and B), each comprising a vehicle-only bridge plus an active-travel bridge, were assessed.
- Both options require a number of resource consents from the territorial authority (QLDC) and one from the regional authority (ORC) as well as concessions from the Department of Conservation.
- It is possible to gain planning approval for the preferred crossing combination via either the resource consent process or the designation process.
- It is recommended that the designation process be pursued. This is because the designation process offers opportunities for enhanced efficiencies and consolidates all the separate components of the project into a whole. Attempting to obtain multiple resource consents risks fragmenting the project, resulting in disjointed assessment and greater potential for time delays.
    - As noted in 7.4.3 Statutory requirements, it is recommended that geotechnical testing be completed to confirm the proposed alignment prior to designations being sought
    - Alternatively, an advance designation could be placed over the land to protect it from other potential activities. This would require another designation process later and the consenting authority will need to be made aware when processing the later consent. Given the long timeframe until delivery, this is not considered to be necessary
- Thorough and comprehensive community and iwi consultation will be required prior to and during the formal planning process.

Various technical assessments will be required to support a planning application, including ecological, heritage and geotechnical reports.

10.5 Risk Allocation and Transfer

Project risks will fall on different owners depending on the procurement and delivery models chosen for each phase of each project stage.

10.5.1 Stage 1

Pre-implementation of the walking and cycling component of the project is anticipated to be incorporated as a Cost Scope Adjustment into WATN Stage 2 (refer 10.1 Implementation Strategy), which has already been tendered. As such, technical risks associated with obtaining statutory approvals will sit with the professional services provider awarded that contract. As the lead organisation, cost, detailed design and implementation risks will sit with QLDC, though these may be allocated otherwise according to the delivery method chosen. Programme risks for the period between business case submission and commencement of pre-implementation will also sit with QLDC.

10.5.2 Stage 2

As described in 10.2 Procurement Strategy, the roading component of the project is expected to be procured using the Price Quality Method. If QLDC wishes to transfer risk on the project to the contractor, it should be let using a Design and Build type contract, though this will reduce the amount of control they retain over the outcomes. A traditional contract type would enable QLDC to retain more control, but they would also need to procure advice from suitably qualified and experienced engineers, as well as other required professional services. Early contractor involvement will also reduce the risk of constructability issues in implementation.

11 MANAGEMENT CASE

This section sets out ongoing roles and responsibilities to ensure the successful delivery of intended outcomes by presenting a governance structure, the approach to risk management and a benefits realisation plan. Integral to the project is the longevity of the heritage listed Edith Cavell Bridge; this section also presents a summary of the Bridge Conservation Management Plan developed for the project.

The business case has been developed under Way to Go (W2G) which is a collaborative partnership between Queenstown Lakes District Council, Otago Regional Council and Waka Kotahi. Way to Go is, "*a collaborative partnership committed to working together to provide an enduring, affordable, safe transport system, which will provide transport choice.*"

11.1 Governance structure

Way to Go provides high level governance oversight for a broad programme of transport improvements in the Queenstown District, including the Arthurs Point Crossing SSBC. QLDC are the lead client organisation for the project. Figure 39 demonstrates the partner membership.

Figure 39: Partner membership

The three partners each have representation at the governance and management levels as demonstrated in Table 27. Way to Go also has its own staff, including a Programme Director and Programme Coordinator. It should be noted that Iwi (Ngai Tahu and Kai Tahu, represented by Aukaha and Te Ao Marama) are also project partners.

Table 27: Way to Go management structure

Organisation	Governance	Management
QUEENSTOWN LAKES DISTRICT COUNCIL	Peter Hansby	Tony Pickard
WAKA KOTAHI NZ TRANSPORT AGENCY	Kesh Keshaboina	Tony Sizemore
Otago Regional Council	Gavin Palmer	Garry Maloney

The Way to Go management structure applies to the Arthurs Point Crossing through to the completion of the business case, at which point the management and responsibility of the programme devolves to the appropriate road controlling authority, which in this case is QLDC. Funding will require approved by QLDC's Programme Control Group. The Transport Strategy Manager at QLDC is the project sponsor and leads the project up to pre-implementation. At this point, QLDC's Project Management Office will be responsible for delivering pre-implementation and implementation. QLDC Operations and Maintenance will be then be responsible for ongoing management of the completed assets.

11.2 Delivery of the Recommended Option Summary

The Recommended Option is currently unfunded, though QLDC's Long Term Plan Steering Committee have agreed in principle to funding for APC Stage 1 in the first two years of the 2021-2031 LTP. Funding for the remainder of the project will be sought from the 2021-2031 LTP and the NLTF.

SCOPE	PHASE	LEAD ORGANISATION	FUNDING	PROGRAMME
Stage 1 (Active modes)	Subject to approval in NLTP for pre-implementation, then implementation	QLDC	Local share agreed, standard FAR to be sought from NLTF	Pre-implementation commencing early 2021; implementation in 2021/22
Stage 2 (Road)	Defer until next Long Term Plan period (2031)	QLDC	Not approved, to be sought from LTP and standard FAR from NLTF	Revisit business case to determine condition of asset (whether nearing end of life), re-assess against QLDC's policy on resilience (when updated) and confirm traffic growth projections

11.3 Roles and Responsibilities

The project is entirely focussed on local roads and there are no state highways or public transport service elements. As such, QLDC will hold the primary responsibility for leadership & governance, planning & design, consenting, land acquisition, pre-implementation, implementation, maintenance & operation and benefits monitoring for the project.

As with other traffic signals in Queenstown, operation of the signalised crossing on Gorge Road is expected to be managed by the Wellington Traffic Operations Centre (WTOC), which itself is managed by a partnership including Waka Kotahi.

11.4 Project Staging Triggers

11.4.1 Stage 1

APC Stage 1 (active modes) was found to have an immediate need for investment as an enabling project for the WATN Stage 2 Arthurs Point to Queenstown route. Community engagement also highlighted strong demand for pedestrian and cycling facilities over the Shotover river in the short term.

11.4.2 Stage 2

APC Stage 2 (roading) was found to have a strong economic case, but weak strategic case, and current funding constraints mean it is unlikely to be prioritised. At the time of writing, the remaining design life of the bridge is estimated at 20 years with maintenance costs currently well below replacement costs, meaning an 'end of life' case for investment is still some time away. Traffic volumes and delays are not forecast to grow sufficiently to warrant investment in a new bridge for travel time reliability benefits alone. Resilience of the existing structure is also acknowledged to be a problem, but funding partners' existing strategies do not support a case for investment. Ongoing monitoring will be important to establish the case for investment in the next Long Term Plan period.

The triggers for investment will be:

1. the existing bridge reaching the end of its useful life (the point at which ongoing maintenance exceeds the cost of replacing it);
2. traffic volumes increasing to the extent that delays and queues (average day or network events) become unacceptable to QLDC and the community (assumed to be LOS F for the overall crossing in this business case); and/or

3. a need to improve resilience of infrastructure being established in policies and strategies.

QLDC's Long Term Plan 2031-2041 is an administrative trigger for the project as the next realistic horizon for funding availability at the scale of investment required for the road bridge. Completion of an infrastructure resilience strategy as part of the LTP may also necessitate investment in the crossing.

The business case should be updated when monitoring identifies that these triggers are being reached, or to enable investment in the next Long Term Plan (i.e. by 2031), whichever comes first. It is anticipated that at least 2 triggers will need to be met before the case for investment is sufficiently strong. The strategic case should be updated to confirm that the triggers identified above still warrant investment. In particular, full seismic and load assessments of the existing bridge will be required to ascertain a precise design life while the economic case should be updated based on current traffic volumes, delays, queues and costs, to reconfirm there are sufficient benefits to justify investment.

If through monitoring it transpires that only trigger 2 (traffic delays and queues) is realised, there may be a case for investing in interim traffic management measures such as traffic signals. As a relatively low cost intervention (less than $400,000), this could occur outside of the business case process. However, signals should be considered in the context of the full project lifecycle, in that benefits provided by signals would be short-lived if the full road bridge was implemented quickly thereafter. In this case, signals would be a sunk cost. Even with increasing volumes in the peak hours, there may not be an economic case for signals due to disbenefits in the off-peak. There will therefore likely need to be alternative justification through strategic objectives, community support and political will.

Traffic modelling indicates that signals would be required by 2028, assuming the forecast demand set materialises. However, the Covid-19 pandemic has effectively moved growth back 3 years (refer to 1.7 Covid-19 Impacts), indicating that signals may not be required until 2031, when the new road bridge is earmarked to be revisited. Additionally, operation of the bridge is highly sensitive to travel patterns as different directional demands have a big influence on priority give way behaviours. It is therefore recommended that funding partners take an agile approach to signals and implement as necessary based on data from ongoing monitoring.

11.5 Assurance and Acceptance

Due to the staging of the recommended option, with the more expensive road bridge component being deferred for two NLTP periods, it was agreed that an external peer review of the business case was not required. Internal review has been undertaken by Way to Go partners by planning, investment, operations, Investment Quality Assurance and walking and cycling practitioners.

Additionally, a peer review of the Queenstown Tracks Strategic Model, which was used to inform economic assessment of APC Stage 2, was undertaken by Ian Clark of Flow Transportation Specialists for the Queenstown Transport Business Case.

Assurance deliverables for remaining project stages are summarised in

Table 28 Remaining Investment Assurance Deliverables

DELIVERABLE	DESCRIPTION
Funding	Internal technical and funding approvals in LTP and NLTP
Safety Audit	Audit to be completed on detailed design at pre-implementation (Stage 1 anticipated to occur alongside WATN AP-QT route) Post-construction safety audit to be completed following implementation
Traffic Signals Operation Audit	WTOC to audit signal operation in detailed design
Property Acquisition	QLDC internal approvals of acquisition for Stage 1 and Stage 2
Detailed Design	Internal QLDC approvals of design standards used
Cost Estimate Peer Review	Potential for independent peer review of cost estimates at pre-implementation

Construction	Internal QLDC procurement and contracting procedure to be followed with appropriate approvals
MSQA	Independent external provider to provide quality assurance throughout construction

11.6 Change Control

At the outset of each phase for each individual project it is critical that the scope of work is clearly defined and agreed between the project partners and between the client and consultant/contractor. This will enable the clear identification of change during the project development, ideally before it impacts.

Any change in the scope of the project is to be managed by the project manager and reported through to the project governance if it is at a significant level (to be determined by the governance group). It is recommended that a change control register is established for each project and across the programme to ensure that interdependencies of change are managed appropriately. Change will be managed within an understanding of the tolerances of the project (related to funding, scope, risk, quality and benefits).

The change control register will sit alongside the risk register and should be managed by the project manager. Any risk that impacts will likely result in a change in the project, and will result in an adjustment of cost, programme or quality that will be subject to approval by the programme governance.

11.7 Monitoring Plan

QLDC will monitor benefit realisation and the effectiveness of the project against the Investment Objectives through their transport portfolio monitoring programme. Monitoring on a six-monthly basis for key indicators is considered appropriate as longer intervals may not identify issues to be remedied in a timely manner while briefer timeframes may be too short for travel behaviour change to manifest itself. A proposed monitoring plan is shown in Table 29.

Table 29 Benefits Monitoring Plan

	MEASURE	BASELINE	TARGET
KPI1: Increased travel by active modes	**Number of pedestrians and cyclists crossing the Shotover River.** Eco-counters used on the Queenstown Trail network are recommended to be implemented on the bridge to monitor use. Counts can be displayed in real-time, incorporated with signage on the route. Units cost between $3,000 and $10,000. Alternatively, cyclist tube counts could be implemented for 2 weeks on 6 monthly cycles	Currently assumed to be less than 10 per day due to absence of facilities and availability of data*	Forecasts in the WATN SSBC are for 900 cyclists on the Arthurs Point to Queenstown route by 2029. Achieving this target is dependent on the full route being implemented
	Mode shift from private vehicles. This can be monitored through the bi-annual Modal Shift Surveys commissioned by QLDC	Current mode share on Gorge Road measured at 3%	The QITPBC set a target of 30% by public transport and active modes by 2024. An active mode share of 10% is considered achievable
KPI2: Improved route and network resilience	**Appropriate capacity in the event of system disruption.** Google Maps is a simple passive way of monitoring the impact of network shocks in real time. Queenstown's network of Bliptrack Bluetooth sensors could also be expanded to include the Arthurs Point route. Additional sensors, including installation, ongoing power and communications are estimated at $10,000 per unit	Delays of 50 minutes observed at the crossing following the closure of SH6A in	Once the new road bridge is built, there should be no delays on the bridge in the event of a closure on SH6A. There should also be no instances where the

		January 2020	bridge is not usable following an earthquake
KPI3: Improved route reliability	**Difference between average travel time A and average travel time B.** Additional permanent Bliptrack sensors on the Arthurs Point route would be required for true continuous monitoring. Alternatively, a commercial license to use TomTom data would provide similar coverage or six-monthly floating car surveys would provide snapshot reliability data.	Abley travel time surveys in January 2019 measured 40s delay at 85%ile volumes	Once the new road bridge is built, there should be no delays on the bridge
	Coefficient of variation. As above, would require travel time data monitoring	Abley travel time surveys in January 2019 measured a coefficient of variation of 0.085	Accounting for random speed variability and outliers, there should be a coefficient of variation no worse than 0.04 when the bridge is built

*at the project initiation meeting it was agreed that no updated traffic data would be collected due to atypical demands as a result of the Covid-19 pandemic, as well as difficulty getting to site during Level 4 lockdown

The total cost to QLDC above and beyond the current monitoring plan is estimated at $15,000 over the life of the project (new Bluetooth sensor and ongoing operation & maintenance plus new cyclist/pedestrian counter and ongoing operation & maintenance).

11.8 Risk Mitigation

A comprehensive Risk Register with 56 project risks and opportunities is presented in Appendix A5. Risks with the 5 highest residual risk scores are summarised in Table 7. While having lower residual risk score, the time required to successfully complete property acquisition and receive statutory approvals should be noted as posing a key risk, in that it could delay completion of pre-implementation for WATN Stage 2. However, the risk has been mitigated through liaison with project managers, who have indicated that WATN Stage 2 and APC Stage 1 can progress on different timeframes with minimal impact on delivery.

Table 30 Top 5 Project Risks (from Risk Register)

Risk Title	Description/ Cause/ Consequence	Established Controls	Consequence	Likelihood	Risk Score
Construction in challenging terrain	Description and Cause: Challenging topography, constraints or logistics of transporting material and precast/prefabricated element makes constructability difficult. Minimal site investigations undertaken at SSBC phase. Consequence: Health and safety of contractors, high cost, difficult to manage traffic.	- Constructability has been considered during business case option development and design philosophy statement for construction methodology - Safety in Design through business case - Early involvement, with a suitably qualified contractor, in next phases.	Very High	Medium	23

Earthquake	Description and Cause: Earthquake damages existing bridge prior to implementation of future two-lane crossing. This Existing Asset Condition report showed the extending bridge could not withstand a significant seismic event. Consequence: No vehicle crossing over the Shotover River. Users must travel via Speargrass Flat and SH6/SH6a. Potential rush to construct new crossing. Could take up to 5 years to complete replacement crossing. Reputation risk and cost increase for fast tracked delivery.	Consider seismic strengthening on Edith Cavell prior to opening of new two-lane crossing.	Very High	Low	20
Bridge Manual changes	Description: Change in design standards. Bridge is a large proportion of the cost estimate. Consequence: Preferred option requires re-design (Cost Estimate is under-estimated).	Build appropriate contingency into cost estimate. To be assessed at next phase of design.	High	Medium	19
Change in design guidelines and consenting requirements	Description and Cause: Due to funding constraints it is likely the road bridge will not be constructed for 10 years after delivery of the business case. In this time design and consenting requirements may change. Consequence: Project delays and additional costs to meet new requirements.	Build appropriate contingency into cost estimate	High	Medium	19
Ecology	Description and Cause: No Ecology report was completed during business case phase. There is a risk that unknown flora or fauna may exist in the project area that require protection and/or relocation. Consequence: Time delays / Further Cost.	Ecology report to be carried out during pre-implementation	High	Medium	19

The implementation stage of the project has more risks associated with Safety in Design and construction in a challenging environment.

11.9 Contract and Cost Management Plan

As pre-implementation and implementation of the Arthurs Point Crossing project is proposed to be delivered with the Wakatipu Active Travel Network Stage 2 project, contract and cost management should be as proposed for that project, subject to agreement from W2G.

As a minimum, Waka Kotahi's Cost Estimation Manual (SM014) guidance on scope and cost management should be adopted for both stages of the project. It is critical that project scope is clearly defined at the start of each phase.

Cost estimates for both Stage 1 and Stage 2 have been developed using scheme level design; it is therefore likely that costs will change through the next phases as more detailed information becomes available, such as

geotechnical testing results and topographical survey. Responsibility for cost management sits with the Programme Control Group as project governance.

To enable appropriate management throughout the project lifecycle, QLDC will require as a minimum from contractors and consultants working on the project:

- Budgeted cash flows
- Value of work completed in preceding month and contract to date
- Forecast value of work completed and revised cashflow through to project completion

11.10 Existing Bridge Conservation

Part of QLDC's responsibility as the owner of the heritage-listed Edith Cavell bridge is to carry out appropriate treatment and maintenance of the structure. The bridge is currently in average - poor condition and requires both remedial work and general maintenance. Of particular note is the poor drainage system, which has resulted in pooling water to the deck surfaces and widespread staining and moisture damage to the bridge. Extensive microbiological growth was also observed, and weathering of the concrete in exposed areas.

The Conservation Management Plan presented in Appendix B4 explains why the bridge is significant, what that significance is, and how to manage the structure in accordance with that significance. Recommendations of the plan include:

- Investigate options for obtaining grants to carry out further investigation, planning, and conservation works
- Adopt a Cyclical Maintenance Plan
- Carry out repair, reconstruction and removal works as proposed in the plan
- Undertake yearly inspections of the bridge
- Prepare a disaster management plan