Business case for implementation

SH1 Opawa Bridge Replacement

Detailed business case to proceed from initiation to implementation

More information

NZ Transport Agency
Published August 2016

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 from the NZ Transport Agency on request.

APPROVAL

PREPARED BY	REVIEWED BY	PROJECT SPONSOR	SUPPORTED BY	APPROVED BY
Brent Morgan	Matthew Taylor	Frank Porter	Julie Alexander	
Team Leader, Opus International Consultants Ltd	Senior Project Manager, Opus International Consultants Ltd	Highway Manager, Marlborough Roads, Highway and Network Operations	Regional Manager, Planning & Investment	Central Highways Leadership Team, Highway and Network Operations
Date: 30 Aug 2016	Date: 31 Aug 2016	Date: 9 Sept 2016	Date: 9 Sept 2016	Date: 22 Sept 2016

TEMPLATE VERSION

REVISION NUMBER	IMPLEMENTATION DATE	SUMMARY OF REVISION
1	24 June 2016	Project Specific Revision

Contents

Appendices

GLOSSARY OF TERMS

Abbreviation	Term
AEE	Assessment of environmental effects
AO	Approved organisation
BCR	Benefit-cost ratio
CAPEX	Capital expenditure
CBD	Central business district
CEMP	Construction environmental management plan
CVIU	Commercial vehicles investigation unit
D&C	Design and construct
DBC	Detailed Business Case
DE	Design estimate
EEM	Economic evaluation manual
EIR	Environmental impact report
EOI	Expression of interest
EPA	Environmental Protection Agency
FYRR	First year rate of return
GPS	Government Policy Statement
HCV	Heavy commercial vehicle
HNO	Highways and Network Operations
IAP2	International Association for Public Participation
IBC	Indicative Business Case
ILM	Investment logic map
ITS	Intelligent transport systems
KPI	Key performance indicator
LTMA	Land Transport Management Act
MOU	Memorandum of understanding
NES	National environmental standards
NIU	National Infrastructure Unit
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NOR	Notice of requirement
NPC	Net present cost
NZTA (or the Agency)	The New Zealand Transport Agency
NZTS	New Zealand Transport strategy
OPEX	Operating expenditure

P&I	Planning and Investment
PI	Performance Indicator
PPFM	Planning Programming and Funding Manual
PWA	Public Works Act
RAMM	Road Assessment and Maintenance Management
RFP	Request for proposal
RLT	Regional Land Transport
RLTS	Regional Land Transport Strategy
RMA	Resource Management Act
SAR	Scheme assessment report
SE	Scheme estimate
SH(#)	State Highway (number)
SOI	Statement of Intent
SSC	State Services Commission
SSEMP	Site specific environmental management plan
TA	Territorial Authority
TDM	Traffic demand management
TOC	Total outturn cost
VAC	Value Assurance Committee (formerly SSRC)
WEBs	Wider economic benefits

EXECUTIVE SUMMARY

The SH1 Opawa Bridge project is approved by the Government for construction under the Accelerated Regional Roads Package (ARRP). The project was identified to improve the resilience and journey times on SH1 in Marlborough.

The Opawa Bridge is located on the northern edge of Blenheim in a 50km/hr speed zone. It is 170m long and carries 9,800 vehicles/day of which 9% are heavy vehicles. The bridge has a narrow carriageway where larger vehicles cannot pass other on-coming large vehicles, causing frequent delays and uncertain travel times. The bridge structure is vulnerable to damage from seismic and flooding events. The bridge is a Category 1 heritage place, indicating a place of outstanding significance.

The SH1 Opawa Bridge is a key structure on the National Strategic State Highway transport route enabling and supporting the growth of the NZ economy. In particular, the bridge enables freight access to the Port of Picton and the ferry link from the South Island to the North Island. In addition the structure enables a considerable amount of inter-regional traffic. Marlborough is an export-focussed producer of primary products, principally from viticulture, aquaculture, and forestry.

The bridge links not only the State Highway but local communities to the north including Grovetown, Spring Creek and Picton, all of which are commuter townships for Blenheim with work, school, community and sporting links. The bridge forms an important link with these and other smaller communities and rural dwellers for access to the services available in Blenheim.

The Indicative Business Case (IBC) confirmed the actual problems evident and summarised these as two problem statements;

Problem One (70%): Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements, particularly heavy commercial vehicles, creating an out of context environment for a nationally strategic state highway.

Problem Two (30%): Poor Structural Resilience - The bridge offers low seismic resistance, is at risk of bridge pier scouring and is significantly vulnerable to structural collapse.

The IBC identified and assessed a long list of potential options for upgrading or replacing the existing bridge. The selected do-minimum and preferred option for the Opawa Bridge project were:

1. The Do-Minimum option, which involved retaining the existing bridge with its current lane width restriction until it reaches the end of its remaining life, in 25-45 years. The Rough Order Cost of this option was $0.7 Million (including 50% contingency).
2. The preferred option was a new parallel 10.8m two lane bridge with the existing bridge used as a pedestrian and cycle bridge. The Rough Order Cost expected estimate of this option was $16 Million (including 50% contingency) with an Indicative Assessment Profile M/L/L.

The preferred option was assessed has having; lower implementation risks, better cost optimisation, and only slightly higher wider project impacts.

The Transport Agency acknowledged the suitability of the selected preferred option, but the assessment profile of M/L/L, did not meet current parameters under the National Land Transport Fund (NLTF). However funding was subsequently confirmed from the Government ARRP fund.

The proposed bridge will provide an appropriate level of resilience on a strategic route and improve the customer journey experience with decreased travel times and appropriate engineering standards for today resulting in fewer complaints. Together with the existing bridge they provide a holistic transport solution while maintaining heritage values.

Public consultation was undertaken on the content of the IBC in May to June 2016 followed by this Detailed Business Case (DBC). The main finding of the consultation is that approximately 70% of all submitters favour a bypass to a new bridge or a bypass first, then a new bridge. The remaining 30% of submitters generally support the preferred option.

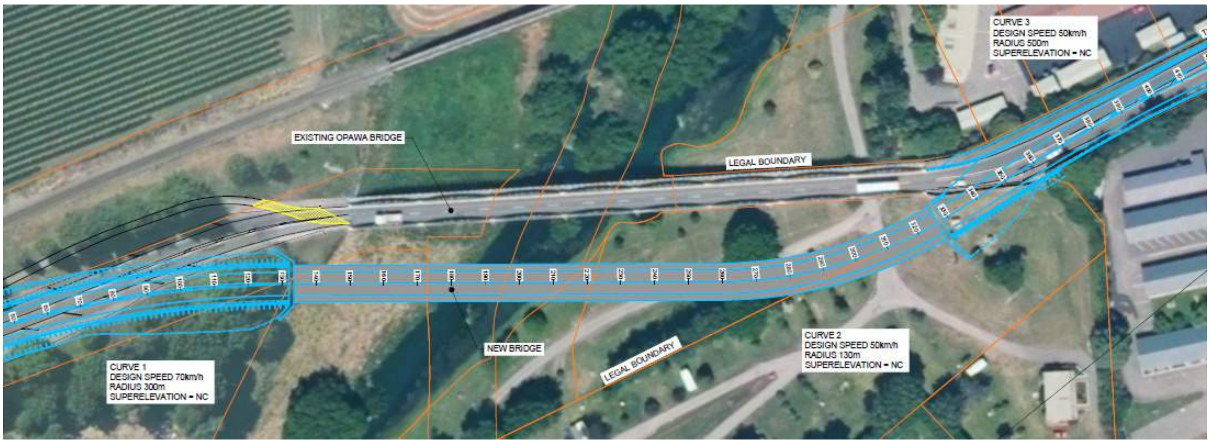
The issue of the Blenheim bypass does not change the need to replace the Opawa Bridge. The bypass remains a future option and will be considered, along with other state highway corridor improvements, as part of the SH 1 Picton to Christchurch investigation. The bypass option does not address the strategic case for this project which still requires a resilient structure that meets the needs of the state highway road users.

As part of the DBC, in order to allow refinement of the preferred option, sub-options for the road alignment were identified as generally consistent with the intent of the preferred option. These sub-options are generic to identify and test horizontal road geometry, structural alternatives, and property impact issues. This has been done to mitigate to the extent possible;

- impacts on property
- the technical complexity, and construction cost of constructing a curved structure verses a straight structure that meets all required design standards
- included a further test on the upstream verses downstream sub-option following the initial assessment in the IBC phase considering the issues above.

Following public engagement on the project and development of this DBC, the preferred option has been confirmed as a new 10.8m wide two lane bridge upstream of the existing heritage bridge which is utilised for walking and cycling in conjunction with the new bridge.

Figure 1: Preferred Alignment



The expected estimate for the project is $15.0M. Significant risks relate to property purchase and resource management consenting approvals impacting on the delivery schedule for the project with the possibility that compulsory property acquisition may be required under the Public Works Act.

This Detailed Business Case recommends the construction of a two lane 180-190m long partially curved bridge, alongside the existing heritage bridge which provides associated walking and cycling facilities on the basis that all work is funded from the Government's ARRP fund. The recommended road alignment is sub-option 8D upstream of the existing bridge, being the preferred alignment that minimises the effect on buildings on neighbouring property.

PART A – THE CASE FOR THE PROJECT

1. BACKGROUND

The State Highway 1 (SH1) Opawa Bridge project is one of several State Highway projects approved for investigation under the Accelerated Regional Roads Package (ARRP) by the Government in June 2014. The project was identified to improve journey times, provide improved resilience, and improve access for High Productivity Motor Vehicles (HPMV) on SH1 in Marlborough.

The Opawa Bridge was constructed in 1917 and is located on the northern edge of Blenheim in a 50 km/hr speed zone. It is 170m long, 5.49m wide between kerbs, and carries 9,800 vehicles/day of which 9% are heavy vehicles. The narrow bridge carriageway does not allow larger vehicles to pass, causing frequent delays, queuing and frustration. In addition, the bridge structure is vulnerable to damage from seismic and flooding events.

The bridge is a Category 1 heritage place, indicating a place of outstanding significance, and therefore is protected under the Awatere RMP and the RMA. Careful consideration needs to be given to managing any change to the heritage place. The Opawa Bridge is one of only seven Category 1 bridges that remain in active use on the state highway network with a further two already being used for off road shared cycling and walkways, following transfer to new owners.

Under a recent Waitangi treaty settlement the name of the Ōpaoa River has been recognised in lieu of the previous European name of Opawa River.

The photographs on the front cover show the bridge details and are described below, in clock wise order, from the top photograph:

- Upstream side view from the south bank of the 8 span bow-string truss bridge with large top cord beams and squat piers
- A driver's view of the narrow 5.49m carriageway with high vertical concrete kerbs and the original horizontal pipe safety rails
- Typical scenario for motorists when heavy commercial vehicles cross the bridge, with vehicle crossing the centreline due to the width of their side mirrors
- Circa 1920 newly opened bridge with unsealed carriageway and original traffic.

Little has changed with the bridge over its 100-year life with the exception of typical maintenance and carriageway sealing and pavement marking.

The NZ Transport Agency (the Transport Agency) is responsible for operating, maintaining, renewing and improving the state highway network. The SH1 Opawa Bridge is integral to the state highway network and a key link to the Interislander ferry. The ferry is a vital freight link between the North and South Island. While the bridge has significance to utility service providers and the Marlborough District Council (Marlborough DC), it is the Transport Agency that has sole responsibility as a Crown Entity for determining the extent of any investments necessary to maintain and improve the asset.

Photograph 1.1: Opawa Heritage Bridge opened 1917

Figure 1.1: Opawa Bridge location SH1S RP18/9.0

1.1 Work Completed to Date

The strategic case for the project was completed in February 2015 and included a preliminary Investment Logic Map (ILM) (refer **Appendix A1**).

The Indicative Business Case (IBC) for the project commenced in February 2015. The IBC (omitting public consultation) was completed in June 2015. A summary of the IBC entitled "Consideration of Options" is included in **Appendix B**.

The IBC confirmed the actual problems evident and summarised these as two problem statements;
Problem One (70%): Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements, particularly heavy commercial vehicles, creating an out of context environment for a nationally strategic state highway.

Problem Two (30%): Poor Structural Resilience - The bridge offers low seismic resistance, is at risk of bridge pier scouring and is significantly vulnerable to structural collapse.

The IBC identified and assessed a long list of potential options for upgrading or replacing the existing bridge. The long list of options was shortlisted to a preferred and a do-minimum option. The selected preferred option offered the best value for money, with acceptable cultural and environmental impacts to achieve the project objectives. The selected do-minimum and preferred option for the Opawa Bridge project were:

1. The Do-Minimum option, which involved retaining the existing bridge with its current lane width restriction until it reaches the end of its remaining life, in 25-45 years. However this option did require some identified deficiencies to be remediated including: pier scour protection, underpinning of the central piers, and completion of deferred bridge resurfacing and joint repairs. The bridge would also require regular condition inspections and one off inspections after any moderate seismic event, due to its seismic structural deficiencies. The Rough Order Cost of this option was $0.7 Million (including 50% contingency).

2. The preferred option was a new parallel 10.8m two lane bridge with the existing bridge used as a pedestrian and cycle bridge. The Rough Order Cost expected estimate of this option was $16 Million (including 50% contingency) with an Indicative Assessment Profile is M/L/L.

The Transport Agency acknowledged the suitability of the selected preferred option, but the assessment profile of M/L/L, did not meet current parameters for investment under the National Land Transport Fund (NLTF).

Funding was subsequently confirmed from the Government ARRP fund. Public consultation was undertaken on the content of the IBC in May-June 2016. The Detailed Business Case (DBC) phase commenced immediately following in June 2016.

1.2 Project Governance

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

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

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

The CHLT is the Central Region Highways Leadership Team within the HNO group, which comprises Highway Managers within the central HNO region and various other senior managers and technical specialists. The CHLT is responsible for approving funding for projects within the region.

The project sponsor is Frank Porter, Highways Manager Marlborough Roads. The project is supported by Neil Walker Regional Highways Manager, HNO, and Julie Alexander Regional Manager, Planning and Investment.

The Strategic Case for investment has been accepted by the project sponsor and the Government.

2. PROBLEMS, OPPORTUNITIES AND CONSTRAINTS

The SH1 Opawa Bridge is a key structure on the National Strategic State Highway transport route enabling and supporting the growth of the NZ economy. In particular, the bridge enables freight access to the Port of Picton and the ferry link from the South Island to the North Island.

In addition, the structure enables a considerable amount of inter-regional traffic. Marlborough is an export-focussed producer of primary products, principally from viticulture, aquaculture, and forestry. Marlborough is New Zealand’s largest wine-growing region, and has also diversified into manufacturing and other services that support and add value to the primary sector activity.

The bridge links not only the State Highway but local communities to the north including Grovetown, Spring Creek and Picton, all of which are commuter townships for Blenheim with work, school, community and sporting links. The bridge forms an important link with these and other smaller communities and rural dwellers for access to the services available in Blenheim.

The project will not create any change in highway traffic volume or traffic composition so there is unlikely to be adverse impacts to the social community. The project will remove some traffic platooning so it is possible that road crossing opportunities will be modestly reduced along Grove Road.

2.1 Problems and Opportunities

An investment logic mapping workshop was held in December 2014 with the key partners, supported by Transport Agency staff, to gain a better understanding of the current issues and business needs. The key partners who assisted in creating the strategic case for this project were:

- Marlborough District Council
- Automobile Association (Marlborough)
- Road Transport Association (Marlborough), and
- Marlborough Police.

The problem definition was reviewed and updated during the IBC phase and agreed with the key partners.

The two strategic problems and their respective proportional weighting (in brackets) are:

(i) Problem One (70%): Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements, particularly heavy commercial vehicles, creating an out of context environment for a nationally strategic state highway.

Problem One highlights failure to allow two-way free flowing traffic due to the bridge’s narrowness and poor alignment, resulting in frequent public dissatisfaction.

The following evidential base was developed to support the strategic case.

The kerb-kerb width of the bridge is 5.49m, significantly below the Austroads recommendation of 7.0m. The narrow carriageway can present larger vehicles as a hazard, particularly if they cross the centreline, so that opposing vehicles slow down or cannot pass, causing frequent delays and uncertain travel times. Wide vehicles and Heavy Commercial Vehicles are forced to stop in one direction if another large vehicle is already travelling across the bridge. This creates travel time delays and journey time variations. As freight traffic increases, without intervention the delays and journey time variations are expected to increase.

Travel time variability was calculated using the Austroads variability formula which explores the relationship between the mean and the standard deviation. This calculation indicates a medium classification (20-30% Variability).

The NZTA MapHUB Efficiency NET geomap[1] indicates a PM peak level of service E at the Opawa Bridge approach. The AM peak level of service is C. The drop in service is considered entirely due to delays caused by large vehicles being unable to pass in either direction at the same time. Generally a level of service A to C is considered acceptable.

Inappropriate functionality means a level of infrastructure (in this case a bridge) that is unexpected or well below that provided elsewhere on the state highway network. The existing narrow Opawa Bridge surprises road users and leads to driver dissatisfaction, frequent complaints to the Transport Agency, and regular negative coverage in the local media.

(ii) Problem Two (30%): Poor Structural Resilience - The bridge offers low seismic resistance, is at risk of bridge pier scouring and is significantly vulnerable to structural collapse.

Problem Two highlights the lack of resilience in the structure which is out of context with the status of the Highway and a source of increased risk to the travelling public.

The following evidential base was developed to support the strategic case.

A detailed structural assessment (DSA) has been completed on the Opawa Bridge. This assessment has highlighted a number of potential seismic deficiencies with the bridge:

- dropping of spans due to a lack of restraint at bearings
- settlement of spans due to pier/pile subsidence under liquefaction with potential collapse
- strutting of heavy spans under longitudinal seismic shaking causing shearing in abutment piles, and
- as low ultimate load limit, which results is a high vulnerability for complete structural collapse failure during a seismic event.

The DSA report provides a preliminary base estimate of $3.4M for seismic remedial works. The bridge structure has inadequate seismic resistance at less than 33% of National Building Standard and, more critically, is vulnerable to a 1 in 100 year return flooding event. With low Ultimate Limit State capacity, structural collapse is the key concern and this is estimated to have a remedial cost of $350,000. This involves underpinning the existing bridge's two central piers which are vulnerable to overturning.

[1] Efficiency Net calculates the Volume/Capacity ratios and Level Of Service (LOS) for individual carriageway sections on New Zealand State Highways using the principals of the Highway Capacity Manual.

The DSA report offers additional comment on the hydraulic loading, which came about after site observations revealed exposed, piles raising concern that further scour could result in the instability of the bridge. It is estimated that the piles would be completely exposed during a 1 in 100 year AEP flood. With significantly reduced lateral support and horizontal pier loading from floodwaters, the central piers would have little resistance to lateral movement. The pier and supported bridge spans would be at risk. There is no evidence to suggest that the 1 in 100 year AEP design flood of 600 m^3/s has been exceeded in the 100-year life of the bridge. However, there remains risk that pier scouring could lead to bridge failure in a 1 in 100 year AEP flood event when it occurs.

The strategic case problems are:

Problem One (70%): Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements, particularly heavy commercial vehicles, creating an out of context environment for a nationally strategic state highway.

Problem Two (30%): Poor Structural Resilience - The bridge offers low seismic resistance, is at risk of bridge pier scouring, and is significantly vulnerable to structural collapse.

There are several other opportunities evident with the project including;

(i) Improved Journey Experience

A new structure to current highway standards will result in a reduction in delays and consistency in travel times reducing driver frustration. Community feedback expressed through newspaper articles in recent years and the engagement process focussed on the delays and near miss events negotiating the existing narrow bridge while wider vehicles are present. All road users will have a better experience particularly when camper vans and heavy commercial vehicles are not required to stop and then proceed slowly to negotiate the narrow carriage way.

(ii) Walking and Cycling

A new structure potentially allows for separate walking and cycling facilities to be provided separate from highway vehicular traffic. This will improve access and safety for walking and cycling users crossing the bridge. In addition it will enhance and encourage walking and cycling generally and specifically on the dedicated route provided to the northern communities.

(iii) Improved Gateway

While the current heritage listed bridge provides a gateway to Blenheim, it is not of an appropriate modern traffic engineering standard. There is an opportunity here to provide an entrance gateway to Blenheim that incorporates urban and landscape design elements complimenting the existing heritage listed bridge alongside current traffic engineering design so together to provide a safe environment for all road users. In utilising the heritage bridge for walking and cycling in conjunction with a new vehicle bridge we are acknowledging its continuing importance, functionality and historical context. There was strong engagement feedback on providing an enhanced gateway to Blenheim as part of this project.

2.2 Issues and Constraints

Major issues and constraints identified at this time include;

(i) Blenheim Bypass Option

Submissions for the project clearly identified a local preference for a bypass first before a new Opawa Bridge is constructed. The bypass option, while an alternative option, does not address the strategic case which still requires a resilient structure that meets the needs of the state highway road users. This issue will be addressed through the separate SH 1 Picton to Ashley River strategic study. Public submissions regarding the bypass will be passed to the SH1 Picton to Ashley River study team.

(ii) Increasing Freight Movements

As noted earlier, the Opawa Bridge is a key structure on the National Strategic State Highway transport route enabling and supporting the growth of the NZ economy and the local economy. In particular, the bridge enables HPMV freight access to the Port of Picton and the ferry link from the South Island to the North Island.

The existing freight volume will continue to grow on this strategic HPMV freight highway and the ferry vessels will become larger resulting in more pronounced freight peaks. The freight growth across New Zealand will be 58% over the next 40 years (GPS Transport, part13-14, pg5).

(iii) Property Purchase

The IBC identified the route which minimised direct impact on buildings as the preferred option when all aspects are taken into account.

Opposition to the project by a property owners or lessees could still impact on the project delivery timeline.

(iv) Temporary Property Access

Temporary staging areas for the construction of the new bridge and its approaches have been considered and options assessed. Construction access at the southern approach will be very tight and every effort is being made to minimise the impact on the operation of the motor camp in particular through which the project runs. Discussions with the camp ground operator are required to ascertain the injurious effects on that business while construction is underway.

(v) Existing Heritage Bridge

The existing Opawa Bridge was designed in 1912 and opened in 1917. The bridge is a Heritage New Zealand Pouhere Taonga (HNZPT) Category 1 historic place, and is protected under the Wairau / Awatere Resource Management Plan (WARMP) and Proposed Marlborough Environmental Plan (PMEMP). The Opawa Bridge is also recognised by the Institute of Professional Engineers New Zealand on its Heritage Record. The Opawa Bridge is one of only 7 Category 1 bridges that remain in active use on the state highway network with a further two already being used for off road shared cycling and walkways, following transfer to new owners. Demolition of the existing bridge is a prohibited activity under the WARMP and PMEMP, meaning that resource consent cannot be sought or granted for demolition. Any modifications to the bridge will require resource consent. Future management of the heritage bridge needs careful consideration. Maintaining the existing bridges aesthetics and heritage values will be important.

While at this time it is not intended to touch the existing structure, it is a significant physical constraint on the site and particularly the geometric design of the project. In addition the spatial extent of the listing (by HNZPT) and scheduling (by Marlborough DC) may differ, but will include reference to the wider extent and curtilage surrounding the existing structure which the design will need to be sympathetic to.

The relevance of acknowledging the importance of setting, curtilage and landscape as contributing to heritage value will need to be part of discussions and design development for the new bridge and associated landscaping, urban design, lighting, and signage/interpretation. Recognising the existing bridge's historical significance, it is important that the structure is incorporated in to any new design sympathetically and in a complementary manner acknowledging its continuing importance, functionality and historical context with the community.

The project fits within the State Highway network which is under increasing pressure on a national strategic key route and removes a structure that is vulnerable to structural collapse in a major event.

The project compliments any future projects to bypass Blenheim to maintain connectivity.

There are associated opportunities evident if the project was to proceed including enhanced walking and cycling facilities to promote community linkages and healthy lifestyle.

There are no major technical impediments to the construction however the delivery schedule could be influenced by timing of property purchase.

3. STAKEHOLDER ENGAGEMENT

The strategic case for this bridge was commenced by the Transport Agency with an investment logic mapping workshop held in December 2014 with the key partners, supported by Transport Agency staff, to gain a better understanding of the current issues and business needs. The key partners who assisted in creating the strategic case for this project were the Marlborough District Council, Automobile Association (Marlborough), Road Transport Association (Marlborough), and Marlborough Police.

As part of the Indicative Business Case development a long list of possible options were developed to address the key problems and to achieve the KPIs established in the strategic case and the subsequent strategic case review. These were presented at five separate stakeholder workshops and meetings.

Stakeholders involved in the option workshops included representatives from: the Transport Agency, Marlborough District Council, Spring Creek Residents Association, KiwiRail, National Road Carriers, Road Transport Association, Automobile Association, NZ Police, Utility Operators, Department of Conservation, Forest and Bird, Heritage New Zealand Pouhere Taonga and Walk Bike Marlborough, and Local Iwi; Te Atiawa, Ngati Koata, Ngati Toa Rangatira, Ngati Apa, Rangitane, Ngati Rarua, Ngati Kuia and Ngati Tama.

Consultation was also undertaken with directly affected property owners to understand their specific concerns and requirements. The identified property owners were: Blenheim Research Centre, Pickerings, Top 10 Holiday Park and the Grove Motel. (KiwiRail land holdings are also affected but it is not considered necessary to consult KiwiRail directly as identified land is well outside their current operational area).

The key issues that were identified in the IBC phase by stakeholders, iwi and affected property owner during consultation were summarised in the IBC.

3.1 Public Consultation and Communication Approach

The Transport Agency sought public feedback between May 11 and June 9 2016 on its proposal to replace the historic Opawa Bridge.

The Transport Agency notified the public through a media release and newspaper advertisements in three local newspapers and on the Transport Agency's website. Two drop-in sessions of three and four hours offered the public an opportunity to ask questions on the preferred option and other aspects of the investigation.

A booklet with information about the investigation was made widely available. It included:

- the problems identified with the existing bridge (that it is too narrow and has poor structural resilience)
- why the road and bridge are strategically important
- why a Blenheim bypass is an issue that will be considered in a separate investigation
- the preferred option
- the benefits of investment, and
- how-to-give-feedback guidance including a form.

A "Consideration of Options" report (**Appendix B**) based on the content of the IBC was also prepared, which detailed the 11 options considered, the reasons why options had been discounted, and the reasons for selecting the preferred option. The report and the booklet could be found on the project website and in hard copy for viewing at the Marlborough DC and Marlborough Roads offices, and at Blenheim and Picton Libraries. The 11 options considered were:

- Option 1: Structural and scour upgrade to the existing bridge;
- Option 2: Intelligent transport solution, with a structural upgrade to the existing bridge;
- Option 3: Central widening of the existing bridge and structural upgrade;
- Option 4: Widening of existing bridge upstream and structural upgrade;
- Option 5: New 10.8m wide single lane bridge, operating in tandem with existing bridge with no structural upgrade;
- Option 6: New 7.3m wide single lane bridge, operating in tandem with existing bridge with no structural upgrade;
- Option 7: New 13.3m wide bridge, with pedestrian facilities, retaining the existing bridge with no structural upgrade;
- Option 8: New 10.8m wide bridge retaining the existing bridge with no structural upgrade;
- Option 9: New two lane 13.3m bridge replacing the existing bridge on the current alignment;
- Option 10: Replace the existing bridge with a two lane tunnel;
- Option 11: Construct a Blenheim by-pass for through traffic.

Individual meetings were also held with Iwi. An initial meeting has been held with relevant Marlborough DC senior managers on the 3rd August 2016 to present an outline of the project as it is developed to date and discuss aspects of the project as it relates to Council and facilitate the statutory application process under the RMA. Initial meetings were also held with individual property owners and lessees potentially affected to discuss the options being considered and to understand their issues.

A total of 173 responses were received from individuals and stakeholders during the engagement period. The public was asked to provide feedback on four separate questions.

3.2 Stakeholder Views

The main finding is that approximately 70% of all submitters favour a bypass to a new bridge or a bypass first, then a new bridge. The primary reasons cited are:

- a new bridge will not solve the congestion problems in Blenheim, and
- the money is better spent on a long term solution.

The remaining 30% of submitters generally support the preferred option. These submitters also prefer the idea of retaining the existing historic Opawa Bridge for pedestrians and cyclists, and would like a safe route from one side of SH1 to the other. The Key Stakeholders who made written submissions and three Iwi also support the preferred option of retaining the existing bridge.

The issue of the Blenheim bypass does not change the need to replace the Opawa Bridge, as local traffic would still use the existing narrow bridge. As noted in the Consideration of Options Report (Appendix B), through traffic to the south of Blenheim is 2,600 veh/day, meaning that 7,200 veh/day would still use the existing bridge with a Blenheim bypass.

The Blenheim bypass remains a future option and will be considered, along with other state highway corridor improvements, as part of the SH 1 Picton to Christchurch investigation. All feedback in reference to the bypass will be forwarded to the appropriate team established from the SH 1 Picton to Ashley River strategic study.

For further detail on stakeholders and consultation undertaken on this project please refer to the consultation summary report in **Appendix L**. This feedback has been evaluated as part of the multi criteria analysis with public/stakeholders knowledge and option acceptance being one of the factors assessed for each option. Other factors including safety, integration, social, environment, and cultural are all influenced by the feedback received from all stakeholders and the public.

4. OUTCOMES

4.1 Strategic Outcomes

The strategic case benefits and KPIs were updated during the IBC to match the problem statements.

The associated objectives and KPIs are:

- Objective One (70%): Increase throughput of HPMV freight & light vehicles and greater certainty of SH journey
- Objective Two (30%): Greater structural resilience to natural hazard events resulting in increased availability and access.

The objectives and KPIs are shown in Table 1.

Table 4.1: Strategic Case Project Objectives

Investment Benefit/ Objective	Measure KPI
Objective 1 (70%) Increased throughput of freight and light vehicles and greater certainty of SH journey	Reduced coefficient of variation - standard deviation of travel time/average minutes travel time
	Minutes delay per kilometre
	Number of customer complaints (CRMS)
	Number of adverse media articles
Objective 2 (30%) Greater structural resilience to natural hazard events, resulting in increased availability & access.	Number of resolved significant road closures and detours urban >2hours (Vehicles) due to structural failure

The Investment Logic Map is included in **Appendix A1**.

4.2 Project Outcomes

The benefit map in **Appendix A2** was developed in the strategic case. The project outcomes for the Opawa Bridge project are defined as;

Investment Benefit	Measure	Baseline	Target
Increased journey reliability	Mean Travel time, Standard deviation of travel time	Mean Travel time 1.3 min, Std Deviation 0.23 min	Mean travel time 1.1 min, Std deviation 0.14 min
Decreased journey time	Travel time delay	Current delay 0.5 min	Nil delay time
Improve comfort & customer experience	Number of customer complaints	3/annum and 7 annual plan submissions	Nil complaints
	Number of adverse media articles	18/annum	Nil complaints
Increased availability and access	Number of resolved significant road closures and detours due to structural failure	Minutes delay created over next 100 years in major seismic event	90% reduction

The proposed bridge will provide an appropriate level of resilience on a strategic route and improve the customer journey experience with decreased travel times and appropriate engineering standards for today resulting in fewer complaints. Together with the existing bridge they provide a holistic transport solution while maintaining heritage values.

This provides other economic benefits with opportunities arising from the continued use and value of the historic bridge. These values and benefits are a mix of tangible and intangible, but still able to be qualitatively expressed, and potential contributors to regional economic development, for example;

- *aesthetic* benefits from the look of the bridge as a gateway, with community value as a well-known entrance into Blenheim
- *tourism* being a well photographed landmark within the marketing collateral for Marlborough
- *educative* with the history of its construction and technological innovation interesting aspects for school based resources
- *recreation* becoming a place to visit rather than just transit with provision made for sitting, vendors, coffee carts, ice cream stalls, craft and market stalls, events, product launches, festivals etc.

5. ALTERNATIVE AND OPTION ASSESSMENT

5.1 Alternatives Analysed

The Opawa Bridge Replacement IBC identified multiple alternatives for addressing the issues with the existing Opawa Bridge including;

- do nothing
- do minimum
- retention and structural upgrade of the existing structure
- intelligent transport systems installing traffic signals for wide vehicles on the bridge
- modification of the existing structure with both splitting the bridge and widening centrally and widening upstream
- a bypass
- a tunnel, and
- various configurations of replacement structures considering options for walking and cycling and continued use of the existing bridge for one lane of vehicular traffic.

The structural upgrade, intelligent transport solution, and the bypass did not solve the strategic problems identified so were not considered further. While the tunnel option achieved the strategic outcomes, it was dismissed due to poor physical and financial viability. All other options were then further assessed by MCA considering;

- cost optimisation; investment cost, benefit cost ratio, operational costs, construction delays, and remaining life solution
- implementation risks; technical, operation, stakeholder, public and property, environmental, safety, accessibility, and social inclusion
- wider project impacts; social, natural environment, human health, culture, heritage and urban design.

The highest score attained was for Option 8 (a new two lane bridge) however there is little to differentiate between Options 8, 5 and 7 given they are similar new bridge schemes. The top 3 options were notably ahead of the remaining options. Option 8 was assessed has having;

- lower implementation risks
- better cost optimisation, and
- only slightly higher wider project impacts.

The IBC assessment is considered consistent with the requirements of the Land Transport Management Act 2003 (LTMA) in that the activity has, to the extent practicable, been assessed against other land transport alternatives.

The DBC has not identified any additional alternatives or issues that would invalidate the IBC alternatives assessment.

5.2 Recommended Package of Alternatives

The preferred alternative recommended in the IBC was a replacement structure using a new 10.8m wide, two-way, two-lane bridge (Option 8) alongside the existing heritage bridge (which will be utilised for walking and cycling in conjunction with the new bridge). The DBC has not identified any additional alternatives or issues that would invalidate the IBC alternatives assessment.

The bypass option, while an alternative option, does not address the strategic case which still requires a resilient structure that meets the needs of the state highway road users. Under the bypass option, the existing heritage bridge would still be required to act as a state highway route connecting to SH 6 and SH 63.

No other alternative solutions have been identified through the DBC process.

Within Option 8 a series of sub-options have been considered to ensure the optimum outcome is achieved to mitigate where possible impacts on the environment, adjoining property owners and the community.

5.3 Sub-options Assessment

In order to allow refinement of the preferred option prior to commencement of pre-implementation activities, sub-options for road alignment were identified as generally consistent with the intent of Option 8. These options are generic options to identify and test horizontal road geometry, structural and property impact issues. This has been done to minimise to the extent possible;

- impacts on property, and in particular the commercial properties and their ability to conduct business involving the camp ground and motel complex where various sub-options impact directly on buildings, internal vehicle movements, and powered camp sites and supporting infrastructure
- the technical and cost implications of constructing a curved structure verses a straight structure that meets all required design standards
- any associated property impacts from a possible straight structure that requires additional property to accommodate the approach geometry, and

The sub-options assessment included a further test on the upstream verses downstream sub-option following the initial assessment in the IBC phase considering the issues above.

All sub-options to Option 8 share similar wider project impacts and other intangible impacts as assessed in the IBC, and achieve equivalent project outcomes. However, the sub-options do vary considerably in terms of effects on neighbouring property and bridge structural complexity. Therefore, to ensure a robust process for alignment selection, a further multi-criterion analysis (MCA) has been undertaken. The general approach for the MCA and criteria used are as per the Transport Agency's standard IBC guidance. An environmental screen for option 8 is attached in **Appendix K**.

Property purchase and bridge construction together comprise 50% of the project cost (10% and 40% respectively), and 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. Analysis identifies the most economical sub-option, and the cost premium that would be paid for any given sub-option that may produce a better outcome in terms of the MCA. 95th percentile cost estimates have been used in the value analysis to reflect the conceptual nature of the alignment designs and the risks inherent to acquisition of property.

Given that the sub-options are mostly equivalent in terms of wider project impacts and other intangible impacts, scoring in the MCA has been treated as variance from the mean, i.e. all criteria are given an initial neutral score of 4 (on a scale of 1 to 7) and where a given outcome has a better or worse affect than the other sub-options they are marked up or down as appropriate.

Appendix C3 outlines the results of the multi-criteria analysis (MCA) and selection of the preferred option from the IBC.

5.4 Options Analysed

Five sub-options have been developed and are denominated 8A through 8E (refer **Appendix C1** for a plan of the sub-option alignments). Note that at the time of evaluation the bridge replacement design was still conceptual.

The five sub-options are illustrated in Figure 2 and summarised as follows:

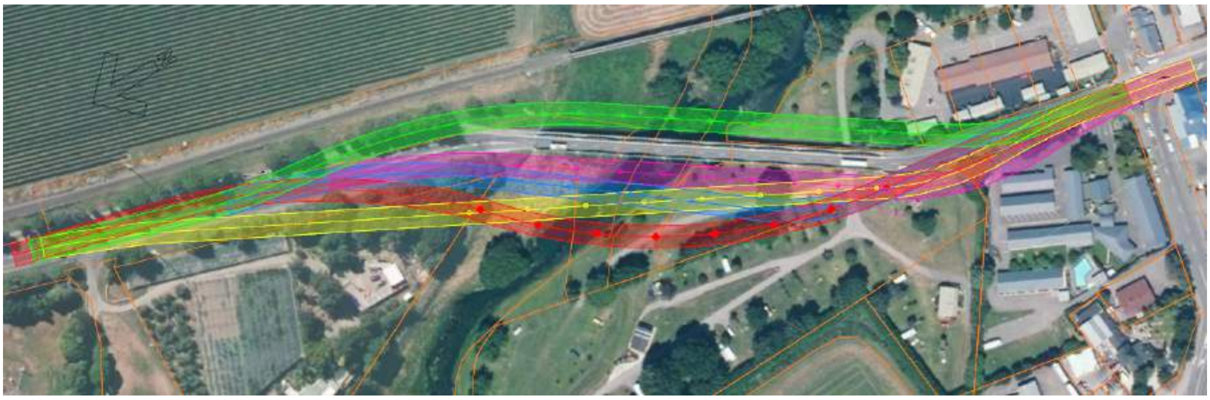
8A	Pink	Straight bridge, parallel to and upstream of existing
8B	Green	Straight bridge, parallel to and downstream of existing
8C	Yellow	Straight bridge, angled away from and upstream of existing
8D	Blue	Partially curved bridge upstream of existing
8E	Red	Fully curved bridge upstream of existing

The straight bridge structures are chosen to minimise structure complexity and cost. All three of these options however impact to varying degrees, and in some cases significantly, on the adjoining properties at the southern abutment due to the geometrical constraints required to achieve the required design speeds.

Curved structures were therefore tested to ascertain the impact of increased structure complexity and cost verses decreased impacts on property and buildings at the southern approach, accepting there are still considerable impacts on the campground grass areas.

A detailed plan of the 5 alignments is in **Appendix C1**.

Figure 5.4.2: Sub-option bridge alignments



Constraints were considered to reduce the number of variables between the sub-options and allow simple comparison of the key costs. These constraints included:

1. All five sub-options have a southern abutment located adjacent to and as close as possible to the existing bridge abutment to line up with Grove Road and reduce the potential for encroachment on the Grove Motel on the western side and the accommodation blocks of the Top 10 Holiday Park on the eastern side

2. The deck edges are no less than 3.5m apart at any point to allow for construction clearance, future bridge maintenance, a possible provision of a pedestrian pathway between the two bridge structures, and allowance for differential oscillation of the bridges during a seismic event
3. Geometric design speed was limited to a maximum of 70km/h (per memo dated 23 March 2016 and email response from Steve James (NZTA) dated 6 April 2016), and a minimum of 50km/h based on regulatory speed limit
4. Length of bridge based on location of existing stop banks and no reduction in waterway capacity
5. The extent of ground improvement is equivalent for all sub-options. (Note ground improvement is the only other aspect of construction greater than 10% of the total project cost, however the extent will not likely be varied by road or bridge alignment
6. The length of approach embankment and pavement works, and extent of retaining walls is equivalent for all sub-options.

Property cost estimates were supplied by NZTA's property consultants for each option that took into account land purchase costs, estimated injurious affects, potential reinstatement obligations, and property acquisition fees. They also undertook a risk analysis of the various options from a property acquisition perspective.

5.5 Assessment Results

Table 1 below summarises the MCA scores and ranking, and the cost premium determined by value analysis. Refer **Appendix C4** for the full detail of the MCA and value analysis.

Table 5.5.1: MCA Summary

Option		MCA Score	MCA Rank	Cost Premium ($M 95%ile)
8A	Straight Parallel Upstream	49%	**4**	0.3
8B	Straight Parallel Downstream	40%	**5**	-
8C	Straight Angled Upstream	51%	**2**	0.1
8D	Partially Curved Upstream	55%	**1**	0.5
8E	Fully Curved Upstream	50%	**3**	1.8

Sub-option 8D is the sub-option that most closely aligns with the Option 8 alignment recommended in the IBC.

Multi-criteria assessment against other alignment sub-options confirms the 8D alignment remains the preferred location and layout for the replacement bridge by a 4% margin.

The initial design philosophy for 8D was to minimise the effect on built developments (motel and camp ground buildings) and includes a relatively complex partially curved bridge to achieve this, which is reflected in the $0.5M cost premium for this option. The cost premium is considered the compensation for the better outcome afforded by the 8D alignment.

5.6 Sensitivity Analysis

The MCA result is sensitive given the 4% margin to the second placed sub-option 8C equates to only 3 points on the scoring scale. Sub-option 8D would only have to be marked down on several criteria (or 8C marked up) in order to produce an outcome where 8C was preferred. Similarly sub-options 8A and 8E are within two marks of 8C so are sensitive to assessment of their and sub-option 8D's assessed score.

As noted earlier the sub-options are mostly equivalent in terms of wider project impacts and other intangible impacts. All sub-options share similar project impacts and other intangible impacts, and achieve equivalent project outcomes with regards to;

- operation and maintenance
- network integration
- safety in design
- road safety, and
- financial and economic impacts,

and they are very similar in;

- statutory approval ability
- social accessibility
- impacts on the natural environment
- and risks to human health

all due to their inherently similar design being a similar bridge in a slightly different configuration. On this basis it is difficult to assess one sub-option as having higher or lower benefits over another sub-option.

The sub-options do vary considerably in terms of effects on neighbouring property and bridge structural complexity. Property purchase and bridge construction together comprise 50% of the project cost (10% and 40% respectively).

Even if the MCA scores were adjusted by 10% (8 marks) we would still have the preferred sub-option as a two lane bridge constructed on the upstream side of the existing bridge. The only consideration is whether the bridge should be straight or curved and the impacts from that. All things considered, it is assessed that the best option is to minimise the direct impacts of the new work on the existing properties and buildings as much as practicable and therefore option 8D is still the preferred sub-option being considerably cheaper than sub-option 8E.

If cost is considered a higher priority for the project, then sub-option 8C could be considered, with a resultant drop in quality of project outcomes. However, given the degree of uncertainty around property purchase, and delays that would be wrought by changing the preferred solution at this stage, there is high risk of project milestones not being met and cost escalation. It is highly likely that the up to $0.5M cost saving for sub-options 8B, 8C or 8A as indicated by the value analysis would not be realised.

6. RECOMMENDED PROJECT OPTION

6.1 Scope

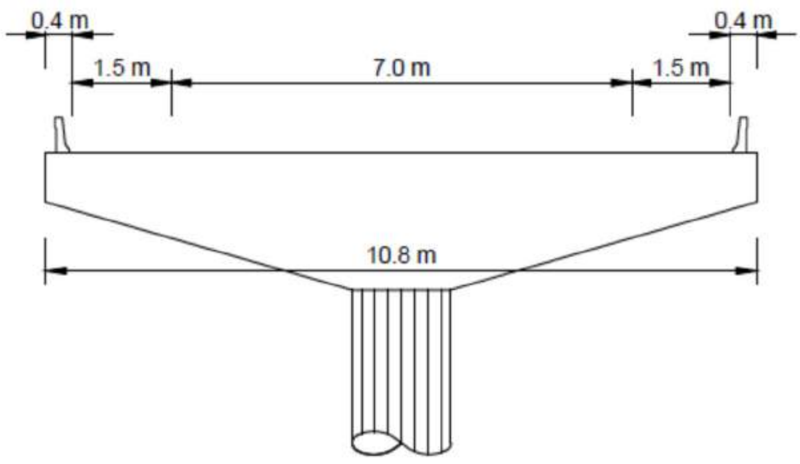
The recommended option consists of a replacement two-lane, two-way bridge working together alongside the existing heritage bridge which will be utilised for walking and cycling. This option is consistent with the outcomes of the IBC.

The recommended road alignment is upstream of the existing bridge (sub-option 8D) which is partially curved bridge in order to minimise the effect on buildings on neighbouring property.

The recommended structure will be between 180-190m long partially curved bridge, nominally 10.8 m wide. It is anticipated that the approaches will be designed to no greater than 70km/h design speed at the north end and 50km/h at the southern end. No specific pedestrian or cycle facilities will be provided on the new bridge except for the 1.5m shoulder. A typical cross section of the new bridge is shown in Figure 3.

The existing heritage bridge will operate as an off-road pedestrian/cycle bridge and is an important component of the design working in tandem with the proposed new bridge. It will include a cycle/ pedestrian shared path on the eastern side of Grove Road to improve pedestrian and cycle access at the southern approach.

Figure 6.1.1: Proposed replacement bridge cross section



6.2 Preliminary Design Philosophy

6.2.1 Design Standards

The design standards listed below will be used through the DBC stage to develop the preferred option to a high level of detail. Generally the standards adopted for design are those defined in the Transport Agency draft State Highway Geometric Design Manual, the Transport Agency Bridge Manual, and the following specific guidance:

i. AUSTROADS Guides to Traffic Management and Road Design

ii. New Zealand Supplement to the Austroads Guide to Traffic Engineering Practice Part 14: Bicycles
iii. AUSTROADS Urban Road Design
iv. AUSTROADS Pavement Design Manual and NZ Supplements
v. Manual of Traffic Signs and Markings
vi. Transport Agency Guidelines for Highway Landscaping (SP/M/020)
vii. Transfund Integrated Stormwater Management Guidelines for the NZ Roading Network (2004)
viii. Transport Agency Stormwater Treatment Standard for State Highway Infrastructure (2010)
ix. Bridging the gap- Transport Agency urban design guidelines (2013)
x. New Zealand Standard; NZS6806: Acoustics - Road Traffic- New and Altered Roads. (2010)
xi. State Highway Construction and Maintenance Noise and Vibration Guide (Aug 2013)
xii. AS/NZS1158.1.1 Street Lighting (2005). In conjunction with Transport Agency -M30 Specification and Guideline for Road lighting (2014)
xiii. Transport Agency Safe Journeys for People who Cycle (2015).

6.2.2 Geometric Design

The proposed cross-section consists of two 3.5m wide lanes with 1.5m wide sealed shoulders on each side leading to traversable or recoverable batter slopes as appropriate on the northern approach and kerb and channel on the southern approach. Guardrail will be required on the bridge and approaches.

Preliminary geometric plans for road alignment are included in **Appendix G.**

Speed management will require careful consideration particularly for southbound traffic entering the 50 km/h regulatory speed zone. With the removal of the existing bridge constraint it can be expected that operating speeds will increase. The threshold treatment and side friction will need to be considered. A concept phase road safety audit has been completed and is attached in **Appendix P**.

6.2.3 Bridge Design

The bridge design is expected to use either reinforced concrete construction with precast and pre-stressed concrete deck units or alternatively composite steel and reinforced concrete to assist with the curvature at the southern end. The southernmost 60m or so of the bridge will be curved horizontally and therefore have slightly shorter spans. Vertical curvature is also expected to enhance deck drainage. Piers are expected to be single columns topped with a hammer head cap. Abutments are expected to be founded on 2 smaller columns. Bridge barriers are likely to be rigid TL-5 concrete barriers.

Particular risks that are expected to require special attention during the design phase include the following:

- Hydrological modelling and hydraulic effects of the new bridge on the vulnerable foundations of the existing bridge
- Foundation conditions particularly the presence of weak soils at risk of liquefaction and lateral spread
- Proximity to the existing bridge for construction clearances
- Protection of the existing Category A listed bridge
- Sequencing of ground improvement at the abutments near the live traffic lanes.

A Preliminary Structure Options Report (PSOR) is included in **Appendix F.**

6.2.4 Urban and Landscape Design

Given the distinctive design and history of the existing bridge, and considering the feedback received, it is anticipated that the proposed bridge will have clean and modern lines so as not to detract from the character of the existing bridge. This consideration will be a focus as the form, barrier treatments and such of the proposed bridge are developed going forward.

Considering both bridges as a whole together to provide a cohesive transport solution gives us an opportunity to develop an urban design and landscape framework that integrates the two bridges together into the future. Using the existing heritage bridge for walking and off road cycling provides a positive future and retains its value to the local and wider community.

The bridge replacement will also be a great opportunity to provide Blenheim with an enhanced 'gateway' egress to and from the town. This will have historical, cultural and social benefits.

The outline Urban Design and Landscape Framework is attached in **Appendix H1**. A set of visualisations is attached in **Appendix H2** that illustrates a number of the principles and opportunities outlined in the Urban Design and Landscape Framework.

6.2.5 Pedestrian and Cyclist Design

Pedestrian and cyclist access over the bridges is a consideration for this project. At present pedestrians and cyclists have to cross the busy highway to use the pedestrian/cycle path on the downstream side of the bridge. Local parents have concerns about letting their children cycle to school due to the large volume of traffic and particularly heavy transport crossing the bridge. Those concerns should be incorporated into the proposed design to make it safer to use the bridge.

Footpaths leading up to the existing bridge need to be addressed. Currently there are no significant footpaths or cycle lanes leading up to the existing bridge at the southern end. These linkages would be incorporated into the gateway design, creating a greater opportunity for everybody to use the existing Opawa Bridge.

Given that the proposed cross section for the proposed bridge from IBC is 10 m between kerbs being two 3.5 m traffic lanes with 1.5m shoulders either side, the intention is that the proposed bridge shoulders will provide for sport or confident cyclists and the existing bridge will provide for less confident cyclists and pedestrians. From a practicality standpoint pedestrian design will include assessment of railing to comply with the Building Act.

6.2.6 Geotechnical Design

The identification of high risk liquefaction soils onsite from previous geological mapping of this area will dictate significant ground improvement works on the approaches in order to prevent subsidence and lateral spreading. Ground Improvements are expected to comprise rammed stone columns over a triangular area to protect the piers at each river bank.

Approach embankments will be constructed using imported fill materials. Pavements on approach fill embankments will be optimised by selecting suitable good quality fill materials.

Bridge piles would be founded below loose to medium dense soils into the underlying dense gravels. Piles are expected to be of 20m deep or greater.

An initial geotechnical site investigation was completed in 2015. A geotechnical factual report is attached in **Appendix R** and the interpretative report is attached in **Appendix S**.

6.2.7 Scour Design

Scour protection for the existing bridge piers, and hydraulic loadings require careful consideration. The desired response in a 1 in 100 year return period flooding event is that the bridge piers will not be undermined to the extent of destabilising the bridge piers, and the bridge structure will not be weakened under pier rotation or horizontal deflection. Brittle behaviour in bridge members and the risk of structural collapse is to be considered.

6.2.8 Stormwater Design

There is existing stormwater infrastructure on this section of highway which will require revision. The bridge deck is likely to incorporate vertical curvature to direct stormwater to the abutments.

Sediment control will be to the Transport Agency / Marlborough District Council requirements and incorporated in the design. Construction and permanent stormwater collection, treatment and discharges will be designed to meet best practice and statutory requirements.

6.2.9 Utility Services

Overhead power lines in the vicinity belong to Marlborough Lines who intend to underground and duct these lines onto any new bridge. Relocation of a transformer will be required on the southern approach where it clashes with the new abutment. Copper and fibre-optic telecommunication cables also exist through the project site. It is anticipated all telecommunications cables can remain on the old bridge however provision will be made on the new bridge for any future relocation.

6.2.10 Accesses

Access to the Grove Motel is within the project area, and accommodation works are expected to form part of the property purchase agreement for this access way.

6.2.11 Noise/ Vibration

Noise generation predictions will be required for a new alignment and where required consideration will be given to of noise mitigation measures such as acoustic walls. Vibration impacts will be monitored before, during, and after bridge construction however it is expected that the new bridge deck surfacing will be similar to the current bridge deck.

6.2.12 Lighting

Bridge design will include review of the existing lighting to ensure V3 standard lighting, and consideration of options for all new lighting to reduce the effect of light spill. The camp ground under the bridge has requested lighting for safety and security of its patrons.

6.2.13 Conservation Plan

An important component of this project is continued utilisation of the existing heritage bridge for the provision of walking and cycling facilities. It is important that the existing bridge is maintained to an appropriate level of service as walking and off road cycling will not be accommodated on the new bridge and they must operate in tandem.

A conservation plan has been prepared to facilitate discussions on the future of the existing heritage listed Opawa Bridge. The purpose of the conservation plan is to provide strategies, guidelines and actions that will allow for the appropriate conservation of the Opawa Bridge based on the proposed change of use. The conservation plan will also inform the assessment of environmental effects in the preparation of the resource consent application.

The Opawa Bridge is one of the first reinforced concrete bowstring bridges in New Zealand, and is the only known example of the bowstring arch truss type that now remains in the country. In recognition of this significance, the Opawa Bridge holds a Category I ranking by Heritage New Zealand Pouhere Taonga, and as a class A heritage item in the Wairau/Awatere Resource Management Plan prepared by the Marlborough District Council. The Opawa Bridge is also recognised by the Institute of Professional Engineers New Zealand on its Heritage Record.

The relevance of acknowledging the importance of setting, curtilage and landscape as contributing to heritage value will need to be part of discussions and design development for the new bridge and associated landscaping, urban design, lighting, and signage/interpretation.

7. RECOMMENDED OPTION – ASSESSMENT

The assessment of the recommended option generally forms part of the Economic Case for the project. The assessment identifies all the impacts of the proposal to fulfil the Transport Agency's requirements for appraisal.

In line with the Transport Agency's appraisal requirements, the impacts considered are not limited to those directly impacting on the measured economy, nor to those which can be monetised. The economic, environmental, social and distributional impacts of a proposal are all examined, using qualitative, quantitative and monetised information.

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 Project Outcomes

Outcomes required of the recommended option as set out in detail in this DBC report are defined as;

Investment Benefit	Measure	Baseline	Target
Increased journey reliability	Mean Travel time, Standard deviation of travel time	Mean Travel time 1.3 min, Std Deviation 0.23 min	Mean travel time 1.1 min, Std deviation 0.14 min
Decreased journey time	Travel time delay	Current delay 0.5 min	Nil delay time
Improve comfort & customer experience	Number of customer complaints	3/annum and 7 annual plan submissions	Nil complaints
	Number of adverse media articles	18/annum	Nil complaints
Increased availability and access	Number of resolved significant road closures and detours due to structural failure	Minutes delay created over next 100 years in major seismic event	90% reduction

The assessment indicates that a new 10.8m two lane bridge upstream of the existing bridge will achieve the project outcomes. Travel time reliability will be met and public complaints in regards to the existing bridge should cease. With the new structure designed to current design standards the resilience of the network will be improved.

7.2 Implementability

This section considers the mechanics of delivery from a technical, operational and consenting ability perspectives.

7.2.1 Constructability

The recommended option is expected to be either a conventional precast, reinforced concrete design or a composite steel and reinforced concrete design, with common and widely-used detailing therefore the construction of the structure is likely to be unremarkable. The space restrictions of the site are expected to present the greatest challenge to constructability with the river channel and adjacent properties dominating the site.

Staging of construction activity and access provisions are likely to be critical to programming the works, and off-site staging areas and working platforms in the river margin are also likely to be required.

Construction of ground improvements at the southern abutment will be complicated and require staging due to the proximity of the existing carriageway.

7.2.2 Operability

The new bridge will operate as a typical two-lane highway bridge and no extraordinary operations activity is expected. The issue of the southbound operating speeds needs to be addressed considering the 100/50 km/hr threshold is only just to the north of the bridge to ensure the operating speed is bought down to the regulatory speed of 50 km/hr.

7.2.3 Statutory requirements

Alteration to the existing designation, and resource consents for construction will be required for the option. The key risk associated with obtaining consent will be time related. At this time it is expected that the consent will be notified and require the consent application to be heard in the Environment Court. Initial conversations have been held with Marlborough DC on consenting in the development of the consenting strategy. Allowance has been made for this in the pre-implementation programme.

It is expected that several 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.

7.2.4 Property impacts

The road alignment of the preferred option has been chosen to mitigate to the extent possible impacts on property and in particular the commercial properties and their ability to conduct business. This involves the camp ground and motel complex where various sub-options impact directly on buildings, internal vehicle movements, and powered camp sites and supporting infrastructure. These are subject to risks in regards to property purchase complexity and uncertainty around likely compensation costs. This is intended to reduce opposition from neighbouring property owners as far as practicable and enhance the timing and process of property acquisition. However, there is still risk of objection and a lengthy legal process to purchase land.

7.2.5 Asset management

The recommended option for the new bridge is expected to be either a conventional precast, reinforced concrete bridge design or a composite steel and reinforced concrete design, with typically low maintenance costs for the majority of the life of the asset. There are no asset management issues which influence the choice of recommended option.

The recommended option utilises the existing heritage bridge for walking and off road cycling and therefore must continue to operate at a yet to be defined level of service. An asset management plan will be required and is being prepared as part of the conservation plan.

7.3 Wider Project Impacts

7.3.1 Environmental impact

The river environment at the bridge site is highly modified from its natural state due to manmade infrastructure, including road and rail bridges and the stop bank system. The existing river has a number of willow trees, which appear to be hindering the waterway.

Inanga are known to be present in the Ōpaoa River in the immediate environs and black swans are currently nesting immediately downstream of the existing bridge on a small islet.

No detailed environmental impact assessment has been undertaken at this time. It is expected that improvements can be made to several aspects including the quality of stormwater runoff into the Ōpaoa River, and modest improvements in noise and vibration allowing that the existing heritage bridge has a reasonable asphalt running surface on it and minimal joints.

7.3.2 Heritage impact

The Opawa Bridge is a Class A heritage item and is protected under the WARMP. This bridge opened in 1917. This bridge is a legacy structure being the first of its kind (concrete bowstring) in New Zealand following international trends, and it was a forerunner of the Balclutha and Fairfield Bridges. The Opawa Bridge is one of only 7 Category 1 bridges listed by Heritage New Zealand Pouhere Taonga that remain in active use on the state highway network with a further two already being used for off road shared cycling and walkways, following transfer to new owners.

A Conservation Management Plan that identifies and documents the historical context of the structure is currently under development. That 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 Conservation Management Plan will also assist discussions between the Transport Agency and Marlborough DC over future stewardship of the heritage structure considering possible maintenance funding models.

7.3.3 Social impact

The bridge forms part of the SH1 link from Picton to Christchurch via Kaikoura.

The Grove Road corridor immediately to the south the Opawa Bridge is part of SH1. This is the northern entrance to Blenheim and is surrounded on both sides by industrial/ commercial development. The Opawa Bridge connects directly to the head of Grove Road and forms part of the entrance.

The immediate southern approach of the Opawa Bridge passes beside motel accommodation and holiday camp ground accommodation. South of the first intersection (Dobson Street) the land use on Grove Road changes to commercial.

The Opawa Bridge on the northern approach is surrounded by rural agricultural activities, with one nearby residential property and a cluster of industrial/commercial buildings known as the Blenheim Research Centre. Both these properties share a common access point and are well set back from the highway. It is expected that any highway realignment will have minimal impact on these activities.

On the eastern side of the highway is a formed off-road cycle path which connects Blenheim to Grovetown, and is shortly to be extended to Spring Creek. The Opawa Bridge is considered by MDC to be a key cycleway link.

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

7.3.4 Cultural impact

Four Iwi groups have an interest in the project and were consulted during individual meetings: Ngati Rarua, Ngati Toa, Rangitane, and Ngati Apa. They accept a new bridge is needed and fully support the preferred option. They acknowledge the importance of keeping traffic going through the CBD from a commercial point of view. They are interested to be involved in the design, artwork and landscaping around the new bridge and an opening ceremony.

7.4 Cost Optimisation

In January 2016 the Government announced a preferred option to build a new two-lane 10.8 metre wide bridge on the western side of the existing bridge, retaining the existing historic bridge for pedestrians and cyclists.

On that basis the Transport Agency is proceeding with Pre-Implementation and Implementation phases to deliver the proposed bridge in line with the Governments intentions.

Cost optimisation has been considered as part of the sub-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 5.4.

Property purchase and bridge construction together comprise 50% of the project cost (10% and 40% respectively), and 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.

Analysis identifies the most economical sub-option, and the cost premium that would be paid for any given sub-option that may produce a better outcome in terms of the MCA. 95th percentile cost estimates have been used in the value analysis to reflect the conceptual nature of the alignment designs and the risks inherent to acquisition of property.

8. RECOMMENDED OPTION - ECONOMIC ANALYSIS

The Opawa Bridge Replacement Project has approved funding allocated under the NZ Government Accelerated Regional Roads Package (ARRP).

Transport Agency guidance notes that the economic efficiency of a proposed solution is linked to BCR. An initial economic analysis was undertaken as part of the IBC phase and indicated a low BCR;

IBC assessed rough order costs of preferred option (undiscounted):

- Year 1 $1M
- Year 2 $3M
- Year 3 $12M

IBC assessed rough order benefits:

- Maintenance cost saving $900,000
- Do minimum saving $700,000
- Travel Time Savings $8M
- Emergency Detour Savings $2M
- Intangible Service Benefits $3M
- Cycle and Walking Benefits $1M
- Safety Improvements $1M

The indicative BCR for this project has been assessed as 1.5, and therefore fits in the 1 and 3 range for a low economic efficiency.

The Transport Agency acknowledged the suitability of the selected preferred option, but the assessment profile of M/L/L, did not meet current parameters under the National Land Transport Fund (NLTF).

No further analysis of the economics has been performed as capital funding is outside of the NLTF. It is anticipated that the maintenance and operational costs of the two structures are not significantly more than the cost of operating and maintaining the existing bridge.

9. FINANCIAL CASE

The Opawa Bridge Replacement Project has approved funding available through the ARRP. The Financial Case therefore concentrates on the costs associated with project delivery and ongoing operation and maintenance.

9.1 Project delivery costs

A Capital Cost Estimate for the pre-implementation and implementation phases including property costs has been produced in accordance with the Cost Estimation Manual (SM014).

The expected estimate for the project is $15.0M and the 95th percentile estimate is $17.0M.

The breakdown of this estimate is attached as **Appendix D**.

Key cost assumptions made as part of this estimate are:

- Timing assumptions
  Construction commencing in 12 months and a construction duration between 12 to 18 months. Property purchase and notified statutory approvals completed within the 12 month pre-implementation period. Some staging costs allowed for allowing for constricted site access.

- Property purchase, management and disposal costs
  Property purchase completed within the 12 month pre-implementation period. Extended period beyond this catered for by escalation generally. Rationalisation of remaining property to be finalised following detailed design. See separate memo attached on property cost risks. Land requirement plans are attached in **Appendix N2**.

- Design costs
  Incorporated into DBC estimate and are fixed with agreement in place for pre-implementation phase works.

- Construction costs
  Construction monitoring fees are incorporated into DBC estimate and are fixed with agreement in place for implementation phase works. The cost estimate has not been independently reviewed at this time. The implementation estimate (Form I) includes a 5% allowance within Base Estimate for extraordinary construction costs in addition to 25% contingency to Expected Estimate and a further 17% to the 95th percentile estimate.

- Statutory application costs
  Transport Agency managed costs available for notified consent process.

- Other costs (insurances etc)
  Provision made in estimate for P&G and insurances.

9.2 Ongoing maintenance and operations costs

The recommended option is a standard bridge design using typical and widely used structural detailing.

There will be some maintenance costs against the NLTP for the maintenance of the new structure although these will be minimal for the first 50 years.

For the new bridge structure, no extraordinary ongoing maintenance activity is anticipated. The annual cost to maintain the new bridge is expected to be less than the existing structure (estimated at $20,000 p.a. compared to $25,000 p.a. for the existing). The present value of all annual maintenance and renewals over the next 40 years is estimated in the region of $420,000. This amount includes:

- Operating Costs:
  - Additional street lighting
- Maintenance Costs:
  - Street cleaning
  - Graffiti removal
  - Landscaping
- Routine (6 monthly), General (2 yearly) and Principal (6 yearly) Inspection Costs
- Renewals Costs:
  - Surfacing
  - Deck Joints

Ongoing maintenance of the existing heritage structure will be as required to ensure walking and cycling can be maintained.

Key ongoing expenditure for the existing heritage bridge structure are likely to include:

- Operating Costs:
  - Street lighting
- Maintenance Costs:
  - Detritus removal
  - Graffiti removal
  - Landscaping
- General (2 yearly) and Principal (as required) Inspection Costs
- Renewal Costs:
  - Minor strengthening
  - Scour Protection

The annual cost to maintain the existing bridge as a walking and cycling structure is expected to be approximately $7,000 p.a. The present value of all annual maintenance and renewals over the next 40 years is estimated in the region of $165,000.

Detailed maintenance cost estimates are included in **Appendix E**.

The Maintenance Cost Estimate appended to this Business Case includes an allowance for minor work that would need to be funded through the NLTP at the appropriate FAR rate.

The conservation plan discusses the maximum level of investment that should be considered for the level of service determined and the replacement of a similar level of service should the heritage structure be significantly damaged in a major seismic event or similar catastrophe. This still needs to be tested to determine the communities' willingness to fund.

9.3 Project revenues

Not applicable.

9.4 Funding options

The Opawa Bridge Replacement Project has approved funding available through the NZ Government Accelerated Regional Roads Package (ARRP). This includes property purchase and Transport Agency managed funds.

It is not anticipated that any additional funding will be required.

9.5 Financial risk

The current DBC estimate has sufficient funding available from the ARRP fund to cover the 95% construction risk for this project. No other funding sources are required at this time.

Project Base Estimate: $11.9M

Project Expected Estimate: $15.0M

95th Percentile Estimate: $17.0M

See **Appendix D** for details.

PART B – READINESS AND ASSURANCE

The Opawa Bridge Replacement Project has approved funding available through the NZ Government Accelerated Regional Roads Package (ARRP) with an anticipated early delivery programme by the Government.

10. COMMERCIAL ANALYSIS

Due to the nature of this project, the Transport Agency has initiated Pre-Implementation and Implementation phases concurrently with the DBC phase. This section details the processes currently in place and identifies others that need to be managed.

The Transport Agency has produced internally a separate procurement strategy for the physical works which is attached in **Appendix O**.

10.1 Output based specification

Options for project delivery were considered as part of the procurement strategy with the decision made to proceed with a traditional design approach considering the anticipated time line for delivery. Early contractor involvement has been allowed for to ensure that construction related technical issues are managed before tendering.

On the basis a traditional design with measure and value delivery has been adopted, this will require; a full detailed design with standard technical specification, a bill of quantities, basis of payment, and a price schedule. There are no unusual processes identified at this time that should complicate the construction process.

All tenderers are pre-qualified to the necessary levels with the required management, quality, safety and technical support systems.

10.2 Implementation strategy

Transport Agency approved property consultants have been engaged and a property strategy prepared in **Appendix N1**. Preliminary discussions with the various property owners and leases have begun. Formal discussions will commence immediately on approval of this DBC and approval to commence.

A design consultant has been engaged for detailed design and statutory application processes. Pre-qualified physical works contractors have undergone an SIA and EOI process to shortlist two to be consulted with through the detailed design process and provide competitive bids at time of tender.

A consenting strategy has been prepared as part of this DBC phase and is attached as **Appendix J**. Statutory applications are to be prepared concurrently with the design for submission early in 2017. Allowing for a notified process all approvals should be in place for construction to commence mid-2017.

The Urban Design and Landscape Framework will ensure that we achieve a holistic transport solution with the two bridges working together in harmony. The conservation plan for the heritage bridge is important as the existing bridge is required to continue operating albeit at a lower level of service having to cater structurally only for walking and cycling. These plans will be developed with Marlborough DC through the pre-implementation phase.

A further round of engagement is proposed with key stakeholders and the community once the bridge design report and design philosophy is confirmed early in the pre-implementation phase. This will provide visualisations of the proposed bridge to be published for the community to comment on before final design is completed.

Ongoing engagement with tangata whenua, Heritage New Zealand Pouhere Taonga, and Marlborough DC on the effects on historic and cultural heritage will assist the consenting process under the RMA, Building Act and Heritage NZ Pouhere Taonga Act.

10.3 Risk allocation and transfer

The traditional design with measure and value contract allows the price risk to be shared equitably between the parties considering the fast track nature of the project. By including the short listed contractors in the design process they should have a good level of understanding of the project complexities and provide competitive prices. Other delivery methods would have resulted in inflated pricing to cover risks for a fast tracked project.

The form and construction method of the proposed replacement bridge is conventional in all aspects and the risks associated with the design and construction phases are therefore considered normal. Technical and construction risks are able to be managed through standard risk management processes.

Significant risks relate to property purchase and resource management consenting approvals impacting on the delivery programme for the project.

A risk register for the project is included in **Appendix Q**.

10.4 Sourcing options

Sources for the provision of services have been agreed at this time with the design consultant engaged and physical works contractors shortlisted. Other minor service providers (for auditing, etc) will be engaged through the normal existing supplier arrangements.

10.5 Payment mechanisms

There are no special payment mechanisms envisaged for this project.

10.6 Pricing framework and charging mechanisms

There are no special pricing frameworks or charging mechanisms applicable to this project.

10.7 Contract length

At this conceptual stage it is envisaged that the physical works contract will be between 12-18 months in duration. This will be heavily dependent on discussions with the adjoining property owners and lessees. In particular the camp ground that the bridge crosses could experience impacts resulting from construction during the summer holiday season.

Alternative options have the work limited in summer to reduce impact on the high tourist season but extending the construction duration.

The final construction contract specification will need to have clear and specific clauses around timing, access, and minimising impacts of construction activities on the adjoining areas.

10.8 Contract management

The Transport Agency Project Manager for the Pre-Implementation and Implementation phases has been assigned.

Transport Agency approved property consultants have been engaged and preliminary discussions with the various property owners and leases have begun. Formal discussions will commence immediately on approval of this DBC and approval to commence. Land requirement plans are attached in **Appendix N2**.

The design consultant has been engaged for detailed design and statutory application processes under a standard CCCS contract. Detailed design will commence immediately on approval of this DBC with the schedule calling for statutory applications to be prepared concurrently for submission early in 2017.

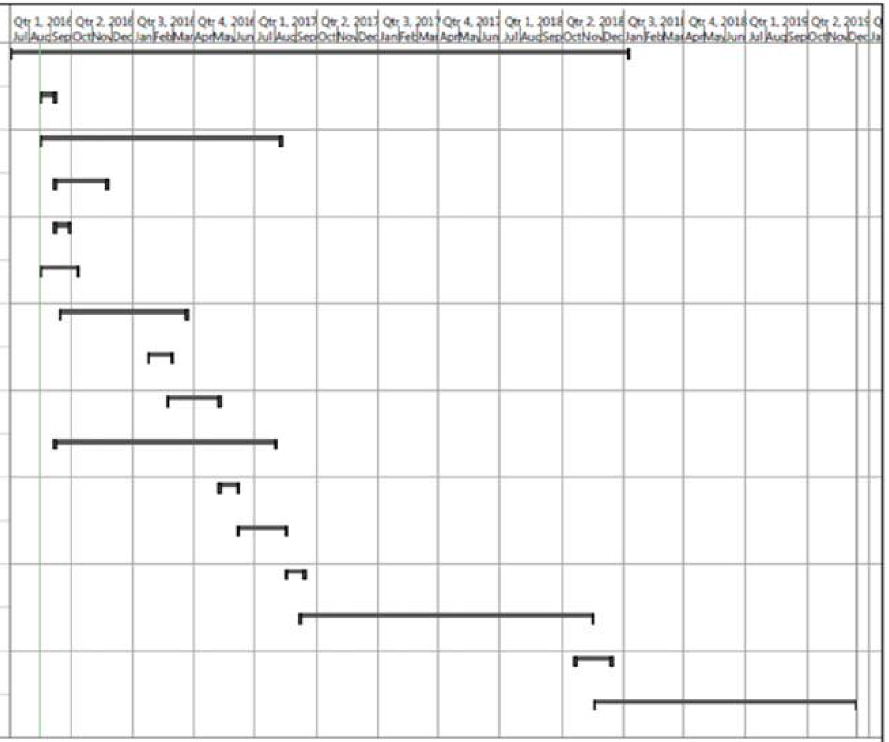
Pre-qualified physical works contractors have undergone an SIA and EOI process to shortlist two to be consulted with through the detailed design process and provide competitive bids at time of tender. This will allow workshopping with the design team to bring possible innovations, reduce complexity where possible to simplify construction, and allow for a streamlined final tender process. They will be engaged under a standard NZS 3910 contract.

10.9 Schedule

Assuming property purchase is completed satisfactorily alongside statutory approvals, physical work should commence on site in the second half of 2017. The work is anticipated to take between 12-18 months to complete depending on staging necessary with completion planned for late 2018 followed by a 12 month defects liability period. This will ensure the Governments anticipated construction in 2018 is met. To meet this delivery schedule it is necessary to fast track the traditional design and consenting process. A procurement strategy has been approved for the project.

Construction duration will vary depending on the final form of the structure and temporary staging required. The schedule is at risk from the property purchase requirements with the possibility that compulsory acquisition may be required under the Public Works Act, and resource management consenting approvals.

ID	Task Name	Duration	Start	Finish	Predecessors
1	Contract Management	630 days	Mon 4/07/16	Tue 8/01/19	
6	DBC Report	15 days	Wed 17/08/16	Tue 6/09/16	
10	Property Purchase	240 days	Wed 17/08/16	Tue 8/08/17	
15	Geotechnical Investigations	55 days	Wed 7/09/16	Wed 23/11/16	
20	Hydraulic Modelling	16 days	Wed 7/09/16	Wed 28/09/16	
24	Preliminary Design	40 days	Wed 17/08/16	Tue 11/10/16	
31	Detailed Design	119 days	Thu 15/09/16	Tue 21/03/17	
48	Detailed Design Stage Road Safety Audit	25 days	Tue 24/01/17	Tue 28/02/17	
52	Tender Documentation	55 days	Wed 22/02/17	Tue 9/05/17	
58	NoR, Outline Plan and Statutory Applications	220 days	Tue 6/09/16	Tue 1/08/17	
68	Finalise Design and Implementation Requirements	20 days	Wed 10/05/17	Tue 6/06/17	
75	PW Contractor Engagement	51 days	Wed 7/06/17	Wed 16/08/17	
82	PW Contract Preliminaries	20 days	Thu 17/08/17	Wed 13/09/17	
92	PW Contract Period	300 days	Wed 6/09/17	Fri 16/11/18	
102	Practical Completion Requirements	40 days	Mon 22/10/18	Fri 14/12/18	
115	Post Implementation Requirements	280 days	Mon 19/11/18	Fri 13/12/19	



Project: Opawa Bridge Replacem
Date: Mon 15/08/16

Task; Split; Milestone; Summary; Project Summary; Inactive Task; Inactive Milestone; Inactive Summary; Manual Task; Duration-only; Manual Summary Rollup; Manual Summary; Start-only; Finish-only; External Tasks; External Milestone; Deadline; Baseline; Baseline Milestone; Baseline Summary; Progress; Manual Progress

SH1 Opawa Bridge Replacement
Pre-implementation and Implementation

11. MANAGEMENT CASE

11.1 Project roles

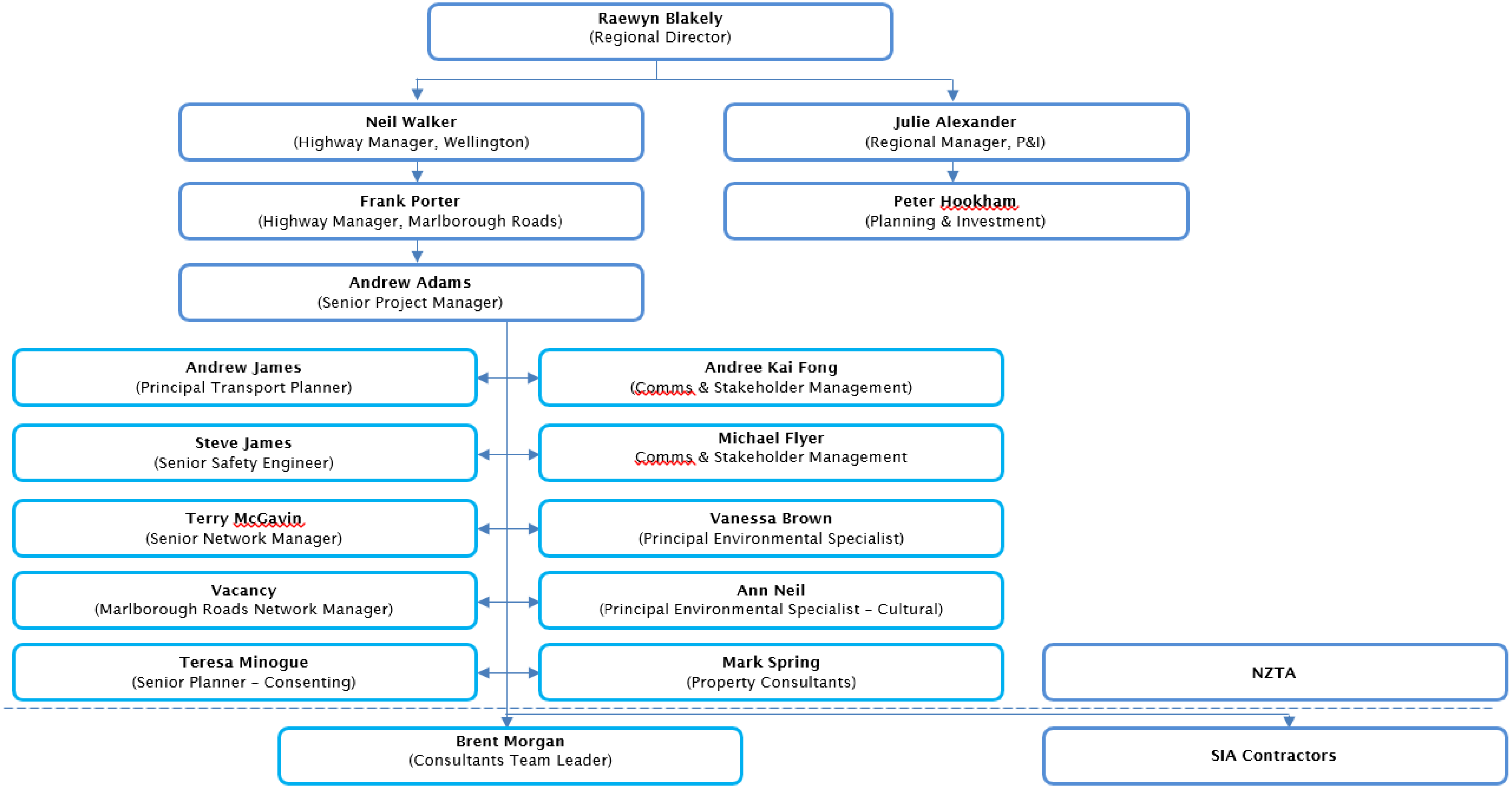
The project team will comprise of:

ROLE	NAME
Project Sponsor (HNO)	Frank Porter, Highway Manager, Marlborough Roads, Highway and Network Operations
Investor Client (P&I)	Julie Alexander, Regional Manager, Planning & Investment
Project Manager	Andrew Adams, CPEng, MIPENZ
Senior supplier	Opus International Consultants Ltd
Team leader	Brent Morgan, CPEng, MIPENZ

11.2 Governance structure

The Transport Agency has a well-defined governance and approvals structure which is followed throughout the business case process. Because this project is funded from the ARRP, pre-implementation and implementation budgets have already been allocated by the SH Programme Review Committee (SHPRC).

During pre-implementation and implementation Andrew Adams will direct the internal project team as necessary.


Raewyn Blakely
(Regional Director)
Neil Walker
(Highway Manager, Wellington)
Julie Alexander
(Regional Manager, P&I)
Frank Porter
(Highway Manager, Marlborough Roads)
Peter Hookham
(Planning & Investment)
Andrew Adams
(Senior Project Manager)
Andrew James
(Principal Transport Planner)
Andree Kai Fong
(Comms & Stakeholder Management)
Steve James
(Senior Safety Engineer)
Michael Flyer
Comms & Stakeholder Management
Terry McGavin
(Senior Network Manager)
Vanessa Brown
(Principal Environmental Specialist)
Vacancy
(Marlborough Roads Network Manager)
Ann Neil
(Principal Environmental Specialist – Cultural)
Teresa Minogue
(Senior Planner – Consenting)
Mark Spring
(Property Consultants)
NZTA
Brent Morgan
(Consultants Team Leader)
SIA Contractors

11.3 Assurance and acceptance

During the pre-implementation and implementation phases key decisions will be presented to the Marlborough Roads Regional Management Team (MRRMT). The MRRMT will determine if decisions require escalating to the Central Highways Leadership Team (CHLT).

Other key project assurance deliverables for the pre-implementation stage are identified in the following table:

Item	Description	Responsibility
Public engagement on final proposal	Engagement required prior to lodging consent applications, in particular to address visuals, entry threshold and safe walking / cycling access	Andrew Adams / Michael Flygar
Safety Audit of final proposal		Andrew Adams / Steve James
Conservation Strategy	To agree standards and responsibilities for the existing bridge, and reach agreement with Marlborough District Council	Ann Neil
Property acquisition		Mark Spring
Statutory applications		Teresa Minogue
Structural design		Terry McGavin
Appointment of contractor		Andrew Adams / WRMT

11.4 Change control

Changes will be made at the Project Manager level, and elevated to the Marlborough Roads RMT as is deemed necessary. The Project Manager will follow Transport Agency procedure when elevating decisions beyond this level.

11.5 Cost management

It is expected that a risk register will be maintained throughout the future phases of the Project in accordance with Z/44 to manage key risks and that they will be reported to the Transport Agency on a monthly basis.

11.6 Issues management

The Transport Agency Project Manager is expected to engage with personnel from suppliers to come to a mutually agreeable solution when issues arise. Where issues are affecting the deliverables on the Project and an agreement cannot be met the issue can be elevated to an appropriate management level within each organisation.

APPENDIX A1 - INVESTMENT LOGIC MAP

INVESTMENT LOGIC MAP
Activity

PROBLEM ▶ **BENEFIT**

Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements

70%

Greater certainty of state highway journey

Investment Benefit: Increase reliability

Measure: Reliability – actual vehicles

Investment Benefit: Decrease journey time

Measure: travel time delay – by mode

Greater customer satisfaction.

Investment Benefit: Improve comfort & customer experience

Measure: Number of customer complaints (CRMS)

Measure: Number of adverse media articles

Poor structural Resilience - Low seismic strength and is at risk of bridge pier scour

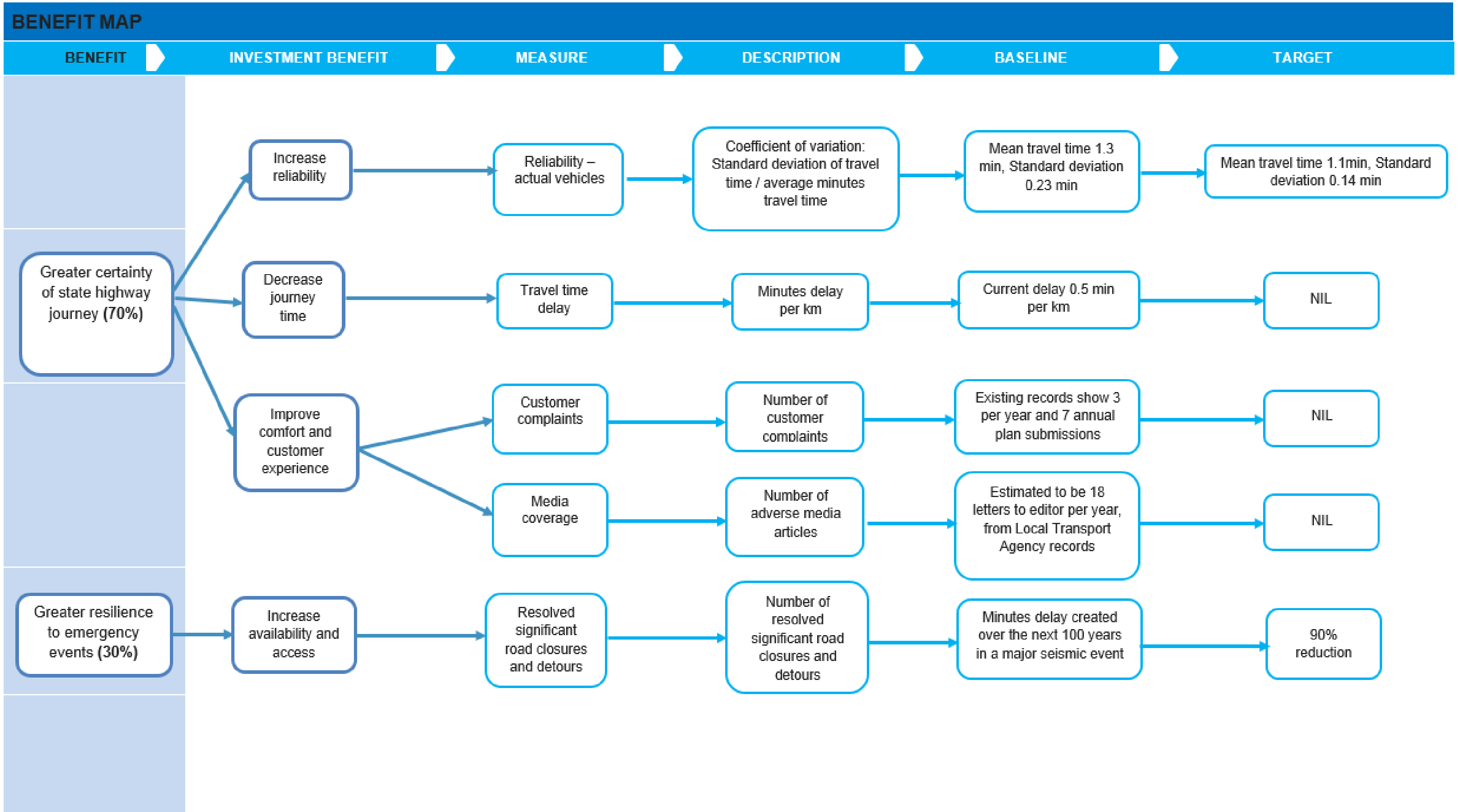
30%

Greater route resilience to emergency events.

Investment Benefit: Increase availability & access

Measure: Number of resolved significant road closures and detours

APPENDIX A2 – BENEFIT MAP


BENEFIT MAP
BENEFIT
INVESTMENT BENEFIT
MEASURE
DESCRIPTION
BASELINE
TARGET
Greater certainty of state highway journey (70%)
Increase reliability
Reliability – actual vehicles
Coefficient of variation: Standard deviation of travel time / average minutes travel time
Mean travel time 1.3 min, Standard deviation 0.23 min
Mean travel time 1.1min, Standard deviation 0.14 min
Decrease journey time
Travel time delay
Minutes delay per km
Current delay 0.5 min per km
NIL
Improve comfort and customer experience
Customer complaints
Number of customer complaints
Existing records show 3 per year and 7 annual plan submissions
NIL
Media coverage
Number of adverse media articles
Estimated to be 18 letters to editor per year, from Local Transport Agency records
NIL
Greater resilience to emergency events (30%)
Increase availability and access
Resolved significant road closures and detours
Number of resolved significant road closures and detours
Minutes delay created over the next 100 years in a major seismic event
90% reduction

APPENDIX B – CONSIDERATION OF OPTIONS REPORT

SH1 Opawa Bridge

9th May 2016

Consideration of options

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

Disclaimer

The NZ Transport Agency has endeavoured to ensure material in this document is technically accurate and reflects legal requirements. However, the document does not override governing legislation. The NZ Transport Agency does not accept liability for any consequences arising from the use of this document. If the user of this document is unsure whether the material is correct, they should refer directly to the relevant legislation and contact the NZ Transport Agency.

More information

NZ Transport Agency
Published May 2016

ISBN [number]

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 www.nzta.govt.nz

Contents

EXECUTIVE SUMMARY

The Opawa Bridge is being investigated for potential replacement to provide better vehicle access on SH1 in Blenheim. The project is one of several State Highway projects approved for investigation under the Accelerated Regional Roads Package (ARRP) by the Government in June 2014. The project was identified to improve the journey and in particular provide improved access for high productivity motor vehicles (HPMV) on SH1 in Marlborough.

The Opawa Bridge is located on the northern edge of Blenheim in a 50km/hr speed zone. It is 170m long and carries 9,800 vehicles/day of which 9% are heavy vehicles. It has a narrow carriageway where larger vehicles cannot pass, causing frequent delays and uncertain travel times. The bridge structure has inadequate seismic resistance at less than 33% of National Building Standard and, more critically, is vulnerable to a 1 in 100 year return flooding event. The bridge is a Category 1 heritage place, indicating a place of outstanding significance. Any demolition or modification to the bridge will need to pass a high consenting threshold.

The first phase of the investigation was developed with contribution from key stakeholders and iwi. It found that the bridge is too narrow for two-lane vehicles including modern heavy commercial vehicles and it has inadequate seismic resistance to natural hazard events.

The second phase identified and assessed a long list of potential options that could solve the two problems. These included options that would upgrade the existing structure and replace or duplicate the bridge.

As a consequence of the option assessment process the following preferred option was identified:

- a new parallel 10.8m wide two-lane bridge on the western side of the existing bridge, which would be retained as a pedestrian and cycle bridge. The cost estimate for this option is $14 - 17.5 million, although it would not meet the criteria for National Land Transport Funding.

In January 2016, the Government announced Crown funding for the preferred option.

1. BACKGROUND

The State Highway 1 (SH1) Opawa Bridge project (the Project) is one of several State Highway projects approved for investigation under the Accelerated Regional Roads Package (ARRP) by the Government in June 2014. The Project was identified to improve the journey and provide improved access for high productivity motor vehicles (HPMV) on SH1 in Marlborough.

The New Zealand Transport Agency (the Transport Agency) is responsible for operating, maintaining, renewing and improving the state highway network. The SH1 Opawa River Bridge is integral to the state highway network and a key link to the interisland ferry. The ferry is a vital freight link between the North and South Island. While the bridge has significance to utility service providers and the Marlborough District Council, it is the Transport Agency that has sole responsibility for managing any investments necessary to maintain and improve the asset.

Following the decision to retain the interisland ferry terminal in Picton, addressing issues on the nationally strategic route between Picton and Blenheim regained importance.

The Opawa Bridge is located on SH 1 at RP 18/9.0 between Picton and Blenheim (refer Photo 1 and Figure 1). It sits on the northern edge of the Blenheim in a 50km/hr speed area.

- The photographs on the front cover show the bridge details and are described below, in clockwise order, from the top photograph:
- Side view of the 8 span bow string truss bridge with large top cord beams and short 5m high piers looking downstream from the Blenheim side
- A driver's view of the narrow 5.49m carriageway with high vertical concrete kerbs and the original horizontal pipe safety rails
- The narrow carriageway squeeze when freight vehicles cross the bridge, as they are forced to cross the centreline due the additional width of their side mirrors
- Circa 1920 newly opened bridge with unsealed carriageway and intended traffic.

Little has changed with the bridge over its 100-year life with the exception of carriageway sealing and pavement marking.

The bridge is 170m long and carries 9,800 vehicles/day, with 9% heavy vehicles.

Photograph 1: Opawa Heritage Bridge opened 1917

Figure 1: Opawa bridge location SH1S RP18/9.0

2. OUTLINING THE NEED FOR INVESTMENT

2.1 Organisational strategies and objectives

In recent years, the Transport Agency has focussed on delivering an efficient freight network to reduce the cost of doing business. HPMVs provide productivity benefits that help improve the competitiveness of New Zealand exports, reduce the cost of goods and grow our economy. Bridge upgrades have been a fundamental part of ensuring the State Highway network are capable of handling heavier trucks.

The Transport Agency purpose is to "create transport solutions for a thriving New Zealand." The desired outcomes are:

- Effective – move people and freight where they need to go in a timely manner
- Efficient – deliver the right infrastructure and services to the right level at the best cost
- Safe and responsible – reduce the harms from transport
- Resilient – meet future needs and endure shocks

The long-term organisation goals and medium term objectives that relate to this project are identified in Table 1.

Table 1: Transport Agency long-term goals and medium-term objectives

Long-term (2013-32) Goals	Medium-term (2013-2022) Objectives
Integrate one effective and resilient network for customers	Improve freight supply chain efficiency
Deliver efficient, safe, and responsible highway solutions for customers	Greater resilience of the state highway network
	Deliver consistent levels of customer service that meet current expectations and anticipate future demand
Maximise effective, efficient, and strategic returns for New Zealand	Align investment to agreed national, regional and local outcomes and improve value for money in all we invest in and deliver

Table 2 identifies high-level organisational strategy in support of an efficient and resilient SH1 transport network between Blenheim and Picton.

Table 2: Relevant organisational strategies and plans

Organisation	Organisational Strategies
Government	Government Accelerated Roading Package
NZ Transport Agency	GPS, Statement of Intent, Freight Plans, National Business Cases, National Infrastructure Plan
Marlborough District Council	Draft Regional land Transport Plan

2.2 Defining the problem /opportunity

An investment logic mapping workshop was held on December 2014 with:

- Marlborough District Council, represented by:
  - Councillors Terry Sloan (Chair of Marlborough Regional Transport Committee),
  - Geoff Evans (Deputy Chair of Marlborough Regional Transport Committee),
- Marlborough Automobile Association, represented by:
  - Humphrey Meyers (District Councillor),
- Marlborough Road Transport Association, represented by:
  - Peter Heagney (nominated representative),
- Marlborough Police, represented by:
  - Sergeant Barrie Greenall (Team Leader, Highway Patrol)

It was also attended by Transport Agency staff to gain a better understanding of the current issues and business needs. Further meetings followed in May 2015 to agree to the problems and opportunities for investment.

Two problems and their respective proportional weighting (in brackets) were agreed as:

Problem One (70%): *Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements, particularly heavy commercial vehicles, creating an out of context environment for a nationally strategic state highway.*

The kerb-kerb width of the bridge is 5.49m is significantly below the Austroads recommendation for 7.0m . The narrow carriageway can present larger vehicles as a hazard, particularly if they cross the centreline because opposing vehicles slow down or cannot pass. This causes frequent delays and uncertain travel times. If another wide vehicle is already travelling across the bridge, wide vehicles, freight and trucks are forced to stop in one direction. This creates travel time delays and journey time variations. As freight traffic increases and without intervention, the delays and journey time variations are expected to increase.

Travel time variability was calculated using the Austroads variability formula, which explores the relationship between the mean and the standard deviation. Summarised ERUC data indicates a medium classification (20-30% Variability).

The NZTA MapHUB Efficiency NET geomap indicates a PM peak level of service E at the Opawa Bridge approach. The AM peak level of service is C. The drop in service is considered entirely due to delays caused by large vehicles being unable to pass in either direction at the same time, where generally a level of service A to C is considered acceptable. This narrowness creates public dissatisfaction.

Problem Two (30%): *Poor Structural Resilience - The bridge offers low seismic resistance, is at risk of bridge pier scouring and is significantly vulnerable to structural collapse.*

A detailed structural assessment (DSA) was completed in March 2015 on the Opawa Bridge. This assessment highlighted a number of potential seismic deficiencies with the bridge, including:

- Bridge span failure due to a lack of restraint at the end bearings
- Settlement of the bridge spans due to pier/pile subsidence caused by liquefaction, and the potential for bridge collapse

- Walking of heavy spans under longitudinal seismic shaking causing shearing in abutment piles

The report offers additional comment on flooding risk. The central bridge pier, located in the river channel thalweg, is at risk from scour in a 1 in 100 Annual Exceedance Probability (AEP)Flood. The existing pile depth is 7.57m from construction drawings and it is calculated that the piles could be completely exposed in a 1 in 100 AEP Flood event. With significantly reduced lateral support and additional horizontal pier loading from floodwaters, the central pier(s) could displace, leading to span failure.

2.3 Project benefits and key performance indicators

The benefits (with weighting in parentheses) and key performance indicators (KPIs) for the problems are shown in Table 3.

Table 3: Project benefits and KPIs

Investment Benefit	Measure KPI
Benefit 1 (70%) Increased throughput of freight and light vehicles and greater certainty of SH journey	Reduced coefficient of variation - standard deviation of travel time/average minutes travel time
	Minutes delay per kilometre
	Number of customer complaints
	Number of adverse media articles
Benefit 2 (30%) Greater structural resilience to natural hazard events, resulting in increased availability & access.	Number of resolved significant road closures and detours urban >2hours

3. CONSTRAINTS AND ASSUMPTIONS

Heritage values, archaeology

The Opawa Bridge was designed in 1912 and opened in 1917. The bridge is listed as a category 1 historic place by Heritage New Zealand and is a protected heritage item under the Wairau / Awatere Resource Management Plan (RMP). Any demolition or modifications to the bridge will require resource consent and approval from Heritage New Zealand for demolition or modification.

Hydrology

The current known hydrology is based on that used in the calibrated 2003 MDC MIKE 11 model for the Opawa River. For a 1 in 100 AEP event at this bridge the model indicate that:

- the design flow is 600m3/s
- the design water level is 6.77m above Nelson Vertical Datum 1955 (NVD55)

Geotechnical

The existing river bed geology contains silty layers of highly liquefiable soils to a depth of around 20-25m. This has a significant bearing on the construction estimate with any new bridge option requiring rock column ground improvements of the existing soils to prevent lateral spreading under earthquake loading. This work has been estimated to have a base cost of $1.6M dollars with a risk contingency of $800,000.

Utilities

The assumption has been made that all existing utilities have sufficient cover, but no onsite potholing has been undertaken.

4. ACTIVITY CONTEXT

4.1 Economic

The SH1 Opawa Bridge is a key structure on the National Strategic State Highway transport route enabling and supporting the growth of the New Zealand economy. In particular, the bridge enables freight access via the Port of Picton and the ferry link from the South Island to the North Island and back.

In addition, the structure enables considerable amount of inter-regional traffic. Marlborough is an export-focussed producer of primary products, principally from viticulture, aquaculture, and forestry. Marlborough is New Zealand's largest wine-growing region, and has diversified into manufacturing and other services that support and add value to the primary sector activity.

4.2 Geographic

The Opawa Bridge is located on SH1 near the northern threshold of the Blenheim township. The bridge is located within the 50km/hr speed zone, 300m south of the 100km/h to 50km/hr speed change on the northern urban fringe of Blenheim.

The Opawa River is a meandering silt-bed river bounded by stop banks. The bridge is situated on an S-bend in the river with the piers skewed about 47 degrees to the direction of flow.

The main trunk railway line runs on the eastern side of the highway and the rail overbridge is 100m downstream of the Opawa Bridge.

4.3 Environmental

The river environment at the bridge site is highly modified from its natural state due to manmade infrastructure, including road and rail bridges and the stop bank system.

On the eastern side of the highway is a formed off-road cycle path, which connects Blenheim to Spring Creek. The Opawa Bridge is a key cycleway link.

4.4 Social

The immediate southern approach of the Opawa Bridge passes beside motel accommodation and holiday camp ground accommodation. Further down Grove Road the land use changes to industrial and commercial.

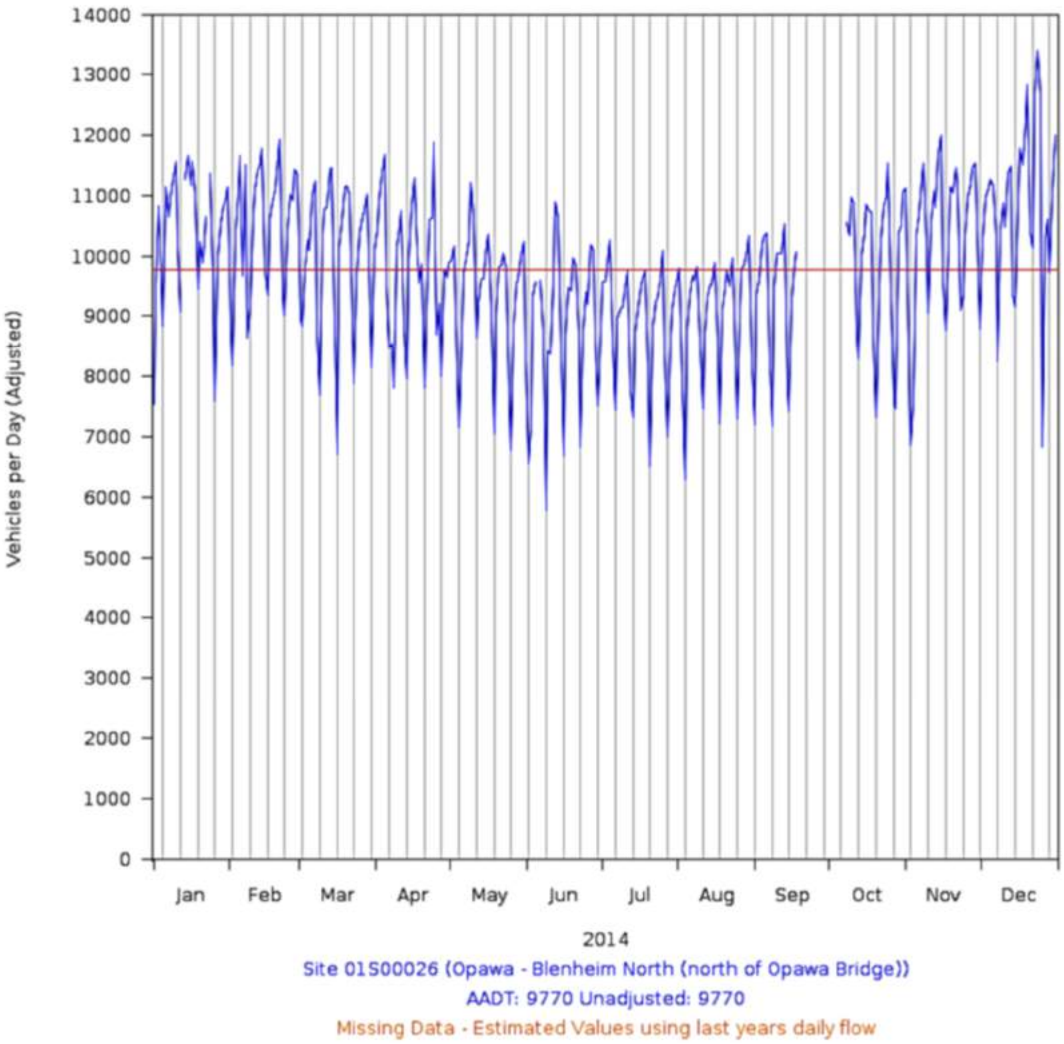
The Opawa Bridge on the northern approach is surrounded by rural agricultural activities, with one nearby residential property and a cluster of industrial/commercial buildings known as the Blenheim Research Centre. Both these properties share a common access point and are set back from the highway.

5. DATA ANALYSIS

5.1 Traffic volumes

A traffic monitoring site is located 100m north of the bridge. This provides classified traffic count information for SH1 for both traffic directions. Figure 2 shows the annual daily traffic data for 2014 and indicates 9,800 average annual daily traffic (AADT), with a summer peak of 13,500 veh/day and a winter low of 5,700 vehicles day. Further analysis indicates there are 9% heavy commercial vehicles. The Wairau Plains Transport Model 2008 forecasts annual traffic growth at this location of approximately 2.2%

Figure 2: Opawa bridge annual daily traffic

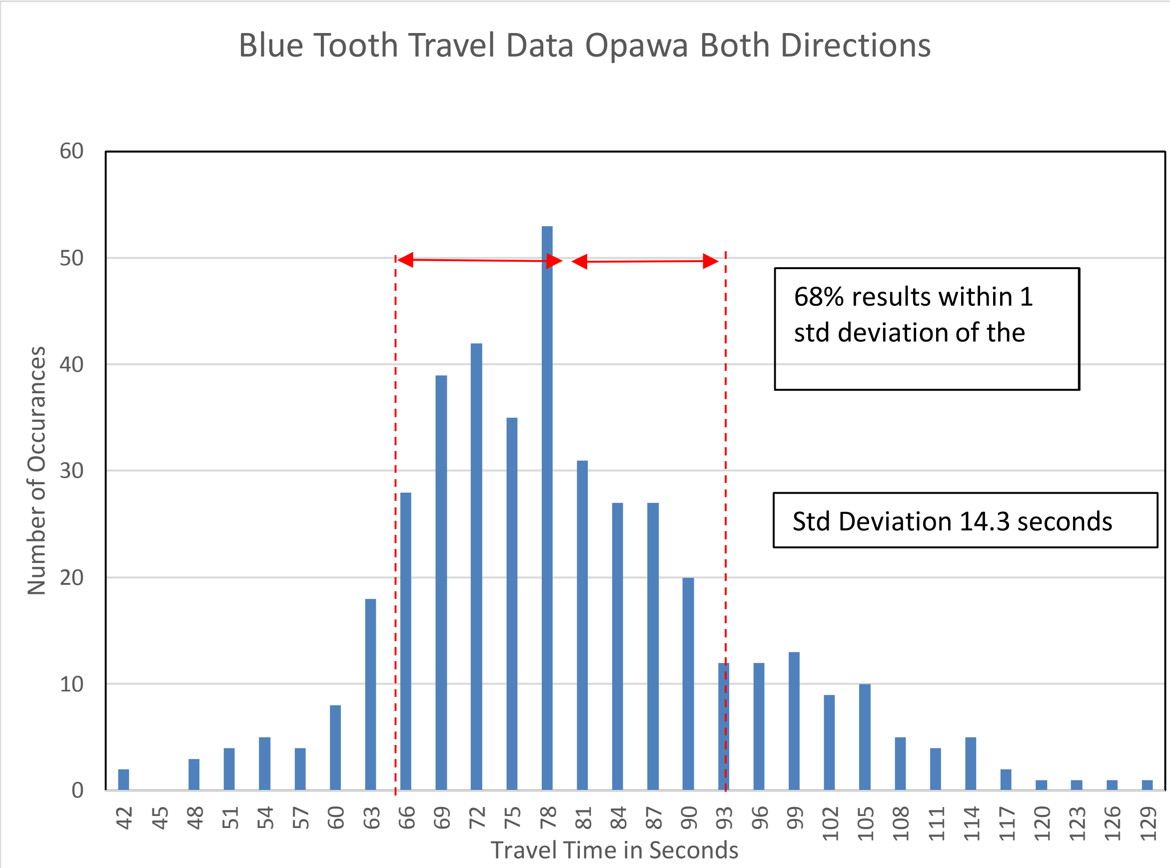


5.2 Journey travel time variation

The Transport Agency installed Bluetooth traffic sensors on this route to record the average travel times through the Opawa Bridge study area. The study area included both 100km/h and 50km/h speed zones. The results of a selected week/day typical hour are shown in Figure 3.

Statistical analysis of this data shows the mean travel time between sensors is 1 minute and 19 seconds with a standard deviation of 14.3 seconds. Sixty-eight percent (68%) of all travel time occurs within 1 standard deviation of the mean or between 1 minute 5 seconds and 1 minute 33 seconds. This measurement allows accurate monitoring of the variation or range of travel times.

Figure 3: Distribution of Bluetooth travel data, weekday hourly average.



5.3 Vehicle travel time delays and queuing

A one-day (8am to 4pm) traffic survey was undertaken on Thursday 12 March 2015. The focus of this survey was to record the frequency of delays created by wide vehicles and vehicles stopping to give way to wide vehicles travelling over the bridge in the opposing direction. The survey showed the following average weekday hourly delays:

- There were 25 delayed groups of vehicles per hour on average in both directions: 36% northbound and 64% southbound
- The average number of vehicles delayed per stoppage varied between 2 to 15 vehicles
- The average delay per stoppage ranged from 8 seconds to 30 seconds.

5.4 Public complaints

Three public complaints were received by Marlborough Roads concerning the Opawa Bridge in 2014, and eighteen letters were published in the Marlborough Express regarding the bridge between January 2014 and February 2015.

5.5 Detour additional travel time

Figure 4 shows the detour routes for freight and light vehicles if the Opawa Bridge is closed due to a natural hazard event. The detour route along state highways is via SH6 and SH62 and the average additional travel time is 19 minutes to travel this route.

A shorter detour route via local roads (Jacksons Road) exists. The average additional travel time is estimated as 12 minutes in both directions. Several other local roads may be suitable for light vehicles however these contain narrow carriageways, secondary urban streets, and single lane bridges and may result in considerable delays, pavement deterioration, and safety risks, if over used.

Figure 4: Detour route map

6. OPTIONS ASSESSMENT CRITERIA

The assessment criteria used for analysing the draft preferred option are as follows:

- Strategic outcomes - Are we solving the identified problem and achieving the KPIs?
- Cost optimisation - What are the financial and time implications?
- Implementation risks- Which options contain the greatest risks to successful implementation?
- Wider project impacts – Which options contain the greatest risks in terms of environmental and social screening?

7. OPTION DEVELOPMENT

A long list of options was developed to address the two identified problems. Eleven separate options were identified as possible solutions; they are summarised in **Appendices C2 and C3**. Cost estimates are provided in **Appendix D**.

A number of the options involve new bridges. A new bridge would require 10m separation from the existing bridge to ensure it would not be damaged from movement of the existing bridge (assuming the option did not include a structural improvement) during a natural hazard event. This requires land acquisition and designation for 25m either side of the existing bridge.

Consideration of the preferred alignment for a new bridge included:-

- Impact on the Blenheim Top 10 Holiday Park. The Holiday Park has three accommodation blocks that are within the footprint of an eastern bridge alignment and camping sites within the footprint of the western bridge alignment.
- Impact on the Grove Motel. The Motel is partly within the footprint of the western bridge alignment.
- Variable stream width
- Location of overhead power services
- Existing eastern alignment of the footpath on the existing bridge
- Existing eastern alignment of the walk/cycle path to Spring Creek

The western alignment is preferred for all of the new bridge options as it has the least impact on surrounding properties, provides better pedestrian and cycle access, and requires less property acquisition.

This section describes each option and considers the main advantages and disadvantages.

7.1 Do nothing

A do nothing option was considered. The existing bridge with its current lane width restriction has an estimated remaining life of 25-45 years. The bridge requires regular condition inspections on a six-monthly basis and after any moderate seismic event.

A do nothing approach is possible, but the bridge surface ride quality would deteriorate. There is a risk that the bridge joints would have accelerated deterioration and pier scour would continually get more severe. This could potentially shorten the remaining life of the bridge and risk damage to the heritage structure in a seismic or flood event.

7.2 Do minimum

The do minimum option includes undertaking some of the critical work identified in the 2015 detailed seismic assessment (DSA) such as pier scour protection, underpinning of the central piers, bridge resurfacing, and joint repairs.

Undertaking this work will mean the bridge is still at risk from failure in a seismic or flooding event. The rough order cost of this option is $0.7M.

7.3 Option 1: Structural and scour upgrade

The option proposes structural and flood mitigation work to reduce the risk of collapse in a seismic or flood event. This option does not alter the lane widths of the existing bridge.

This option includes a structural upgrade as identified in the 2015 DSA. In addition, a cycle/pedestrian shared path will be created on the eastern side of Grove Road.

Key advantages and disadvantages of option 1 are as follows:

Advantages

- Provides for benefit 2
- Retains the existing bridge
- Retains the 'gateway to Blenheim' benefit and associated traffic slowing effect
- Requires no additional land

Disadvantages

- Does not provide for benefit 1
- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure

The rough order cost of this option is $6M.

7.4 Option 2: Intelligent transport solution with a structural upgrade

The option includes the work proposed in option 1, but in additional proposes an intelligent transport solution with a wide vehicle detection system. The system could alert an approaching wide vehicle of another wide vehicle traveling in the opposite direction on the bridge. A variable messages sign would advise the wide vehicle to pull off the road and wait, allowing the unimpeded flow of light vehicles. Additional road widening would be required to create a safe vehicle pull off area.

Key advantages and disadvantages of option 2 are as follows:

Advantages

- Provides for benefit 1 for light vehicles
- Provides for benefit 2
- Retains the existing bridge

Disadvantages

- Does not provide for benefit 1 for freight
- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure
- High risk as the technology would require some development and implementation
- Approval from Transport Agency for a new traffic control device
- Additional road space would require property purchase

The rough order cost of this option is $8M.

7.5 Option 3: Central widening of existing structure and structural upgrade

The option includes the work proposed in option 1 and also involves cutting the existing structure down the centre of the deck and increasing the width of the deck to 9m. This would preserve the appearance of the heritage structure and resolve the narrow existing traffic lanes. While the option is feasible, it would require widened piers, new piles, and a temporary bridge during construction.

Key advantages and disadvantages of option 3 are as follows:

Advantages

- Provides for benefit 1 and 2
- Retains the existing bridge
- No significant property requirements

Disadvantages

- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure
- Significant technical and engineering construction risk
- Traffic delays and temporary bridge property requirements during construction would be significant
- Environmental effects from widened bridge piers and new piles

The rough order cost of this option is $16M.

7.6 Option 4: Widening of existing structure upstream and structural upgrade

The option includes the work proposed in option 1 and adds an additional 6m width on the upstream side of the existing bridge. This would resolve the narrow traffic lanes and partially preserve the heritage nature and appearance of the bridge side truss.

Key advantages and disadvantages of option 4 are as follows:

Advantages

- Provides for benefit 1 and 2
- Retains the existing bridge
- No significant property requirements

Disadvantages

- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure
- Significant technical and engineering construction risk
- Traffic delays during construction
- Environmental effects from widened bridge piers and new piles
- The visual appearance of the bridge from the west would be altered

The rough order cost of this option is $12M.

7.7 Option 5: New 10.8m wide single lane bridge, operating in tandem with existing bridge with no structural upgrade

The option involves constructing a new 10.8m wide bridge upstream of the existing bridge. The new bridge would operate as one traffic lane with a shared walk/cycle path northbound with southbound traffic and existing shared walk/cyclepath on the existing bridge.

The existing bridge would have no structural upgrade, although a cycle/pedestrian shared path will be formed on the eastern side of Grove Road.

The new bridge could be converted to a two lane facility in the future when the existing bridge’s remaining useful life is exceeded or if it is damaged beyond practical repair in a seismic or flooding event. The new bridge has sufficient width to be converted to two traffic lanes and two on-road cycle lanes. It would be necessary to construct a new pedestrian bridge if the existing bridge was unserviceable for pedestrians.

Key advantages and disadvantages of option 5 are as follows:

Advantages

- Provides for benefit 1
- Provides for benefit 2 for the new bridge
- Retains the existing bridge
- Confident cyclists provided with on-road cycle lanes so won’t have to cross the road and use the shared path facility
- Minor construction delays
- New bridge can be converted to two traffic lanes in the future

Disadvantages

- Does not improve seismic or flooding risk of existing bridge
- Significant property requirements
- Increased operation and maintenance costs for two bridges
- In the future, the existing bridge may need to be replaced with a new pedestrian bridge at this point additional capital expenditure will be required to move all traffic onto the new bridge

The rough order cost of this option is $16M.

7.8 Option 6: New 7.3m wide single lane bridge, operating in tandem with existing heritage bridge with no structural upgrade

The option is similar to option 5 but involves constructing a narrower 7.3m wide bridge upstream of the existing bridge. The new bridge would operate as a one-lane northbound highway lane with the southbound traffic on the existing bridge.

The new bridge would not have a pedestrian/cycle shared path beside the traffic lane as option 5, but an on-road cycle lane only. This would allow the bridge to be used for two-way traffic in emergencies.

Key advantages and disadvantages of option 6 are as follows:

Advantages

- As option 5, but with reduced land requirements
- The new bridge can be used for two-way traffic in emergencies

Disadvantage

- As option 5

The rough order cost of this option is $15M.

7.9 Option 7: New 13.3m wide bridge, with pedestrian facilities, retaining the existing bridge with no structural upgrade

The option involves constructing a new two lane 13.3m wide bridge with on road cycle lanes and a footpath on one side. The existing bridge would not be structurally upgraded, but would retain the cycle/ pedestrian shared path.

Key advantages and disadvantages of option 7 are as follows:

Advantages

- Provides for benefit 1
- Provides for benefit 2 for the new bridge
- Retains the existing bridge
- Confident cyclists provided with on-road cycle lanes so won't have to cross the road and use the shared path facility
- Minor construction delays
- Operation and maintenance costs reduced from option 5 as existing bridge would not carry traffic

Disadvantages

- Does not improve seismic or flooding risk of existing bridge

- Significant property requirements
- Footpath on side of new bridge unlikely to be utilised and will require additional costs to connect footpaths at either end of the bridge

The rough order cost of this option is $19M.

7.10 Option 8: New 10.8m wide bridge retaining the existing bridge with no structural upgrade

This option is the same as option 7 but does not have a footpath on one side of the new bridge.

Key advantages and disadvantages of option 8 are as follows:

Advantages

- Provides for benefit 1
- Provides for benefit 2 for the new bridge
- Retains the existing bridge for public use
- Confident cyclists provided with on-road cycle lanes so won't have to cross the road and use the shared path facility
- Minor construction delays
- Operation and maintenance costs reduced from option 5 as existing bridge would not carry traffic

Disadvantages

- Does not improve seismic or flooding risk of existing bridge
- Significant property requirements
- In the future the existing bridge may need to be replaced with a new pedestrian bridge

The rough order cost of this option is $16M.

7.11 Option 9: New two lane 13.3m bridge replacing the existing bridge on the current alignment

The option involves demolishing the existing bridge and replacing it with a new two lane 13.3m bridge on the current bridge alignment, the new bridge would have on road cycle lanes and a footpath on one side.

Key advantages and disadvantages of option 9 are as follows:

Advantages

- Provides for benefit 1 and 2
- Confident cyclists provided with on-road cycle lanes
- Operations and maintenance cost reduced

Disadvantages

- Removes the existing bridge

- Traffic delays and temporary bridge property requirements during construction would be significant

The rough order cost of this option is $23M.

7.12 Option 10: Replace the existing bridge with a two lane tunnel

The option involves constructing a two-lane tunnel under the Opawa River to replace the existing Opawa Bridge.

Key advantages and disadvantages of option 10 are as follows:

Advantages

- Provides for benefit 1 and 2
- Would create a distinct 'gateway to Blenheim'

Disadvantages

- High cost
- The existing bridge can be retained without structural upgrade for walking and cycling access
- Significant engineering and technical challenges due to the presence of liquefiable insitu ground
- Significant environmental impact and consenting issues

The rough order cost of this option is over $50M.

7.13 Option 11: Construct a Blenheim by-pass for through Traffic

The option is a complete by-pass on the eastern edge of the Blenheim urban area providing a new link for the Picton to Christchurch route. The bypass option would be in the region of 5km long, and as the Opawa River splits in two downstream of the existing bridge the bypass will include two new significantly-sized bridge structures. The existing bridge could be retained for local traffic and as the SH6 link to Blenheim and Base Woodbourne. The through traffic to the south of Blenheim is 2,600 veh/day, so 7,200 veh/day will still use the existing bridge.

Advantage

- Removes the through freight portion of traffic from the bridge and Blenheim

Disadvantages

- Local traffic would still use the existing narrow bridge therefore the strategic objectives are not fully met
- High cost
- Unlikely to be supported unless considered as part of a network wide investigation
- Challenging property acquisition

- Significant environmental impacts and consenting issues

The rough order cost of this option is over $50M.

8. OPTIONS ASSESSMENT AND EVALUATION

A preliminary options assessment has been undertaken. All options were considered in terms of satisfying the strategic outcomes.

Options 3 through 9 inclusive fully satisfy the strategic outcomes and were assessed against the remaining assessment criteria: cost optimisation, implementation risks, and wider project affects. Their rankings are summarised in Table 4.

Options 1, 2, and 11 do not meet the strategic outcomes and have been excluded from further assessment. Although Option 10 achieves the strategic outcomes, it was dismissed due to poor physical and financial viability.

Table 4: Assessment summary

Option		Score	Rank
Option 3	Widen & upgrade existing bridge	12.3	6
Option 4	Extend & upgrade existing bridge	12.4	5
Option 5	New northbound bridge (10.8m wide) with existing bridge southbound	16.0	2
Option 6	New northbound bridge (7m wide) with existing bridge southbound	14.4	4
Option 7	New 2-way parallel bridge (13.3m wide)	15.7	3
Option 8	New 2-way parallel bridge (10.8m wide)	16.2	1
Option 9	New 2-way replacement bridge (13.3m wide)	11.6	7

Options 5 and 8 were further refined and compared. Option 8 was preferable to option 5 for the following reasons:

- Lower implementation risks,
- Better cost optimisation, and
- Only slightly higher wider project impacts.

An aerial plan and cross section is provided in **Appendix C** as a potential alignment.

The preliminary options assessment documentation is provided in Appendix D.

APPENDICES

APPENDIX A –INVESTMENT LOGIC MAP

Appendix A: Investment Logic Map

INVESTMENT LOGIC MAP
Activity

PROBLEM ▶ **BENEFIT**

Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements

70%

Greater certainty of state highway journey

Investment Benefit: Increase reliability
Measure: Reliability – actual vehicles

Investment Benefit: Decrease journey time
Measure: travel time delay – by mode

Greater customer satisfaction.

Investment Benefit: Improve comfort & customer experience
Measure: Number of customer complaints (CRMS)
Measure: Number of adverse media

Poor structural Resilience - Low seismic strength and is at risk of bridge pier scour

30%

Greater route resilience to emergency events.

Investment Benefit: Increase availability & access
Measure: Number of resolved significant road closures and detours

APPENDIX B –BENEFIT MAP

BENEFIT MAP

BENEFIT	INVESTMENT BENEFIT	MEASURE	DESCRIPTION	BASELINE	TARGET
Greater certainty of state highway journey **(70%)**	Increase reliability	Reliability – actual vehicles	Coefficient of variation: Standard deviation of travel time / average minutes travel time	Mean travel time 1.3 min, Standard deviation 0.23 min	Mean travel time 1.1min, Standard deviation 0.14 min
	Decrease journey time	Travel time delay	Minutes delay per km	Current delay 0.5 min per km	NIL
	Improve comfort and customer experience	Customer complaints	Number of customer complaints	Existing records show 3 per year and 7 annual plan	NIL
		Media coverage	Number of adverse media articles	Estimated to be 18 letters to editor per year, from Local Transport Agency records	NIL
Greater resilience to emergency	Increase availability and access	Resolved significant road closures and	Number of resolved significant road closures and detours	Minutes delay created over the next 100 years in a major	90% reduction

APPENDIX C – PLAN OF ALIGNMENT

Appendix C2: Plan of Alignment and Options

Option (1)

Retain existing heritage bridge and seismic upgrade
- Seismic strengthening, $3.4 M
- Upgrade pedestrian / cycle handrail
- Upgrade drainage
- Upgrade footpath on southern approach
- Rough order cost: $6 M

Option (2)

Retain existing heritage bridge with seismic upgrade and wide vehicle pull out system
- Create truck pull off zone both ends with ITS over dimension / wide load detection system, $0.6 M
- Retain heritage bridge
- Rough order cost: $8 M

Option (3)

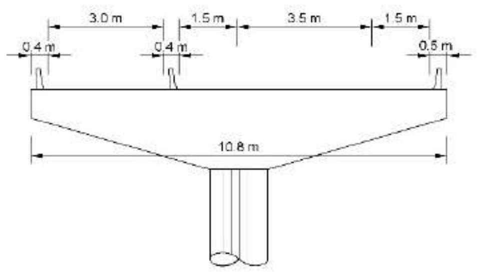
Widen existing bridge by cutting middle of deck and widening piers and deck
- Structural upgrade
- Achieve 9 m deck
- Rough order cost: $16 M

Option (4)

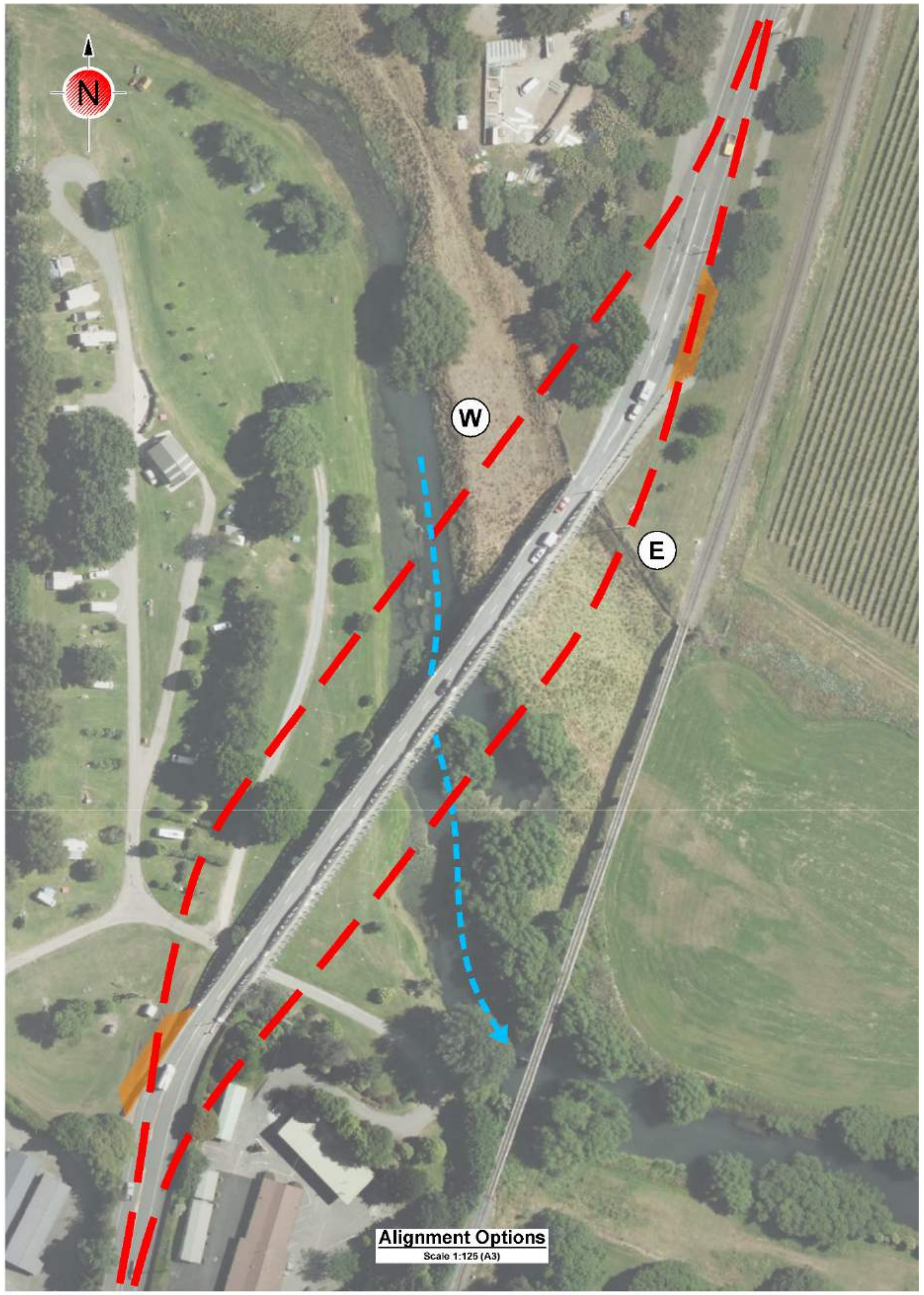
Widening bridge on western side by adding additional lane
- Structural upgrade
- Widen piers
- Add 6 m
- Rough order cost: $12 M

Option (5)

Retain existing heritage bridge for southbound, new single lane bridge for northbound traffic 10.8 m wide. No structural upgrade of heritage bridge.
- New structure can operate as two lane bridge in emergencies
- Rough order cost: $16 M

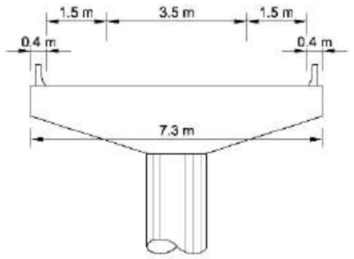


Option 5



Option (6)

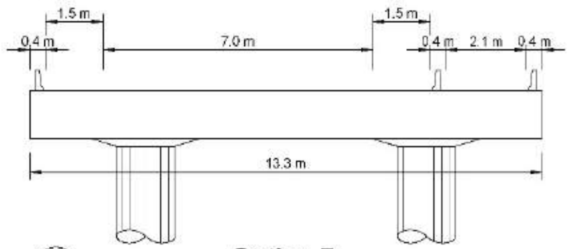
Retain existing heritage bridge for southbound traffic. New single lane bridge for northbound traffic 7.3 m wide (No footpath). Structural upgrade of heritage bridge. •
Rough order cost: $15 M



Option 6

Option (7)

New 2 lane bridge 13.3 m wide •
No structural upgrade of old bridge •
Old bridge returned to MDC
- Rough order cost $19 M

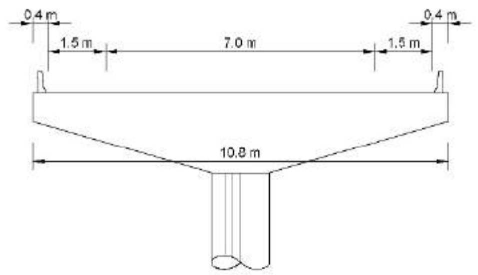


Option 7

Option (8)

New 2 lane bridge 10.8 m wide, pedestrian / cycle use old heritage bridge
- No structural upgrade
- Heritage bridge returned to MDC as walk / pedestrian bridge •

Rough order cost $16 M



Option 8

Option (9)

New 2 lane structure on existing alignment 13.3 m wide
- Demolish existing bridge
- Rough order cost $23 M

Option (10)

Tunnel option
- Rough order cost $50 M

Option (11)

By-pass option
- Rough order cost $50 M

APPENDIX D – MULTI CRITERIA ANALYSIS

Project: MR223 Opawa Bridge - Multi Criteria Analysis

Strategic Assessment Criteria	Measurement	Option 1 Upgrade existing bridge	Option 2 Upgrade existing bridge and install ITS system	Option 3 Widen & upgrade existing bridge	Option 4 Extend & upgrade existing bridge	Option 5 New northbound bridge (10.8m wide) with existing bridge southbound	Option 6 New northbound bridge (7m wide) with existing bridge southbound	Option 7 New 2-way parallel bridge (13.3m wide)	Option 8 New 2-way parallel bridge (10.8m wide)	Option 9 New 2-way replacement bridge (13.3m wide)	Option 10 Tunnel	Option 11 Blenheim by-pass
Strategic Objectives												
Objective 1 (70%) Increase Reliability & Decrease Journey Time Greater certainty of State Highway Journey	Reduced coefficient of variation - standard deviation of travel time/average minutes travel time	1	4	7	7	7	7	7	7	7	7	7
	Minutes delay per kilometer	1	4	7	7	7	7	7	7	7	7	7
	Number of customer complaints (CRMS)	1	5	7	7	7	7	7	7	7	7	3
	Number of adverse media articles	1	5	7	7	7	7	7	7	7	7	3
	Reason for score	No widening of Bridge	Removes restriction for light vehicles only	Widens bridge		Duplicates bridge		Replaces bridge				Reliable journey on new SH1 bypass, no change on exisitng link (new SH6A)
Objective 2 (30%) Increase Availability & Access. Route resilience to natural events	Number of resolved significant road closures and detours urban >2hours (Vehicles)	7	7	7	7	7	7	7	7	7	7	3
	Reason for score	Strengthens to full seismic and flood loading		Strengthens to full seismic and flood loading		New bridge to full seismic and flood loading					New tunnel to full seismic and flood loading	Resilience on new SH1 bypass, no change on exisitng link (new SH6A)
Other Criterion												
Cost Optimisation												
Investment Cost (Range)				$14 to $16M	$10M to $12M	$13M to $16M	$13M to $15M	$15M to $19M	$13M to $16M	$19M to $23M		
Investment Cost Score				4.6	7.0	4.9	5.2	3.4	4.9	1.0		
Economic BCR (Low Medium High)				2	3	2	2	2	2	1		
	Reason for score			Medium cost solution with marginal benefits								
Operational Costs if significant (Range) - Over next 20-years				4	4	4	4	7	7	7		
	Reason for score			High maintenance costs on aging structure				Low maintenance costs				
Construction Delays (Low Medium High)				1	1	7	7	7	7	1		
	Reason for score			High construction delays		Low construction delays				High construction delays		
Life estimate of solution (short term , medium term , long term)				4	4	7	4	7	7	7		
	Reason for score			Medium term solution		Long term solution	Medium term solution	Long term solution				
	SUBTOTAL Cost Optimisation			3	4	5	4	5	6	3		
Implementation (Risk)												
Technical				1	1	7	7	7	7	7		
	Reason for score			High complexity strengthening and widening/extension design		Low complexity standard bridge design						
Operational				4	4	7	4	7	7	7		
	Reason for score			Standard bridge operation								
Stakeholders/Public/Property				4	3	4	4	5	5	1		
	Reason for score			Would involve more works in waterways than options 1 and 2, and also would involve altering a heritage bridge which may lead to some public / stakeholder opposition. May involve land being required to widen the bridge, and potentially alteration of designation? If so, may be opposed by adjacent landowners.	Would involve more works in waterways than options 1 and 2, and also would involve altering a heritage bridge (altering the visual effect on one side) which may lead to some public / stakeholder opposition. May involve land being required to widen the bridge, and potentially alteration of designation? If so, may be opposed by adjacent landowners.	Additional 25m of land required upstream and would increase noise for adjacent properties which may be opposed by landowners. Would also involve significant works within the waterway - more potential for environmental effects = more potential for public / stakeholder opposition. Retention of heritage bridge without alteration (i.e. no seismic upgrade) would lessen opposition.	Land required upstream to allow for widening and would increase noise for adjacent properties which may be opposed by landowners/occupiers. Would also involve significant works within the waterway - more potential for environmental effects = more potential for public / stakeholder opposition. Retention of heritage bridge (with some changes required for seismic upgrade) would lessen opposition.	Retention of heritage bridge without alteration (i.e. no seismic upgrade) would lessen opposition. Loss of primary function of state highway bridge could be opposed by Heritage NZ, but may be balanced by increased enjoyment of bridge as used for walking and cycling. Additional 20m strip of land required which has potential for landowner opposition.	Retention of heritage bridge without alteration (i.e. no seismic upgrade) would lessen opposition.	Likely to be strong public/Heritage NZ opposition to losing the heritage bridge as it is seen as iconic / gateway to Blenheim.		
Environmental				4	4	3	3	3	3	2		
	Reason for score			Would involve more works in waterways than options 1 and 2, and would alter noise effects as would be closer to properties, but may be neutralised by reducing stop/start noise from vehicles		More impact on waterways than options 1-4 as would involve new piles. Would increase noise for adjacent landowners, but eliminate the stop/start vehicle noise				Demolision of old bridge and installing new piles for new bridge would impact the riverbed and water, and would have noise effects throughout construction and operation		

Safety			6	6	7	6	7	7	7		
Reason for score			Wider carriageway provided								
Accessibility & Social Inclusion			7	7	7	7	7	7	7		
Reason for score			Improved accessibility for all road users								
SUBTOTAL Implementation			4	4	6	5	6	6	5		
Wider Project Impacts (Environmental Impact and Social Responsibility Screen)											
Social			5	5	5	5	5	5	5		
Reason for score			Addresses pedestrian and cyclist issues. Altered designation.								
Natural Environment			5	5	4	4	3	4	2		
Reason for score			Would involve more works in waterways than options 1 and 2		More impact on waterways during construction period than options 1-4 as would involve new piles.		More impact on waterways during construction period than options 1-4 as would involve new piles. Slightly more impact for bridge with twice the amount of piles (13.3m).	More impact on waterways during construction period than options 1-4 as would involve new piles.	Demolision of old bridge and installing new piles for new bridge would impact the riverbed (disturbance / sedimentation / erosion) and water (potential for sedimentation / pollution), and would have noise effects, mainly		
Human Health			5	5	5	5	5	5	5		
Reason for score			No sensitive education or medical facilities nearby. Would alter noise effects as would be closer to properties, but reduce stop/start noise from vehicles, particularly heavy vehicles therefore would marginally reduce traffic congestion and emissions.								
Culture and Heritage			4	3	7	6	6	6	1		
Reason for score			Alteration to heritage bridge which may be of some concern, but would retain visual impact of bridge and functional use as highway	Alteration to heritage bridge which may be of some concern, particularly as it would lose visual effect from the upstream side. Would still retain functional use as highway	Retention of heritage bridge without alteration, and still retained for state highway function	Involves heritage bridge, however work would ensure longer life, and retain functional use as a state highway and retain original visual impact of bridge.	Retention of heritage bridge without alteration (i.e. no seismic upgrade) would lessen opposition. Loss of primary function of state highway bridge could be opposed by Heritage NZ, but may be balanced by increased enjoyment of bridge as used for walking and cycling.		Likely to be strong public/Heritage NZ opposition to losing the heritage bridge as it is seen as iconic / gateway to Blenheim.		
Urban Design			5	4	5	4	3	3	2		
Reason for score			Limited visual effect as assumed existing bridge 'archs' retained; footpath improved	Visual effect of new 'clip-on'; better footpath	Visual effect of new bridge; new 3 m wide pedicycle path shown on cross-section on upstream side of new bridge; better footpath on existing???	Visual effect of new bridge + no pedicycle path on new bridge; assume better path on existing bridge	Visual effect of new 'wide' bridge + new 2.1 m wide pedicycle on downstream side of new bridge; assume all of old bridge becomes a pedicycle link??? (not sure why you would put a path on new bridge if old bridge serves this purpose???)	Visual effect of new bridge; old bridge fully available as pedicycle facility	Visual effect of new 'wide' bridge which includes pedicycle path; loss of visual 'amenity' of old bridge + old bridge not available as pedicycle link		
SUBTOTAL Wider Project Impacts			5	4	5	5	4	5	3		
Overall Other Criterion Assessment											
TOTAL			**12.3**	**12.4**	**16.0**	**14.4**	**15.7**	**16.2**	**11.6**		
Ranking (Option to take forward)			**6**	**5**	**2**	**4**	**3**	**1**	**7**		

Scoring Key

1	Low Benefit / High Cost
3	
5	
7	High Benefit / Low Cost

Completed by	**Initial Compilation (June 2015):** Peter Kortegast (Opus) Transportation Engineer Donna Hills (Opus) Resource Management Planner Martin Crundwell (Opus) Civil & Structural Engineer	**MCA Workshop (5 April 2016) Participants:** 1. Brent Morgan (Opus) Team Leader 2. Frank Westergard (Opus) Deputy TL 3. Donna Hills (Opus) RMA Planner 4. Andrew Adams (NZ Transport Agency) Project Manager Design 5. Frank Porter (NZ Transport Agency) Marlborough Manager 6. Andrew James (NZ Transport Agency) Project Manager IBC/DBC 7. Erik Teekman (Opus) Transportation Planner 8. Martin Crundwell (Opus) Technical Reviewer	**Technical Review (April 2016):** Frank Westergard (Opus) Civil Engineer David McKenzie (Opus) Technical Principal Landscape Architecture Lea Osullivan (Opus) Resource Management Planner Erik Teekman (Opus) Transportation Planner Alan Dinan (Opus) Structural Engineer	

APPENDIX C1 – OPTIONS ASSESSMENT – GEOMETRIC OPTIONS

KEY:
10.8m wide corridor shown.
Road reserve width post-completion likely 5m additional width each side

- 8A - Straight Parallel Bridge Upstream (West) (min 50km/h)
- 8B - Straight Parallel Bridge Downstream (East) (min 50km/h)
- 8C - Straight Bridge Angled Upstream (West) (min 50km/h)
- 8D - Partial Curved Bridge Upstream (West) (min 50km/h)
- 8E - Fully Curved Bridge Upstream (West) (min 70km/h)

1:1 @ A1 / 1:2 @ A3 — 0 10 20 30 40 50 60 70 80 90 100 mm

Revision	Amendment	Approved	Revision Date

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date

Drawn	Scales
FTW	1:500 (A1) 1:1000 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
MR 223 SH1 OPAWA BRIDGE

Sheet
BRIDGE CONSTRUCTION
ALIGNMENT OPTIONS

Project No.	Sheet. No.	Revision
5-MB982.03		

Original Sheet Size A1 [841x594] Plot Date 2016-09-28 at 3:42:56 p.m. Path \\bmsv01\branchlib\projects\5MB982.XX Wairau and Opawa Bridges\03_Opawa IBC & DBC\Opawa DBC\Construction Access\Opawa-70kmh-CONST-ACCESS-2016-07-20.dwg AlignOptions

Opus International Consultants Ltd
Blenheim Office
19 Henry Street
PO Box 563, Blenheim 7240
New Zealand

t: +64 3 520 9500
f: +64 3 520 9501
w: www.opus.co.nz

To	Brent Morgan
Copy	Frank Porter, Nicky Bilbrough, Mark Spring, Peter Wilson, Andrew Noble, Matthew Taylor, Michael Cowan, Matthew Tidball, Martin Crundwell
From	Frank Westergard
Date	20 July 2016
File	5-MB982.03
Subject	**Opawa Bridge Replacement DBC Alignment Options**

The Opawa Bridge Replacement IBC report identified the preferred option for replacement as a new 10.8m wide, two-way, two-lane bridge, located to the west (upstream) of the existing bridge (Option 8).

Five sub-options for road alignment have been identified generally within the bounds of Option 8, each with varying effects on neighbouring property. This alignment option assessment intends to refine the likely road alignment to allow progression of property purchase discussions with the neighbouring landowners. These options have been identified as generic options to test and identify road geometry, structural and property impact issues.

The five sub-options are denominated 8A through 8E (refer attached drawing). Note that at this time the bridge replacement design is still conceptual, with minimal details that are subject to revision.

Common constraints

1. All five options have a southern abutment adjacent to and as close as possible to the existing bridge abutment to line up with Grove Road and reduce the potential for encroachment on the Grove Motel on the western side and the accommodation blocks of the Top 10 Holiday Park on the eastern side. The deck edges are no less than 3.5m apart at any point to allow for construction clearance, future bridge maintenance, provision of a pedestrian pathway between the two abutments, and allowance for differential oscillation of the bridges during a seismic event.

2. Geometric design speed: maximum 70km/h (per memo dated 23 March 2016 and email response from Steve James (NZTA) dated 6 April 2016); minimum 50km/h based on regulatory speed limit.

3. Length of bridge based on location of existing stop banks and no reduction in waterway capacity.

Qualitative Comparison of Sub-Options	
Option 8A – Straight Parallel Bridge Upstream	
The IBC report recommended an upstream bridge alignment. The option with the smallest land requirement for the bridge footprint would be parallel and as close as practicable to the existing.	
Advantages	Disadvantages
simple structural design of straight bridge 70km/h design speed on northern approach (simple curve)	requires the removal of building in Grove Motel most impact on amenity value of motel restricts internal motel traffic movement 50km/h max design speed on southern approach to tie back into Grove Road (reverse curves required)
Option 8B – Straight Parallel Bridge Downstream	
In the IBC report an eastern bridge alignment (downstream) was dismissed from assessment due to the clash with accommodation blocks in the Holiday Park. However, given the upstream western alignment also potentially clashes with buildings of the Grove Motel it has been reintroduced to this alignment option assessment for comparative purposes.	
Advantages	Disadvantages
simple structural design of straight bridge shortest bridge of all the options >50km/h design speed curve on southern approach to tie back into Grove Road (no reverse curve required)	require the removal of 2 or 3 small buildings in the Holiday Park significant impact on amenity value of Holiday Park reverse curves introduced to northern approach to tie back into SH1 road reserve closer to MNL rail corridor

Option 8C – Straight Bridge Rotated Upstream	
To reduce the amount of encroachment on Grove Motel, the Option 8A alignment with 50km/h southern approach is rotated anticlockwise about the southern abutment.	
Advantages	Disadvantages
simple structural design of straight bridge essentially straight northern approach	reduces encroachment on Grove Motel but still likely requires the removal of building heavily impacts on amenity value of motel restricts internal motel traffic movement shorter curves on southern approach to tie back into Grove Road but still 50km/h max design speed (reverse curves still required) second longest bridge of all the options and significantly longer northern approach works significantly larger amount of land required from Pickering on the northern approach, albeit of mostly unbuilt orchard land reduction in amenity value of Pickering land
Option 8D – Partial Curved Bridge Upstream	
To further reduce encroachment on the Grove Motel for an upstream alignment, a curved bridge is required. Option 8D straightens the southern approach by translating the 50km/h curve into the southern 70m length of the bridge. The northern portion of the bridge is straight and angled back into towards the existing northern abutment to reduce the impact on the Pickering property.	
Advantages	Disadvantages
no buildings require removal 70km/h design speed on northern approach (simple curve)	Complex structural design, likely two types of superstructure required for the curved and straight ends of the bridge varying pier spacing with more piers required on the curved section due to 50km/h curvature greater requirement for land from the camping side of the Holiday Park to accommodate the curved structure shortest curves on southern approach to tie back into Grove Road but still 50km/h max design speed (reverse curves still required)

Option 8E – Fully Curved Bridge Upstream	
This option is an evolution of option 8D with the curvature of the bridge eased to 70km/h design speed and the curve taken for full length to reduce the complexity in the structure.	
Advantages	Disadvantages
no buildings require removal 70km/h design speed on both approaches (this option is the only option with no tight 50km/h curves in the alignment)	Moderate complexity structural design of curved bridge, however only one type of superstructure required (compared to 8D) greatest requirement for land from the camping side of the Holiday Park to accommodate the curved structure

Preliminary Discussion

Consideration of the alignment options above does not clearly identify a preferred solution which either minimises the undesirable effects on all affected parties or quantifies the balance the costs between property acquisition and construction.

We require further inputs in order to develop the options and select a preferred alignment with which to pursue property purchase with the greatest certainty that the acquisition process will be successful.

Any discussions with property owners at this time should be generic until we are able to complete this exercise.

Input is required from:

- the property consultants, with feedback on the various generic alignment options including indicative property costs and compensation costs and especially the effect of loss of amenity and buildings.

- our geometric, structural, and urban designers, to provide more detail around their specific disciplines, identify further opportunities or constraints, and indicative construction costs for the various bridge alignments.

Once we have this additional information we will be in a better position to complete our assessment of the preferred option and demonstrate that the selection process has been robust.

APPENDIX C2 – OPTIONS ASSESSMENT – OPTION ESTIMATES

Bridge Alignment Option Estimates

	Option 8A Straight Parallel Upstream	8A - Straight Parallel Upstream	8B - Straight Parallel Downstream	8B - Straight Parallel Downstream	8C - Straight Angled Upstream	8D - Partially Curved Upstream	8E - Fully Curved Upstream
Spans	7 21.3 supersingle	6 30 supersingle	7 21.3 supersingle	5 30 supersingle	7 28.5 supersingle	3 22.3 super T	7 29 super T
Spans	1 30 supersingle		1 17.9 supersingle	1 17 supersingle		4 30 supersingle	
No. piers	7	5	7	5	6	6	6
Total length (m)	179.1	180	167	167	199.5	186.9	203
Total Structure Cost ($)	$ 4,854,628	$ 4,556,200	$ 5,323,560	$ 5,124,960	$ 5,073,260	$ 5,946,127	$ 6,630,740
Total Structure Cost ($M)	**$ 4.85**	**$ 4.56**	**$ 5.32**	**$ 5.12**	**$ 5.07**	**$ 5.95**	**$ 6.63**
Total Structure Cost ($/m2)	$ 2,510	$ 2,344	$ 2,952	$ 2,842	$ 2,355	$ 2,946	$ 3,024

Item	Description	Unit	Option 8A Rate	Quantity	Sub-Element Totals	8A Rate	Quantity	Sub-Element Totals	8B Rate	Quantity	Sub-Element Totals	8B Rate	Quantity	Sub-Element Totals	8C Rate	Quantity	Sub-Element Totals	8D Rate	Quantity	Sub-Element Totals	8E Rate	Quantity	Sub-Element Totals
6	**Bridges**																						
6.1	Substructure (includes piling, foundations, piers, abutments and bearings)																						
	Preparation of Abutment/Pier sites																						
	Abutments	ea	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$ 20,000	$ 40,000
	Piers	ea	7	$10,000	$ 70,000	5	$10,000	$ 50,000	7	$10,000	$ 70,000	5	$10,000	$ 50,000	6	$10,000	$ 60,000	6	$10,000	$ 60,000	6	$ 10,000	$ 60,000
	Cylinder Foundations to Abutment																						
	Supply and Install 1050 dia Steel Casing & Excavate 20m deep	m	80	$ 2,500	$ 200,000	80	$ 3,000	$ 240,000	80	$ 2,500	$ 200,000	80	$ 2,500	$ 200,000	80	$ 3,000	$ 240,000	80	$ 3,000	$ 240,000	80	$ 3,000	$ 240,000
	Supply and Install Precast Concrete End Plugs	ea	4	$ 5,000	$ 20,000	4	$ 5,000	$ 20,000	4	$ 5,000	$ 20,000	4	$ 5,000	$ 20,000	4	$ 5,000	$ 20,000	4	$ 5,000	$ 20,000	4	$ 5,000	$ 20,000
	Pile Concrete Construction	ea	4	$30,000	$ 120,000	4	$35,000	$ 140,000	4	$30,000	$ 120,000	4	$30,000	$ 120,000	4	$35,000	$ 140,000	4	$35,000	$ 140,000	4	$ 35,000	$ 140,000
	Cylinder Foundations to Piers																						
	Supply and Install 1800 dia Steel Casing & Excavate 20m deep	m	140	$ 4,800	$ 672,000	100	$ 5,800	$ 580,000	140	$ 4,800	$ 672,000	100	$ 5,500	$ 550,000	120	$ 5,800	$ 696,000	120	$ 7,000	$ 840,000	120	$ 6,500	$ 780,000
	Supply and Install Precast Concrete End Plugs	ea	7	$10,000	$ 70,000	5	$15,000	$ 75,000	7	$10,000	$ 70,000	5	$15,000	$ 75,000	6	$15,000	$ 90,000	6	$15,000	$ 90,000	6	$ 15,000	$ 90,000
	Pile Concrete Construction	ea	7	$60,000	$ 420,000	5	$65,000	$ 325,000	7	$60,000	$ 420,000	5	$65,000	$ 325,000	6	$65,000	$ 390,000	6	$65,000	$ 390,000	6	$ 65,000	$ 390,000
	Construct Piers																						
	Construct Crossheads	ea	7	$45,000	$ 315,000	5	$50,000	$ 250,000	7	$45,000	$ 315,000	5	$50,000	$ 250,000	6	$50,000	$ 300,000	6	$90,000	$ 540,000	6	$ 70,000	$ 420,000
	Construct Diaphragms (including deck outstands)	ea																3	$50,000	$ 150,000	6	$ 50,000	$ 300,000
	Construct Abutments																						
	Capping Beams (includes bearing plinths, headwall, and sidewalls))	ea	2	$65,000	$ 130,000	2	$65,000	$ 130,000	2	$65,000	$ 130,000	2	$65,000	$ 130,000	2	$65,000	$ 130,000	2	$70,000	$ 140,000	2	$ 70,000	$ 140,000
	Beam Diaphragms (including service ducts)	ea																1	$35,000	$ 35,000	2	$ 35,000	$ 70,000
	Transition slabs	ea	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$20,000	$ 40,000	2	$ 20,000	$ 40,000
	Wingwalls (non-integral)	m2	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$ 30,000	$ 60,000
	Filter Drains and Select Fill	LS	1	$ 7,000	$ 7,000	1	$ 7,000	$ 7,000	1	$ 7,000	$ 7,000	1	$ 7,000	$ 7,000	1	$ 7,000	$ 7,000	1	$ 7,000	$ 7,000	1	$ 7,000	$ 7,000
6.2	Superstructure, (includes beams, finishings, tensioning, waterproofing, expansion joints, edge protection and graffiti guard)																						
	Supply and Install Super Single beams (Ashley River)																						
	External Beams (17.0m) 2/span	ea										2	$15,750	$ 31,500									
	Internal Beams (17.0m) 8/span	ea										8	$14,000	$ 112,000									
	External Beams (17.9m) 2/span	ea							2	$16,155	$ 32,310												
	Internal Beams (17.9m) 8/span	ea							8	$14,360	$ 114,880												
	External Beams (21.3m) 2/span	ea	14	$20,385	$ 285,390				14	$17,685	$ 247,590												
	Internal Beams (21.3m) 8/span	ea	56	$18,120	$ 1,014,720				56	$15,720	$ 880,320												
	External Beams (28.5m) 2/span	ea													14	$26,325	$ 368,550						
	Internal Beams (28.5m) 8/span	ea													56	$23,400	$1,310,400						
	External Beams (30m) 2/span	ea	2	$27,000	$ 54,000	12	$27,000	$ 324,000				10	$27,000	$ 270,000				8	$27,000	$ 216,000			
	Internal Beams (30m) 8/span	ea	9	$24,000	$ 216,000	48	$24,000	$1,152,000				40	$24,000	$ 960,000				32	$24,000	$ 768,000			
	Supply and Install Super T beams																						
	External Beams (22.3m) 2/span	ea																6	$45,183	$ 271,095			
	Internal Beams (22.3m) 3/span	ea																9	$44,697	$ 402,270			
	External Beams (29m) 2/span	ea																			14	$ 46,500	$ 651,000
	Internal Beams (29m) 3/span	ea																			21	$ 46,000	$ 966,000
	Construct/Pour Deck Slabs																						
	22.3m span	ea																3	$74,333	$ 223,000			
	29.0m span	ea																			7	$100,000	$ 700,000
	Service Covers to Bridge Deck	ea	2	$ 2,500	$ 5,000	2	$ 2,500	$ 5,000	2	$ 2,500	$ 5,000	2	$ 2,500	$ 5,000	2	$ 2,500	$ 5,000	2	$ 2,500	$ 5,000	2	$ 2,500	$ 5,000
	Supply and Install Bearings																						
	Abutment	ea	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$30,000	$ 60,000	2	$ 30,000	$ 60,000
	Pier	ea	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$30,000	$ 30,000	3	$30,000	$ 90,000	6	$ 30,000	$ 180,000
	Expansion Joints	ea	3	$35,000	$ 105,000	3	$35,000	$ 105,000	3	$35,000	$ 105,000	3	$35,000	$ 105,000	3	$35,000	$ 105,000	5	$35,000	$ 175,000	8	$ 35,000	$ 280,000
	Barriers																						
	Supply and install precast barriers to bridge	m	358	$ 1,000	$ 358,200	360	$ 1,000	$ 360,000	334	$ 1,000	$ 334,000	334	$ 1,000	$ 334,000	399	$ 1,000	$ 399,000	373.8	$ 1,000	$ 373,800	406	$ 1,000	$ 406,000
	Supply and install precast barriers to abutments wing wall	m	22	$ 1,400	$ 30,800	22	$ 1,400	$ 30,800	22	$ 1,400	$ 30,800	22	$ 1,400	$ 30,800	22	$ 1,400	$ 30,800	22	$ 1,400	$ 30,800	22	$ 1,400	$ 30,800
	Supply and install steel handrail	m	358	$ 240	$ 85,968	360	$ 240	$ 86,400	334	$ 240	$ 80,160	334	$ 240	$ 80,160	399	$ 240	$ 95,760	373.8	$ 240	$ 89,712	406	$ 240	$ 97,440
	Supply and install expansion joint cover plates and fixing	LS	1	$10,000	$ 10,000	1	$10,000	$ 10,000	1	$10,000	$ 10,000	1	$10,000	$ 10,000	1	$10,000	$ 10,000	1	$10,000	$ 10,000	1	$ 10,000	$ 10,000
	Bridge deck surfacing	m2	1791	$ 50	$ 89,550	1800	$ 50	$ 90,000	1670	$ 50	$ 83,500	1670	$ 50	$ 83,500	1995	$ 50	$ 99,750	1869	$ 50	$ 93,450	2030	$ 50	$ 101,500
	Anti-Graffiti Protection	m2	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$30,000	$ 30,000	1	$ 30,000	$ 30,000
	Date and Loading Panels, Survey Pins, and new BSN signs	LS	1	$ 4,000	$ 4,000	1	$ 4,000	$ 4,000	1	$ 4,000	$ 4,000	1	$ 4,000	$ 4,000	1	$ 4,000	$ 4,000	1	$ 4,000	$ 4,000	1	$ 4,000	$ 4,000
6.3	Temporary works in association with bridge construction (launching gantry, access platform)																						
6.4	Underpasses	LS							1	100000	$ 100,000	1	100000	$ 100,000									
	Additional Costs																						
	Service Relocation - power	LS							1	250000	$ 250,000	1	250000	$ 250,000									
	Service Relocation - other	LS							1	100000	$ 100,000	1	100000	$ 100,000									
	Access constraints	LS							1	350000	$ 350,000	1	350000	$ 350,000									
6.5	Rip-rap scour protection to abutments	m3	2600	$ 120	$ 312,000	2600	$ 120	$ 312,000	2600	$ 120	$ 312,000	2600	$ 120	$ 312,000	2600	$ 120	$ 312,000	2600	$ 120	$ 312,000	2600	$ 120	$ 312,000

Jointly issued by;

The Property Group Limited
and,

Opus International
Consultants Limited

TO	Brent Morgan - Opus, Kris Connell - NZTA
COPY	
FROM	Andrew Noble - Opus, Peter Wilson - TPG
DATE	19 July 2016
FILE	
SUBJECT	NZTA Opawa Bridge Replacement Project – property cost option analysis

Hi Brent,

Following your e-mail of 18 July 2016 in relation to the property cost option analysis Peter and Andrew have met and discussed the property cost options for the five alignments under consideration.

Upon further review the estimated costs associated with Grove Motor Lodge have been increased for Option 8B. While there is only minimal land required further analysis indicates that even construction on the downstream side may impact on guests and accordingly some compensation for loss of business with Grove Motor Lodge has been provided for. Following making this adjustment there appears to be no alteration in the ranking of the options from a cost basis.

Points to note are

- Options 8A, 8C, 8D and 8E are all upstream of the current bridge and all impact on the same properties/stakeholders to varying or lesser degrees.
- Option 8B being downstream predominantly affects the Top 10 site but in a different way and location to the other four options affecting the Top 10 site. Land is still required from LINZ and KiwiRail but Pickering is avoided with Option 8B. Grove Motor Lodge remains affected with temporary occupation required and business compensation is likely to be required as construction noise will affect guests.
- These property estimates are high-level estimates based on the option land requirement plans provided. We further note that with all property cost analysis associated with this project we have only used the requirement plans available and that no useful information has been available from the project with regard bridge design, constructability and actual design location of both the bridge and support infrastructure including location of abutments and treatment of batter/retaining walls. Without this level of detail it is very difficult to provide more accurate cost estimates as batter/retaining walls and bridge locations may have different value effects on the same alignment option especially where access or significant improvements are affected.

The value table from your e-mail is noted below;

Land + Compo ($)	Pickering	MDC	KiwiRail	LINZ	Top10	Grove Owner	Grove Lessee	Total
8A	51,095	33,150	38,950	35,250	599,000	800,350	140,035	1,697,830
8B	0	0	94,060	39,500	861,850	37000	33000	1,065,950
8C	90,850	37,650	38,950	35,250	638,500	434,350	106,435	1,381,985
8D	60,095	35,550	38,950	35,250	642,000	93,490	55,349	960,684
8E	60,095	37,500	38,950	35,250	819,000	93,490	55,349	1,139,634

To address your query *"while option 8A does have major impacts on the 2 main players (Motels and Camp) verses 8B, considering buildings are impacted on both, is it really nearly ¾ more cost for option A over B?"* The simple answer is that while option A has the least footprint effect on Top 10, all five project options have a significant effect on the Top 10 site no matter what. Option A having the highest total property cost still impacts the Top 10 camp site amounting to nearly $600k. Option A (and C) also significantly impact on Grove Motor Lodge to the extent that the circular vehicle access is affected and buildings – motel units will require demolition and compensation or replacement. Option B has no effect on Grove Motor Lodge in terms of land take thus reducing the compensation as no motel units are affected but construction is still likely to create a compensation requirement due to disruption of guests and recognition of business loss – an adjustment to the estimate for Grove Motor Lodge accordingly has been made to accommodate this in Option B.

In summary.

- The difference between the total cost of Option A and Option B is valid and that difference remains on review.

- That in addition to property costs the project does need to look at the view of all stakeholders and while option B has the second lowest property cost the actual affect with the removal of a number of buildings from the Motel component of the Top 10 site more than likely has a greater stakeholder effect on Top 10 than acquiring land for the up-stream options from Top 10 despite the cost estimate differences.

- If option C is adopted as indicated from an engineering cost perspective it is the property view that the effect on stakeholders will be increased and this may be unacceptable to the landowners as stakeholders especially when initial approaches have already been made. It is anticipated that both the Pickering's and Grove Motor Lodge will become more difficult to deal with especially Grove Motor Lodge where motel buildings become effected. The likely flow on effect is an increased requirement for compulsory acquisition and negative public relations and project risk in terms of acquiring the required land within the project timeframes.

Addendum to Memo - NZTA Opawa Bridge Replacement Project – property cost option analysis

This memo considers the 95% cost analysis of the figures presented in the above memo

Existing analysis plus 95% analysis in column to right of each landowner

Land + Compo ($)	Pickering	Pickering 95%	MDC	MDC 95%	KiwiRail	KiwiRail 95%	LINZ	LINZ 95%	Top10	Top 10 95%	Grove Owner	Grove Owner 95%	Grove Lessee	Grove Lessee 95%	Total	Total @ 95%
8A	51,095	56,205	33,150	36,465	38,950	42,845	35,250	38,775	599,000	838,600	800,350	1,120,490	140,035	196,049	1,697,830	2,329,429
8B	0	0	0	0	94,060	117,575	39,500	43,450	861,850	1,378,960	37,000	40,700	33000	36300	1,065,410	1616985
8C	90,850	127,190	37,650	41,415	38,950	42,845	35,250	38,775	638,500	893,900	434,350	608,090	106,435	149,009	1,381,985	1901224
8D	60,095	66,105	35,550	39,105	38,950	42,845	35,250	38,775	642,000	898,800	93,490	112,188	55,349	66,419	960,684	1264236.3
8E	60,095	66,105	37,500	41,250	38,950	42,845	35,250	38,775	819,000	1,146,600	93,490	112,188	55,349	66,419	1,139,634	1514181.3

Total Cost analysis and ranking below

Normal Analysis Ranking

	Normal Analysis	Rank
8A	1,697,830	5
8B	1,065,410	2
8C	1,381,985	4
8D	960,684	1
8E	1,139,634	3

95% Analysis Ranking

	95% Analysis	
8A	2,329,429	5
8B	1616985	3
8C	1901224	4
8D	1264236.3	1
8E	1514181.3	2

Risk Summary – property perspective – the predominant risk focus lies between the effects on on Top 10 and Grove Motor Lodge, with option 8C having an increased stakeholder risk on the Pickering Property. Risk variance is based on status quo being the original option that all landowner engagement has occurred to date being an alignment similar to 8D.

8A – Top 10 property risk and effect on landowner high but similar across options 8A, 8C, 8D and 8E with variation in area. Grove Motor Lodge risk is significantly increased from Status Quo option 8D given the significant effect on motel buildings and operation. This risk will also extend to a time risk to achieve acquisition,

8B – Top 10 property risk is considered higher in this option even though the $compensation is similar. This is due to the effect on the Motel complex and reduction in accommodation with limited opportunity to replace accommodation on same site/location. This option also has some stakeholder risk given that negotiations have commenced with all landowners on the 8D (approx.) alignment. Public perception is also a factor with cycleway/shared path connectivity being affected on the north side. Dealings with KiwiRail may be more difficult as the land required is in core rail corridor and KiwiRail infrastructure may be affected – fibre cable.

8C – Top 10 remains high but stakeholder affects significantly increased for Pickering and Grove Motor Lodge without any similar reduction in effect on the Top 10 to offset this effects on Pickering and GML. Accordingly the property risk is considered higher for this over option 8D

8D – Status Quo with risks being high for both Top 10 and to an extent Grove Motor Lodge.

8E – Property risk remains similar to that in option 8D.

APPENDIX C3 – OPTIONS ASSESSMENT – MULTI CRITERIA ANALYSIS

Project: Opawa River Bridge Detailed Business Case							
Alignment Option Multi-Criteria Assessment		Option 8A Straight Parallel Upstream	Option 8B Straight Parallel Downstream	Option 8C Straight Angled Upstream	Option 8D Partially Curved Upstream	Option 8E Fully Curved Upstream	Basis of Score
Implementability Appraisal of Option							
Technical	Design and construction complexity and constructability	7	5	6	3	1	Base score from structural cost estimate for option (range low:high $2.6M); takes into account design complexity and construction complexity and constructibility
Consentability	The level of complexity anticipated in gaining statutory approvals	4	3	4	4	4	Downstream alignment puts bridge closer to KiwiRail than existing, and extremely close to accommodation buildings, with potential for objection to consent
Operational/Maintenance	Factors which might adversely affect the ability to operate or maintain the option	4	4	4	4	4	All options similar construction materials and equivalent in terms of maintenance costs
Safety in Design	Hazards that pose a safety risk in the construction and operation of the option	4	4	4	4	4	All options similar construction methods and materials and equivalent in terms of safety in design
Financial	Capital cost funding and methods	4	4	4	4	4	No financial implications for any option with funding secured under ARRP
Public/Stakeholders	Factors affecting the knowledge and acceptance of the sub-option	4	2	4	6	4	D presented in IBC to government and public. B significant departure from IBC alignment, will require consultation, delays for resetting project. Others are variations on D, some consultation and resetting of expectations would be required.
Multi-criteria Assessment of Option							
Safety	Assessed safety for all modes	4	4	4	4	4	Safety issues at feasibility stage equivalent between options
Economy	Affect traffic volumes, journey times, or the reliability of travel times	4	4	4	4	4	Parallel options increased construction disruption on highway users, otherwise options equivalent
Integration	Enhance transport land-use integration in a more complementary manner	4	4	4	4	4	All options equivalent
Social	Affect accessibility for transport users incl peds and cyclists	4	2	4	4	4	B significant issues with connectivity for Spring Creek cycleway, other options equivalent
Natural Environment	Impacts on the natural environment	4	2	4	4	4	Downstream alignment disturbs backwater in river, nesting swans present, other options equivalent
Human Health	Significant risks to human health related to noise, air quality or contaminated land	4	3	4	4	4	B extremely close to accomodation buildings, other options equivalent
Cultural	Impact on historical, cultural or archaeological values	3	3	4	4	5	A & B are in very close proximity to the existing bridge and will impact on the setting and therefore heritage values of the existing bridge. D & E are more separated from existing bridge reducing impact on heritage values and urban design
Property	Property risks to delivery . Affect other infrastructure providers	1	4	3	7	6	Takes into account purchase cost, purchase complexity, risks, demolition/reconfiguration of buildings, construction effects, disruption. B marked down further for clash with overhead power lines.
	Combined Score	**49%**	**40%**	**51%**	**55%**	**50%**	
	Overall Multi-Criteria Ranking	**4**	**5**	**2**	**1**	**3**	
Cost Appraisal of Option							
Cost Premium over lowest cost option	(95% Percentile $M)	0.3	0.0	0.1	0.5	1.8	

Scoring Key

1	Lowest Benefit / Highest Cost or Risk
3	Lower Benefit / Higher Cost or Risk
4	Neutral
5	Higher Benefit / Lower Cost
7	Highest Benefit / Lowest Cost

Sensitivity

Number of criteria = 14
Minimum score = 14 marks = 0%
Maximum score = 98 marks = 100%
Spread = 84 marks
Therefore change in individual score +/- 1 mark = change in combined score of +/- 1.2%

Completed with input from:

Brent Morgan (Opus) Team Leader
Matthew Taylor (Opus) Design Manager
Michael Cowan (Opus) Principal Bridge Engineer
Frank Westergard (Opus) Civil Engineer
David Jackson (Opus) Senior Planner
Erik Teekman (Opus) Senior Transportation Planner
Andrew Noble (Opus) Property Consultant
Chessa Stevens (Opus) Senior Heritage Consultant
Vince Dravitzki (Opus) Research Manager
Richard Nichol (Opus) Senior Ecologist

Assessment date: 26 July 2016
Version date: 31 August 2016

APPENDIX C4 – OPTIONS ASSESSMENT – SUMMARY TABLE

OPTION ASSESSMENT SUMMARY TABLE
PROPOSAL DETAILS

Activity name:	*SH1 Opawa Bridge Replacement*	Name of Project Manager & Region:	*Andrew James* *Region 10 Nelson/ Marlborough*
Activity description:	*Replacement of bridge in Blenheim SH 1S at RP 18/9.0*		

Background information

Geographic context:	*The Opawa Bridge is located on SH1S near the northern threshold of the Blenheim township and the Ōpaoa River forms a natural geographic boundary between the urban and the rural agricultural activities on the lower Wairau River Plain.* *The bridge is located within the 5okm/hr speed zone, but is only 300m from the 100km/h to 50km/hr speed threshold. Being on the northern urban fringe of Blenheim, it is an important gateway to Blenheim.* *The true Ōpaoa River is a meandering silt-bed river bounded by stop banks. The existing SH1 Bridge is situated on an S-bend in the river with the piers skewed about 47 degrees to the direction of the flow.* *The true left (northern side) and true right (southern side) banks of the river channel are formed by a grass-covered flood plain bounded by stop banks. Upstream of the bridge there are a number of trees on the right flood plain. The widths of floodplains on both sides vary.* *The main trunk railway line runs on the eastern side of the highway and the rail over bridge is 100m downstream of the existing Opawa road bridge.*

Social context:	*The immediate southern approach of the Opawa Bridge passes beside motel accommodation and holiday camp ground accommodation. Further down Grove Road the land use changes to industrial and commercial.* *The Opawa Bridge on the northern approach is surrounded by rural agricultural activities, with one nearby residential property and a cluster of industrial/commercial buildings known as the Blenheim Research Centre. Both these properties share a common access point and are well set back from the highway. It is expected that any highway realignment will have minimal impact on these activities.* *The project will not create any change in highway traffic volume or traffic composition so there is unlikely to any possible adverse impacts to the social community. The project will remove some traffic platooning, so it is possible that road crossing opportunities will be modestly reduced along Grove Road.*
Economic context:	*The SH1S Opawa Bridge is a key structure on the National Strategic State Highway Transport Route enabling and supporting the growth of the NZ economy. In particular, the bridge enables HPMV freight access to the Port of Picton and the ferry link from the South Island to the North Island.* *The retention of the ferry terminals in Picton (following the Government's decision not to proceed with the on the Clifford Bay proposal in May 2014) has meant that addressing the issues on the nationally strategic corridor between Picton and Blenheim have become more important.* *In addition, the structure enables considerable amount of inter-regional traffic. Marlborough is an export-focussed producer of primary products, principally from viticulture, aquaculture, and forestry. Marlborough is New Zealand's largest wine-growing region, and has also diversified into manufacturing and other services that support and add value to the primary sector activity.*

OUTCOME OBJECTIVES

Objective:	Performance against planning objective:
Objective 1(70%) *Increased throughput and greater certainty of SH journey and improved comfort & customer experience with greater customer satisfaction* *Objective 2 (30%)* *Increased availability & access. Route resilience to emergency events*	*Reduced coefficient of variation standard deviation of travel/time/average minutes travel time by 0.09 minutes* *Reduced Minutes delayed per Km to zero over project section* *No Customer complaints related to the Opawa Bridge narrow width* *No negative media articles or letters to editor related to the Opawa Bridge narrow width* *A 90% reduction in minutes of delay over the next 100 years in a major seismic event.*
Rationale for selection or rejection of option:	*An analysis was undertake of 10 different options and this option achieved all of the strategic case objectives and also achieved a beneficial rating for Cost Optimisation, Implementation Risks and wider Project Impacts (Environmental Screening)*

Option number 8A

Option description:	**Option 8A** **10.8m wide two lane bridge replacement – Straight Parallel Upstream**						
Estimated total public sector funding requirement:			**Lower**			**Upper**	
	Capital cost ($m):		*9.8*			*14.0*	
	Net property cost ($m):		*1.7*			*2.6*	
	Opex ($m/40yr):		*nil*			*nil*	
	Maintenance ($m/40yr):		*0.4*			*0.6*	
	Present value of cost to govt. ($m):		*11.9*			*17.2*	
Estimated BCR range:			*1*			*2*	
Timing of need:	***Optimal programme:***		*Construction 2017/18*	***Likely:***		*Construction 2018*	
IAF profile:	**Strategic fit*:***	*M*	**Effectiveness*:***	*L*		**Efficiency*:***	*L*

IMPLEMENTABILITY APPRAISAL OF OPTION 8A	
Technical:	*Low technical risks with straight bridge design complicated somewhat with approach alignment.*
Consentability:	*No perceived significant planning restrictions.*
Operational/Maintenance:	*Small increase in operational and maintenance costs with an estimated 40 year increase of $50k assuming ownership of existing heritage bridge transferred to MDC and @ 50% FAR applies.*
Safety and design consideration: (Zero Harm)	*No significant Safety in Design issues perceived, conventional design.*
Financial:	*Funding secured through the Accelerated Regional Roads Package.*
Public/Stakeholders:	*General support for a bridge replacement. Some opposition from a section of the public who don't oppose a bridge replacement but would prefer a Blenheim bypass (which does not address the problems of the Strategic Case).*

MULTI-CRITERIA ASSESSMENT OF OPTION 8A

Criterion	Scale of impact	Supporting information
Safety:	*4*	*Neutral effect - Modest safety improvements for pedestrian, cyclists and HPMV freight.*
Economy:	*4*	*Neutral effect - This project is on a key strategic highway and HPMV freight route and will improve freight movements and remove a freight bottleneck.*
Integration:	*4*	*Neutral effect - this project is an isolated removal of a Highway constraint and can be undertaken as an independent project.*
Social:	*4*	*Neutral effect- No significant social impact nor no significant social impacts.*
Natural environment:	*4*	*Neutral effect- No significant effects perceived. Opportunity to reduce adverse impacts of the highway.*
Human health:	*4*	*Neutral effect- No significant human health impacts predicted, may require some noise mitigation.*
Cultural:	*3*	*This project preserves the existing heritage bridge which is a category 1 heritage place. It may remove its functionality as a road bridge, but will preserve its role as a cycle walking bridge. It will provide a longer life for heritage structure. However, the proximity of the new bridge will disturb the setting of the existing bridge, negatively impacting its cultural heritage values.*
Property:	*1*	*Require land acquisition upstream of the existing bridge impacting on buildings in motel. Function of estimated purchase costs, and demolition/reconfiguration of buildings, construction effects, disruption.*

Option number 8B

Option description:	**Option 8B** **10.8m wide two lane bridge replacement - Straight Parallel Downstream**						
Estimated total public sector funding requirement:		**Lower**			**Upper**		
	Capital cost ($m):	*10.4*			*14.8*		
	Net property cost ($m):	*1.1*			*1.6*		
	Opex ($m/40yr):	*nil*			*nil*		
	Maintenance ($m/40yr):	*0.4*			*0.6*		
	Present value of cost to govt. ($m):	*11.9*			*17.0*		
Estimated BCR range:		*1*			*2*		
Timing of need:	***Optimal programme:***	*Construction 2017/18*	***Likely:***		*Construction 2018*		
IAF profile:	***Strategic fit:***	*M*	***Effectiveness:***	*L*	***Efficiency:***	*L*	

IMPLEMENTABILITY APPRAISAL OF OPTION 8B	
Technical:	*Low technical risks with straight bridge design complicated somewhat with approach alignment.*
Consentability:	*Some perceived planning restrictions with downstream alignment putting bridge closer to KiwiRail than existing, with potential for objection to consent.*
Operational/Maintenance:	*Small increase in operational and maintenance costs with an estimated 40 year increase of $50k assuming ownership of existing heritage bridge transferred to MDC and @ 50% FAR applies.*
Safety and design consideration: (Zero Harm)	*No significant Safety in Design issues perceived, conventional design.*
Financial:	*Funding secured through the Accelerated Regional Roads Package*
Public/Stakeholders:	*General support for a bridge replacement. Some opposition from a section of the public who don't oppose a bridge replacement but would prefer a Blenheim bypass (which does not address the problems of the Strategic Case). Option B is a significant departure from IBC alignment, which will require further consultation, with resultant delays for resetting project.*

MULTI-CRITERIA ASSESSMENT OF OPTION 8B

Criterion	Scale of impact	Supporting information
Safety:	*4*	*Neutral effect - Modest safety improvements for pedestrian, cyclists and HPMV freight*
Economy:	*4*	*Neutral effect - This project is on a key strategic highway and HPMV freight route and will improve freight movements and remove a freight bottleneck.*
Integration:	*4*	*Neutral effect - this project is an isolated removal of a Highway constraint and can be undertaken as an independent project.*
Social:	*2*	*Some social impact with issues with connectivity for Spring Creek cycleway.*
Natural environment:	*2*	*Downstream alignment disturbs backwater in river, nesting swans present.*
Human health:	*3*	*Some human health impacts predicted with new alignment extremely close to accommodation buildings which may require some mitigation.*
Cultural:	*3*	*Neutral effect - This project preserves the existing heritage bridge which is a category 1 heritage place. It may remove its functionality as a road bridge, but will preserve its role as a cycle walking bridge. It will provide a longer life for heritage structure. However, the proximity of the new bridge will disturb the setting of the existing bridge, negatively impacting its cultural heritage values.*
Property:	*4*	*Neutral effect - Require land acquisition downstream of the existing bridge impacting on buildings and limited by Kiwirail clear zone. Function of estimated purchase costs, and demolition/reconfiguration of buildings, construction effects, disruption.*

Option number 8C

Option description:	**Option 8C** **10.8m wide two lane bridge replacement - Straight Angled Upstream**						
Estimated total public sector funding requirement:		**Lower**		**Upper**			
	Capital cost ($m):	*10.1*		*14.4*			
	Net property cost ($m):	*1.4*		*2.1*			
	Opex ($m/40yr):	*nil*		*nil*			
	Maintenance ($m/40yr):	*0.4*		*0.6*			
	Present value of cost to govt. ($m):	*11.9*		*17.1*			
Estimated BCR range:		*1*		*2*			
Timing of need:	***Optimal programme:***	*Construction 2017/18*	***Likely:***	*Construction 2018*			
IAF profile:	**Strategic fit:**	*M*	**Effectiveness:**	*L*	**Efficiency:**	*L*	

IMPLEMENTABILITY APPRAISAL OF OPTION 8C	
Technical:	*Low technical risks with straight bridge design complicated somewhat with approach alignment.*
Consentability:	*No perceived significant planning restrictions.*
Operational/Maintenance:	*Small increase in operational and maintenance costs with an estimated 40 year increase of $50k assuming ownership of existing heritage bridge transferred to MDC and @ 50% FAR applies.*
Safety and design consideration: (Zero Harm)	*No significant Safety in Design issues perceived, conventional design.*
Financial:	*Funding secured through the Accelerated Regional Roads Package*
Public/Stakeholders:	*General support for a bridge replacement. Some opposition from a section of the public who don't oppose a bridge replacement but would prefer a Blenheim bypass (which does not address the problems of the Strategic Case).*

MULTI-CRITERIA ASSESSMENT OF OPTION 8C

Criterion	Scale of impact	Supporting information
Safety:	*4*	*Neutral effect - Modest safety improvements for pedestrian, cyclists and HPMV freight.*
Economy:	*4*	*Neutral effect - This project is on a key strategic highway and HPMV freight route and will improve freight movements and remove a freight bottleneck.*
Integration:	*4*	*Neutral effect - this project is an isolated removal of a Highway constraint and can be undertaken as an independent project.*
Social:	*4*	*Neutral effect- No significant social impact nor no significant social impacts.*
Natural environment:	*4*	*Neutral effect- No significant effects perceived. Opportunity to reduce adverse impacts of the highway.*
Human health:	*4*	*Neutral effect- No significant human health impacts predicted, may require some noise mitigation.*
Cultural:	*4*	*This project preserves the existing heritage bridge which is a category 1 heritage place. It may remove its functionality as a road bridge, but will preserve its role as a cycle walking bridge. It will provide a longer life for heritage structure. The proximity of the new bridge will impact the setting of the existing bridge, mainly at the southern end.*
Property:	*3*	*Require land acquisition upstream of the existing bridge with impacts on motel circulation and possible impacts on building. Function of estimated purchase costs, and demolition/reconfiguration of buildings, construction effects, disruption.*

Option number 8D

Option description:	**Option 8D** **10.8m wide two lane bridge replacement - Partially Curved Upstream**						
Estimated total public sector funding requirement:			**Lower**			**Upper**	
	Capital cost ($m):		*11.2*			*15.6*	
	Net property cost ($m):		*1.0*			*1.3*	
	Opex ($m/40yr):		*nil*			*nil*	
	Maintenance ($m/40yr):		*0.4*			*0.6*	
	Present value of cost to govt. ($m):		*12.6*			*17.5*	
Estimated BCR range:			*1*			*2*	
Timing of need:	***Optimal programme:***		*Construction 2017/18*	***Likely:***		*Construction 2018*	
IAF profile:	**Strategic fit:**	*M*	**Effectiveness:**	*L*		**Efficiency:**	*L*

IMPLEMENTATIBILITY APPRAISAL OF OPTION 8D	
Technical:	*Moderate technical risks with partially curved bridge design*
Consentability:	*No perceived significant planning.*
Operational/Maintenance:	*Small increase in operational and maintenance costs with an estimated 40 year increase of $50k assuming ownership of existing heritage bridge transferred to MDC and @ 50% FAR applies.*
Safety and design consideration: (Zero Harm)	*No significant Safety in Design issues perceived, conventional design.*
Financial:	*Funding secured through the Accelerated Regional Roads Package*
Public/Stakeholders:	*General support for a bridge replacement. Some opposition from a section of the public who don't oppose a bridge replacement but would prefer a Blenheim bypass (which does not address the problems of the Strategic Case).*

MULTI-CRITERIA ASSESSMENT OF OPTION 8D

Criterion	Scale of impact	Supporting information
Safety:	*4*	*Neutral effect - Modest safety improvements for pedestrian, cyclists and HPMV freight.*
Economy:	*4*	*Neutral effect - This project is on a key strategic highway and HPMV freight route and will improve freight movements and remove a freight bottleneck.*
Integration:	*4*	*Neutral effect - this project is an isolated removal of a Highway constraint and can be undertaken as an independent project.*
Social:	*4*	*Neutral effect- No significant social impact nor no significant social impacts.*
Natural environment:	*4*	*Neutral effect- No significant effects perceived. Opportunity to reduce adverse impacts of the highway.*
Human health:	*4*	*Neutral effect- No significant human health impacts predicted, may require some noise mitigation.*
Cultural:	*4*	*This project preserves the existing heritage bridge which is a category 1 heritage place. It may remove its functionality as a road bridge, but will preserve its role as a cycle walking bridge. Option D separated from existing bridge along its length, but is still in close proximity and therefore will impact on the setting and the associated cultural heritage values. It will provide a longer life for heritage structure.*
Property:	*7*	*Require land acquisition upstream of the existing bridge and reconfiguration of camp ground internal roads and sites but no impacts on motel circulation or buildings. Function of estimated purchase costs, and demolition/reconfiguration of buildings, construction effects, disruption.*

Option number 8E

Option description:	**Option 8E** **10.8m wide two lane bridge replacement - Fully Curved Upstream**						
Estimated total public sector funding requirement:			**Lower**			**Upper**	
	Capital cost ($m):		*12.2*			*16.7*	
	Net property cost ($m):		*1.1*			*1.5*	
	Opex ($m/40yr):		*nil*			*nil*	
	Maintenance ($m/40yr):		*0.4*			*0.6*	
	Present value of cost to govt. ($m):		*13.7*			*18.8*	
Estimated BCR range:			*1*			*2*	
Timing of need:	***Optimal programme:***		*Construction 2017/18*	***Likely:***		*Construction 2018*	
IAF profile:	***Strategic fit:***	*M*	***Effectiveness:***	*L*		***Efficiency:***	*L*

IMPLEMENTABILITY APPRAISAL OF OPTION 8E	
Technical:	*Highest technical risks with fully curved bridge design.*
Consentability:	*No perceived significant planning restrictions.*
Operational/Maintenance:	*Small increase in operational and maintenance costs with an estimated 40 year increase of $50k assuming ownership of existing heritage bridge transferred to MDC and @ 50% FAR applies.*
Safety and design consideration: (Zero Harm)	*No significant Safety in Design issues perceived, conventional design.*
Financial:	*Funding secured through the Accelerated Regional Roads Package*
Public/Stakeholders:	*General support for a bridge replacement. Some opposition from a section of the public who don't oppose a bridge replacement but would prefer a Blenheim bypass (which does not address the problems of the Strategic Case).*

MULTI-CRITERIA ASSESSMENT OF OPTION 8E

Criterion	Scale of impact	Supporting information
Safety:	*4*	*Neutral effect - Modest safety improvements for pedestrian, cyclists and HPMV freight.*
Economy:	*4*	*Neutral effect - This project is on a key strategic highway and HPMV freight route and will improve freight movements and remove a freight bottleneck.*
Integration:	*4*	*Neutral effect - this project is an isolated removal of a Highway constraint and can be undertaken as an independent project.*
Social:	*4*	*Neutral effect- No significant social impact nor no significant social impacts.*
Natural environment:	*4*	*Neutral effect- No significant effects perceived. Opportunity to reduce adverse impacts of the highway.*
Human health:	*4*	*Neutral effect- No significant human health impacts predicted, may require some noise mitigation.*
Cultural:	*5*	*This project preserves the existing heritage bridge which is a category 1 heritage place. It may remove its functionality as a road bridge, but will preserve its role as a cycle walking bridge. Option E separated from existing bridge to the greatest extent of all the options considered, reducing the impact on the setting of the existing bridge and associated cultural heritage values. It will provide a longer life for heritage structure.*
Property:	*6*	*Require land acquisition upstream of the existing bridge and reconfiguration of camp ground internal roads and sites but no impacts on motel circulation or buildings. Function of estimated purchase costs, and demolition/reconfiguration of buildings, construction effects, disruption.*

APPENDIX D – CAPITAL COST ESTIMATES

Project Estimate - Form C

Opawa Bridge Replacement

DBE

Detailed Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	**Nett Project Property Cost**	960,684	0	303,552
	Project Development Phase			
	Consultancy Fees	Nil	Nil	Nil
	NZTA Managed Costs	Nil	Nil	Nil
B	**Total Project Development**	Nil	Nil	Nil
	Pre-implementation Phase			
	Consultancy Fees	813,616	224,191	125,797
	NZTA Managed Costs	75,000	20,666	11,596
C	**Total Pre-implementation**	888,616	244,857	137,393
	Implementation Phase			
	Implementation Fees			
	Consultancy Fees	55,000	15,155	8,504
	NZTA Managed Costs	75,000	20,666	11,596
	Construction Monitoring Fees	442,885	122,036	68,477
	Sub Total Base Implementation Fees	572,885	157,858	88,576
	Physical Works			
1	Environmental Compliance	120,000	33,066	18,554
2	Earthworks	219,300	60,428	33,907
3	Ground Improvements	1,250,000	344,436	193,268
4	Drainage	23,750	6,544	3,672
5	Pavement and Surfacing	147,160	40,550	22,753
6	Bridges	5,806,700	1,600,030	897,801
7	Retaining Walls	150,000	41,332	23,192
8	Traffic Services	74,740	20,595	11,556
9	Service Relocations	317,380	87,454	49,072
10	Landscaping	146,700	40,423	22,682
11	Traffic Management and Temporary Works	60,000	16,533	9,277
12	Preliminary and General	690,000	190,129	106,684
13	Extraordinary Construction Costs	500,000	137,774	77,307
	Sub Total Base Physical works	9,505,730	2,619,294	1,469,726
D	**Total for Implementation Phase**	10,078,615	2,777,152	1,558,303
E	**Project Base Estimate** **(A+C+D)**	**11,927,915**		
F	Contingency (Assessed/Analysed) (A+C+D)		3,022,009	
G	**Project Expected Estimate** (E+F)		**14,949,924**	
	Nett Project Property Cost Expected Estimate		960,684	
	Project Development Phase Expected Estimate		Nil	
	Pre-implementation Phase Expected Estimate		1,133,473	
	Implementation Phase Expected Estimate		12,855,767	
H	Funding Risk Contingency (Assessed/Analysed) (A+C+D)			1,999,248
I	**95th percentile Project Estimate** (G+H)			**16,949,172**
	Nett Project Property Cost 95th percentile Estimate			1,264,236
	Project Development Phase 95th percentile Estimate			Nil
	Pre-implementation Phase 95th percentile Estimate			1,270,866
	Implementation Phase 95th percentile Estimate			14,414,069

Date of Estimate	Cost Index (Qtr/Year)	**Q3 2016**
Estimate prepared by	Signed	**Opus**
Estimate internal peer review by	Signed	**Opus**
Estimate external peer review by	Signed	
Estimate accepted by NZTA	Signed	

Note: (1) These estimates are exclusive of escalation and GST.
(2) Project Development Phase Estimates are set to Nil as these are now sunk costs.

APPENDIX E – MAINTENANCE COST ESTIMATES

SP2 Structural bridge renewals

Spreadsheet v 3 (27-March-2014)

Worksheet 3 - Cost of option

Worksheet 3 is used to calculate the costs of the different options. At the top of the worksheet, choose the option being evaluated. A separate Worksheet 3 is required for each option evaluated. To convert dollar values from different years to base date values, use the update factors in appendix A12.
The Do Minimum is determined by using worksheet 3 for all options and selecting least cost option as the Do Minimum.

1 Option (choose option being considered): new bridge

2 PV of estimated cost of proposed work (as per attached estimate sheets)

$ ______ x 0.94 = $ 0 **(a)**

3 PV of maintenance cost in year 1 = $ ______ **(b)**

4 PV of annual maintenance and inspection costs following the work

(years 2 to 40 inclusive) $ 20,000 x 14.52 = $ 290400 **(c)**

5 PV of periodic maintenance costs

Time zero — 1st July in the year 2015

Year	Type of maintenance	Amount $	SPPWF	Present Value
20	joint seals	150,000	0.31	46,771
20	resurfacing	150,000	0.31	46,771
40	joint seals	150,000	0.10	14,583
40	resurfacing	150,000	0.10	14,583

Sum of PV of periodic maintenance costs $ 122,708 **(d)**

6 PV cost of additional annual maintenance (due to extra HCV trips)

$ ______ x 15.49 = $ 0 **(e)**

7 PV of total costs of option

PV total costs **(a)** + **(b)** + **(c)** + **(d)** + **(e)** = $ 413,108 **B**

Transfer total to **B** on worksheet 1. if the preferred option is to close the bridge, then transfer **(e)** to worksheet 1

SP2 Structural bridge renewals

Spreadsheet v 3 (27-March-2014)

Worksheet 3 - Cost of option

Worksheet 3 is used to calculate the costs of the different options. At the top of the worksheet, choose the option being evaluated. A separate Worksheet 3 is required for each option evaluated. To convert dollar values from different years to base date values, use the update factors in appendix A12.3.
The Do Minimum is determined by using worksheet 3 for all options and selecting least cost option as the Do Minimum.

1 Option (choose option being considered): alternative route

2 PV of estimated cost of proposed work (as per attached estimate sheets)

$ ______ x 0.94 = $ 0 **(a)**

3 PV of maintenance cost in year 1 = $ ______ **(b)**

4 PV of annual maintenance and inspection costs following the work

(years 2 to 40 inclusive) $ 7,000 x 14.52 = $ 101640 **(c)**

5 PV of periodic maintenance costs

Time zero — 1st July in the year 2015

Year	Type of maintenance	Amount $	SPPWF	Present Value
5	Scour protection	50,000	0.75	37,363
20	Siesmic linkage replacement	80,000	0.31	24,944
	Historic bridge (no traffic)			

Sum of PV of periodic maintenance costs $ 62,307 **(d)**

6 PV cost of additional annual maintenance (due to extra HCV trips)

$ ______ x 15.49 = $ 0 **(e)**

7 PV of total costs of option

PV total costs **(a) + (b)** + **(c)** + **(d)** + **(e)** = $ 163,947 **B**

Transfer total to **B** on worksheet 1. if the preferred option is to close the bridge, then transfer **(e)** to worksheet 1

APPENDIX F – PRELIMINARY STRUCTURES OPTION REPORT

New Zealand Transport Agency

Opawa River Bridge Replacement

SH1, RP 18/9.01, BSN 270

Preliminary Structure Options Report

August 2016

New Zealand Transport Agency

Opawa River Bridge Replacement

SH1, RP 18/9.01, BSN 270

Preliminary Structure Options Report

August 2016

Prepared By

Mark Jeffries BE (Civil) Hons, MIPENZ, CPEng
Civil Structural Engineer

Reviewed By

p.p.

Michael Cowan BE (Civil) Hons, MIPENZ, CPEng
Principal Civil Structures Engineer
Team Leader – Bridges (Christchurch)

Approved for Release By

Brent Morgan NZCE (Civil), MIPENZ, CPEng
Team Leader

Opus International Consultants Ltd
Blenheim Office
19 Henry Street
PO Box 563, Blenheim 7240
New Zealand

Telephone: +64 3 520 9500
Facsimile: +64 3 520 9501

Date: 17/08/2016
Reference: 5-mb982.03 / 700BG
Status: Issue 1

Contents

Executive Summary

The SH1 Opawa Bridge replacement project is approved by the Government for construction under the Accelerated Regional Roads Package (ARRP). The project was identified to improve the resilience and journey times on SH1 in Marlborough. This Preliminary Options Report is provided as an appendix to the detailed business case that follows the Indicative Business Case from 2015.

The new bridge will operate as a typical two-lane highway. The proposed replacement will be approximately 189 m long and constructed on the upstream side of the existing bridge.

The carriageway width of the proposed bridge is 10 m which includes two 3.5 m lanes and 1.5 m shoulders. The horizontal alignment is about two thirds straight and one third curved on a 130 m radius. A desirable geometric design speed will transition from a maximum of 70 km/h to 50 km/h.

Spans may be either simply supported or continuous. Span lengths are likely to be in the order of 30 m reducing to approximately 20 m on the curved portion depending on the selected superstructure type.

For the proposed alignment of a partially curved bridge positioned upstream of the existing bridge, we suggest that the most significant differentiating factor is the superstructure type. The two most likely superstructure options are a) prestressed concrete superstructure and b) steel-concrete composite superstructure.

For a simply supported precast super tee beam option, 1225 mm deep beams would be used to accommodate the longer 30 m spans. For a plate girder option the depth would be approximately 1100 mm deep for 30 m long continuous spans either straight or curved.

The pier substructure may consist of a single column pier and a hammerhead. The size of the pier column would be dependent upon the tributary mass of the superstructure and hammerhead.

Pier piles are expected to be in the order of 1800 mm to 2100 mm diameter being sufficient size to a) support gravity loads and b) resist lateral earth pressure demands resulting from liquefaction and lateral spreading.

At the abutments, the approach embankment would be constructed of a mechanically stabilised earth (MSE) wall using steel straps and structural facing panels. MSE has demonstrated reliable performance under high intensity ground shaking. Ground improvement would also be provided at the abutment locations. Stone columns or ground replacement may be best suited for these conditions. A sill beam, backwall and settlement slab would be supported either by bored piles, say 1050 mm diameter, or directly on the MSE wall (provided design tolerances can be met).

Particular risks that are expected to require special attention during the design phase include the following:

- Hydrological modelling and hydraulic effects of the new bridge on the vulnerable foundations of the existing bridge and the KiwiRail bridge,
- Foundation conditions, particularly the presence of weak soils at risk of liquefaction and lateral spread,
- Proximity to the existing bridge for construction clearances,

- Protection of the existing Category A listed bridge,
- Sequencing of ground improvement at the abutments near the live traffic lanes

A preferred superstructure option for replacement of Opawa River Bridge could not be determined at this stage. Either Option A: Prestressed Concrete Superstructure or Option B: Structural Steel Superstructure may be most suitable. We recommend further detailed analysis once the constraints and factors influencing design are better defined and a more detailed cost estimate is prepared.

We recommend both of these options are further considered and the preferred solution concluded in the Structure Options Report prepared during the Design and Project Documentation phase.

The preliminary estimated cost for the bridge construction is $5,800,000 -10%/+20%.

Preliminary Options Report

1 Introduction

1.1 Purpose of the Bridge Replacement

The SH1 Opawa Bridge project is approved by the Government for construction under the Accelerated Regional Roads Package (ARRP). The project was identified to improve the resilience and journey times on SH1 in Marlborough.

The existing Opawa Bridge is located on the northern edge of Blenheim in a 50km/hr speed zone. It is 170m long and carries 9,800 vehicles/day of which 9% are heavy vehicles. It has a narrow carriageway where larger vehicles cannot pass, causing frequent delays and uncertain travel times. Recent assessments indicate it has inadequate seismic and scour resistance to meet current standards.

The bridge is about 100 years old and is now listed Category 1 by the Heritage New Zealand.

1.2 Proposed Replacement

The Opawa Bridge Replacement Indicative Business Case report identified the preferred option for replacement as a new two-way, two-lane bridge, with 10.0 m carriageway width, located to the west (upstream) of the existing bridge (Option 8).

Five sub-options for road alignment have been identified generally within the bounds of Option 8, each with varying effects on neighbouring property. From these, Option 8D is being recommended for progression to the Design and Project Documentation stage. Option 8D is a partially curved bridge approximately 180 m long, some 15 m upstream of the existing bridge.

The objective of this report is to investigate the proposed bridge replacement with regards to structural factors that influence the design.

1.3 General Site Description

The Opawa River Bridge (SH1, RP 18/9.01, BSN 270) is located at the northern entrance to Blenheim as shown in Figure 1.1 and 1.2 below.

The speed limit at the bridge location is 50 km/h.

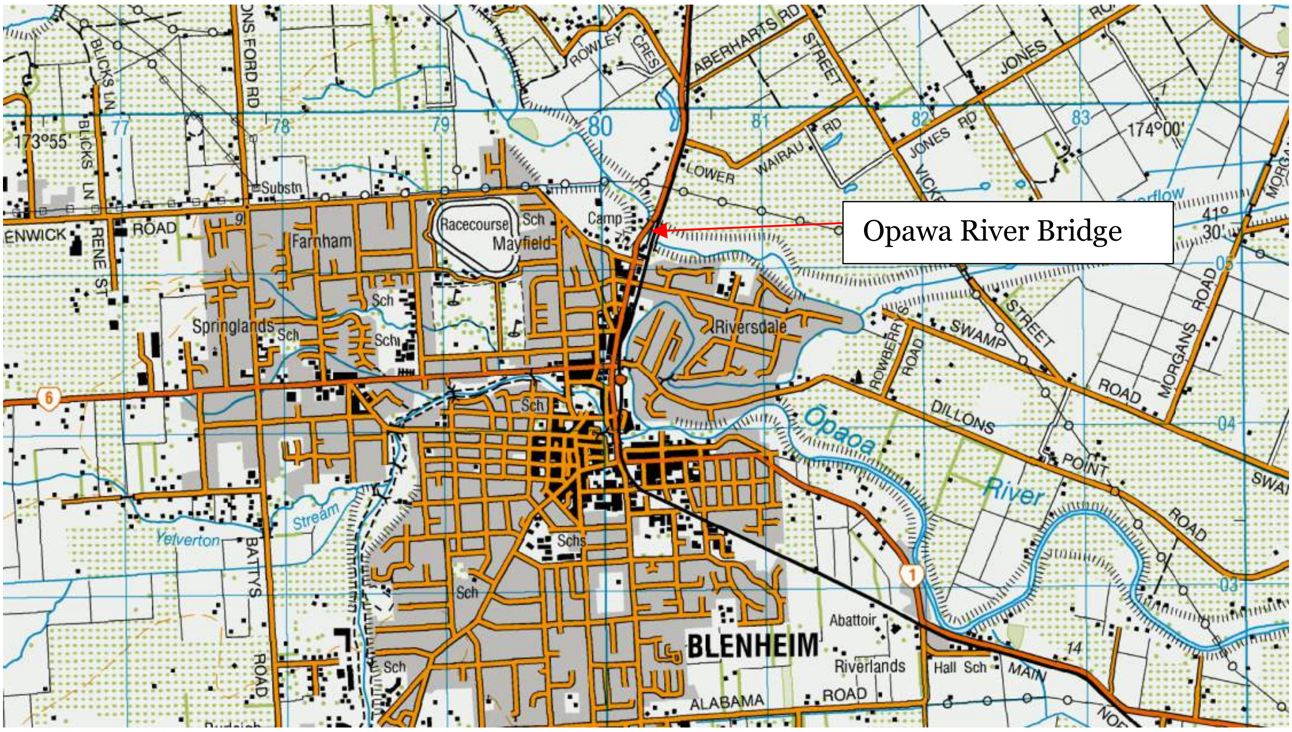


Figure 1.1 – Location of SH1 Opawa River Bridge

Figure 1.2 – Existing SH1 Opawa River Bridge

The bridge runs between stopbanks and crosses through a camp ground situated in the floodway. The environment on the south approach is a mix of residential and commercial while the northern approach is rural.

2 Factors Influencing Design

2.1 Level of Service Requirements

The proposed Opawa River Bridge has been categorised as an Importance Level 3 structure (as per Bridge Manual, Table 2.1) with an annual probability of exceedance of 1/2500 for the ultimate limit state design for earthquake actions.

State Highway 1 at Blenheim is classified as a national highway under the "One Network Road Classification". The new bridge will be a key lifeline arterial route that provides national north-south access from Picton to Christchurch as well as local access into Blenheim and parts of Marlborough District. Therefore, the resilience of this route is important and careful consideration should be given in the selection of bridge form and design concepts to provide resilience.

At the site, traffic volume is 9800 vehicles per day and the posted speed limit is 50 km/h. The proposed structure makes no particular allowance for pedestrians or cyclists to cross the river as these are intended to be catered for by using the existing bridge that will be linked into a shared use pathway.

Consultation with utility providers is not complete at this stage however it is anticipated that allowance would need to be made for power cables (both 11 kV and low voltage), telecommunications (Transpower and Chorus) and other future services.

2.2 Foundation (subsurface) conditions

The Opawa Bridge site is located in an area with very loose sandy silt deposits with poor bearing capacity, potential for large settlements and prone to liquefaction and lateral spreading in design earthquakes. These conditions could give rise to foundation failure and large displacements if adequate foundations and mitigation measures are not adopted. Deep piled foundations are therefore appropriate for the new Opawa River Bridge.

The piles should have adequate embedment into the dense gravels to counteract scour effects and to resist down drag from the liquefiable soils. In addition, the pile founding depths should be three to five times the pile diameter below any overlying liquefiable layers and at least five times the pile diameter above any underlying liquefiable layers.

Due to the variable nature of the ground, the pile founding depths will vary along the bridge and will need to be assessed during design when the alignment and loading demand is better defined. The bridge may be founded in the very dense gravel layer (soil unit 4) at about RL -19.5 m to RL - 21.5 m, i.e. at a depth of about 20 m to 25 m. Refer to Table 2.1 below for soil unit descriptions. At some locations where there are no deeper seated liquefiable or low strength soils, the piles may possibly be founded within the dense gravel in soil unit 2 (below -6 m RL), depending on the settlement tolerance of the structure, lateral capacity required and the scour estimates.

Soil unit	Reduced level (RLm)		Soil description	SPT "N" values	Prone to liquefaction or cyclic softening
	North abutment BH2	South abutment BH1			
1	6.3 to 2.5	5.1 to -1	SILT, very soft & moderately to non-plastic; Silty SAND / SAND, very loose to loose	1 to 4	Yes
2	2.5 to -10	-1 to -11	Gravelly SAND / SAND, dense to very dense	Varies; 15 to 50+	Yes. Liquefaction likely only in lenses with SPT "N" <24
3	-10 to -15.5	-11 to -13.5	Interbedded SILT (stiff to very stiff and moderately to non-plastic) and SAND (medium dense to dense)	13 - 37	Yes. Liquefaction likely only in some weak lenses
4	Below -15.5	Below -13.5	Sandy GRAVEL; very dense	50+	No

Table 2.1 – Soil Unit Descriptions for an Upstream Bridge Alignment

In the absence of extensive ground improvement, bored piles are likely to be the most suitable option for the bridge piers. Given the variable ground conditions, river environment and presence of cohesionless very loose sand and dense gravel deposits, permanently cased bored piles are likely to be required to provide construction ground support as well as long term resilience in earthquakes. Driven piles will likely be a noisy operation affecting nearby Blenheim residential areas and the holiday park. Also, given the presence of intermediate dense gravels, driven piles are not likely to be suitable to achieve the required penetrations to provide adequate vertical and lateral capacity for the piles.

It is important to develop a suitable bridge form taking into consideration the geotechnical and earthquake hazards. This may include consideration of:

- Moderately long spans (say 20 m to 40 m) to reduce the number of piers in the flood plain prone to liquefaction and lateral spreading.
- Locating the piers away from the river banks that are most prone to lateral spreading in earthquakes.
- Designing and detailing the sub-structure and bridge superstructure to be tolerant of ground displacements.

Ground improvement will likely be required at the bridge abutments to mitigate the risk of liquefaction and lateral spreading. Reinforced soil walls are excellent in tolerating residual differential settlement and lateral movements due to liquefaction and lateral spreading after ground improvement. Abutments in the form of vertical reinforced soil walls with steel strip reinforcement and structural facing panels will be likely be most appropriate. Subject to adequate stability and acceptable displacements suitably designed ground improvement and MSE walls may be sufficient to support a sill beam without the need for piles at the abutments.

2.3 Urban Design Considerations

The design of the proposed new bridge should consider a number of contextual factors:

- Heritage values;
- Existing landscape;
- Visual impact; and
- Implications on adjacent land owners.

The new bridge will need to consider the heritage values and distinctive design of the original bridge. It is anticipated that the proposed bridge will have clean and modern lines so as not to detract from the character of the existing bridge. This consideration will be a focus as the form, barrier treatments and such of the proposed bridge are developed going forward. There is a risk of a new larger and higher structure dominating the context of the existing heritage listed bridge. This could be minimised by keeping the finished level of the new bridge close to that of the existing bridge.

With regards to landscape, there is an opportunity to provide ecological restoration of the river edges through removal of invasive crack willow and planting local native tree and plant species. This would likely improve water quality and encourage native fauna to inhabit the area.

Lighting under the proposed bridge would likely improve safe access for holiday park users. Consideration would need to be given to the neighbouring properties such as Top Ten Holiday Park to provide a suitable aesthetic outcome and minimise light pollution. Other opportunities include lighting up the existing Opawa Bridge at night and creating a sculptural feature seen when driving into town.

The bridge upgrade provides an opportunity to establish a 'gateway' into Blenheim. Early consultation with local iwi indicates the possibility of having several large pou (wooden carved poles) placed to the side of the bridge before you cross into Blenheim, the intent being to show the story of local significance of this area. The pou could be up-lit creating an impressive entrance at night as well as during the day. A palette of native tree and shrub planting on both sides of the bridges would also enhance this entrance to Blenheim.

Pedestrian and cyclist facilities separate to the highway carriageway would be incorporated into the gateway design and into the ongoing use of the existing bridge. An existing shared use pathway located between the highway and the railway line to the north of the bridge would likely be maintained and extended. Confident cyclists, especially those heading north, may well use the shoulders of the new bridge rather than cross the highway to use the shared-use pathway.

2.4 Geometrics

The proposed alignment for the new bridge is nominally 15 m upstream of the existing bridge with a straight section (northern two-thirds) and a curved section (southern two-thirds) with a 130 m radius. However, geometric requirements have not been settled at this stage. Horizontal and vertical curvature will be determined based on constraints such as sight distance, design speed, stormwater drainage requirements, property constraints, and tie-in with existing roadway alignments. The desirable geometric design speed will transition from a maximum of 70 km/h on the northern approach to 50 km/h on the southern approach.

The proposed clear width between face of barriers would meet the NZ Transport Agency Bridge Manual desirable design width criteria of 10.0 m as shown in Figure 2.1 below. Finalised barrier width may range from 0.4 m to 0.5 m dependent on results of detailed design and Test Level requirements.

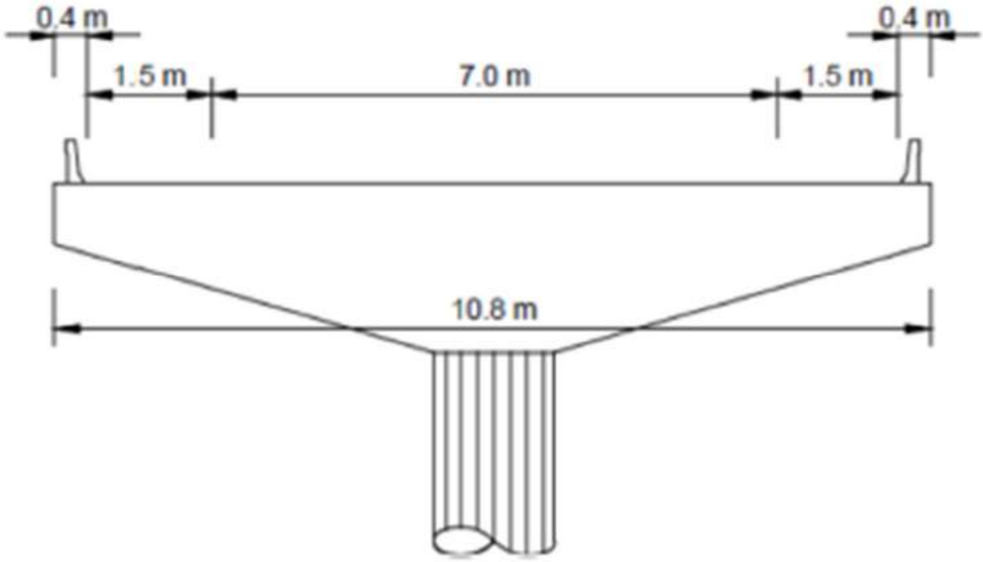


Figure 2.1 – Desirable carriageway width from NZ Transport Agency Bridge Manual Appendix A

Vertical curvature would be influenced by freeboard requirements, superstructure depth and sight distance and drainage of the deck surface.

2.5 Hydrology and Hydraulics

The Opawa River is a meandering silt-bed river bounded by stop banks. The current known hydrology is based on that used in the calibrated 2003 MDC MIKE 11 model for the Opawa River. For a 1 in 100 AEP event at this bridge the model indicates that:

- The design flow is 600 m^3/s
- The design water level is 6.77 m above Nelson Vertical Datum 1955 (NVD55)

The following key hydraulic design issues will need to be assessed in the design:

a. Proximity of the new bridge to the existing highway bridge (and to a lesser extent the KiwiRail Bridge)
b. Form of new bridge, in particular the number and positioning of piers
c. Encroachment of abutments for any new bridge into the flood berms.
d. Flood water levels and the resulting freeboard to the bridge soffit in accordance with the "Bridge Manual" (NZTA, 2014) for the Serviceability Limit State Flood (1 in 100 AEP flood).
e. Scour depths at the piers and the abutments in accordance with Melville and Coleman (2000) against all forms of scour:

- General
- Contraction
- Thalweg
- Pier
- Abutment
- Debris

f. Hydrodynamic loading on the bridge under all design flow cases both with and without debris on the bridge
g. Design of appropriate protection for the piers and abutments including:

- grading envelope of armour rock;
- thickness and slope of all the protection layers;
- any geotextiles.

h. The soffit level of a new bridge relative to the stopbank levels. It must be noted that there is a potential for MDC to improve the stopbanks and the level to which they protect Blenheim.
i. Any new bridge crossing or modification of the existing bridge must be limited to a less-than-minor impact on the existing flood risk to Blenheim.
j. Climate change effects to be accommodated in accordance with Bridge Manual requirements and Ministry for the Environment guidelines.

2.6 Constraints on Span Arrangement and Clearances

The proposed alignment has a 130 m radius at the south end and is straight for the remainder. The overall length is 189 m and the alignment is illustrated in Figure 2.2 below:

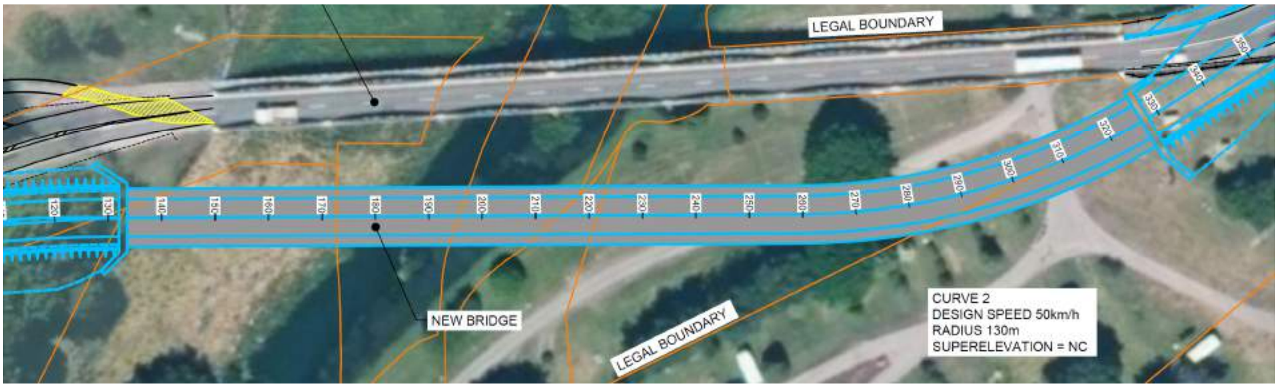


Figure 2.2 – Proposed Alignment

Optimal span length for a bridge of this type is typically about 30 m which is usually achieved with prestressed precast superstructure or steel-concrete composite construction. However, the span length may necessarily be varied for particular constraints. For example, the 130 m radius curve may require a reduction in span length depending on the type of superstructure selected. eg. prestressed super-tee beams may require 22m spans at this radius while structural steel plate girders can be supplied with a curve and maintain a 30 m span and have one less span.

Positioning the new bridge on the western (upstream) side of the existing highway bridge is advantageous insofar as minimising hydraulic effects on the railway bridge. However, the upstream position will of course have an influence on the old highway bridge which risks exacerbating the potential for scour. Measures to minimise this influence include a) aligning the new piers with the old pier positions (with respect to flood flow) and b) using only single column piers on the new bridge. Note that wall piers on the old bridge are at 21 m centres so alignment of new piers with the old pier walls may be economically onerous. Mitigation measures for the old bridge (such as rock protection or underpinning) may be more cost effective.

Longer spans are advantageous for minimising the number of piers in the flood plain. Demands from liquefaction and lateral spreading may also be reduced if the piled foundations are positioned away from the banks of the river channel where lateral earth pressure demands may peak.

In summary, span length is dependent on an evaluation of conflicting factors that have yet to be determined.

The southern abutment is adjacent to the existing bridge abutment in order to tie into Grove Road and to minimise encroachment into neighbouring properties. The space between old and new bridges ranges from about 3.5 m to 15 m. The 3.5 m minimum clearance is a significant constraint for construction access but is expected to be sufficient for future bridge maintenance and allowance for differential oscillation of the bridges during a seismic event.

Ground improvement at the south abutment may encroach on the existing traffic lanes of Grove Rd and might also clash with buried tie-backs from the existing bridge. It may be possible to relieve this constraint by extending the abutment location further into the flood berm to provide more space between the two bridge structures. This will be influenced by council rivers department requirements and by the outcomes of hydrological modelling.

Positioning of the north abutment may also be dependent upon measures required to protect the integrity of the stopbank.

Council rivers department have indicated a desire for the soffit of the new bridge to be no lower than the existing bridge.

A hogging vertical curve may be required in order to control stormwater on the deck of the new bridge. Rigid concrete barriers are likely to be required in the form of HT “F-shape” TL-5 barrier (1270 mm high including oval-section top rail) in order to meet the requirements of Bridge Manual Appendix B Cl B3.1.2

No specific arrangements for future widening in the new structure have been allowed for.

2.7 Constraints on Construction Methods

The space restrictions of the site are expected to present a significant challenge to constructability. Significant constraints on site include:

- the existing bridge,
- the river channel,
- the stop banks,
- adjacent properties,
- 11kV and Low Voltage transmission lines.

Staging of construction activity and access provisions are likely to be critical to programming the works and off-site staging areas and working platforms in the river margin are also likely to be required. The 3.5 m minimum clearance between the south abutments of the bridges is a significant constraint for constructability.

Ground improvement at the south abutment may encroach on the existing traffic lanes of Grove Rd and might also clash with buried tie-backs from the existing bridge. The existing bridge will need to be kept open to traffic during the day due to the high traffic volumes and the strategic nature of the bridge. It may be possible to relieve this constraint by extending the abutment location further into the flood berm to provide more space between the two bridge structures. Alternatively, night works may be required to implement lane closures ensuring two lanes are reopened to traffic in the morning.

Heavy equipment may need to work in the existing river channel. This may require extensive rockwork or other forms of construction platforms.

Agreements for access and temporary occupation are yet to be negotiated but are expected to be an important consideration.

Working hours and limitations on noise and vibration levels shall be agreed with the NZ Transport Agency and shall be in accordance with resource consent and designation requirements.

As described in Section 2.2 above, driven piles are not likely to be suitable to achieve the required penetrations to provide adequate vertical and lateral capacity for the piles. As such, bored piles are likely to be the most suitable founding option for this bridge. Given the variable ground conditions, river environment and presence of cohesionless very loose sand and dense gravel deposits, permanently casings are likely to be required to provide construction ground support as well as to provide long term resilience in earthquakes.

2.8 Constraints on Construction Materials

Construction materials shall meet the requirements of the NZ Transport Agency Bridge Manual 3rd Edition, Amendment 2, Chapter 4 Analysis and Design Criteria. This describes requirements for typical materials such as reinforced concrete, prestressed concrete, and structural steel along with bearings and deck joints.

Weathering steel may be an option to be considered during concept design.

2.9 Interaction of Construction with Traffic Flows

It is anticipated that any work requiring lane closures on SH 1 will need to be done at night in order to minimise traffic interruption. Data from 2009 and 2012 indicates traffic flow of about 150 vehicles per hour between the hours of 10 pm and 5 am compared to daytime flows of 800-1100 vehicles/hour.

Agreements for access and temporary occupation have not been negotiated as yet. Access onto both banks of the river is likely to be directly onto State Highway 1. These details will require resolution in accordance with Transport Agency requirements and following review of conditions on the resource consent and the change to the designation.

2.10 Site Seismic Hazard

The Opawa River Bridge has been categorised as an Importance Level 3 structure (as per Bridge Manual, Table 2.1) with an annual probability of exceedance of 1/2500 for the ultimate limit state design for earthquake actions.

The geotechnical interpretive report indicated the subsoil site class at the bridge site is Class D (deep or soft soil site) according to NZS1170.5. The site has a zone factor of 0.33.

Faults within 15 km of the bridge are summarised in Table 2.2 below.

Fault	Characteristic event magnitude	Recurrence interval (years)	Distance from site (km)	Direction
Wairau Fault	7.8	2490	3	Northwest
Vernon Fault	8.4	4210	11	Southeast
Awatere Fault	7.6	3200	15	Southeast

Table 2.2 – Active Fault Summary

Based on these categorisations and classifications, NZS 1170.5 provides a peak ground acceleration (PGA) for ultimate limit state design of 0.67g.

2.11 Environmental Considerations and Constraints

Constraints for environmental considerations have not yet been defined. This is expected to be resolved through the Resource Consent application process, through the application for an alteration to the designation, and through compliance with the Transport Agency's own environmental plan. We expect consideration will need to be given to the following factors:

- Construction Noise, hours of work and Traffic Noise.
- Air Quality
- Water Resources
- Erosion and Sediment Control
- Social Responsibility
- Culture and Heritage
- Ecological Resources
- Spill Response and contamination
- Resource efficiency
- Climate Change
- Lighting
- Visual Quality
- Vibration

3 Design Options

For the proposed alignment of a partially curved bridge positioned upstream of the existing bridge, we suggest that the most the most significant differentiating factor is the superstructure type. The two most likely superstructure options are a) prestressed concrete superstructure and b) steel-concrete composite superstructure. Outline descriptions for both options are provided below.

3.1 Option A – Prestressed Concrete Superstructure

3.1.1 Structural form and mode of behaviour

Typical prestressed concrete superstructures are Super-tee, I-beam, and single hollowcore, all as detailed in NZ Transport Agency Research Report 364, Standard precast concrete bridge beams, December 2008.

For a preferred economical span of 30 m, super tee beams 1225 mm deep may be selected. These are typically simply supported on elastomeric bearing and they have a nominal 180 mm thick in-situ deck slab.

For a 130 m radius curve, the span length would likely be reduced to about 20 m.

Shear keys and linkage bolts or linkslabs would be provided at piers and abutments to transfer lateral loading to the substructure.

As illustrated in Figure 3.1 below, the substructure would consist of a single column pier and a hammerhead. The pier column, nominally 1800 mm diameter, would be continuous from a larger single pile. Pier piles are expected to be in the order of 2100 mm diameter being sufficient size to a) support gravity loads and b) resist lateral earth pressure demands resulting from liquefaction and lateral spreading.

At the abutments, the approach embankment would most likely be constructed of a mechanically stabilised earth wall using steel straps and structural facing panels. Ground improvement would also be provided at the abutment locations. A sill beam, a backwall and a settlement slab would be required at each abutment. These may be supported on a pair of bored piles (say 1050 dia) or directly onto the MSE wall (dependent on adequate stability and acceptable displacement requirements being met).

A typical superstructure cross-section for this option is shown in Figure 3.1 below.

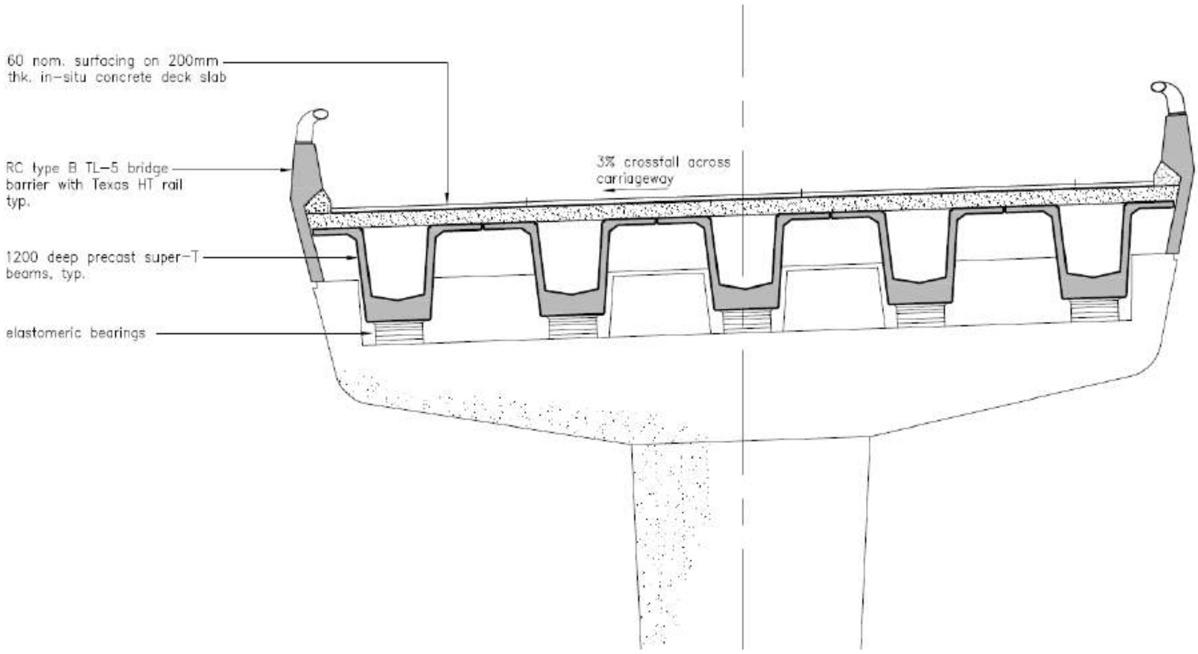


Figure 3.1 – Option A Prestressed Concrete Superstructure

3.1.2 Likely methods of construction

Conventional methods of construction would be employed for a bridge of this type. An outline is provided below:

a. Establish on site, establishing environmental controls, site access, site clearance and enabling works such as service relocation (eg overhead lines)
b. Establish piling rig, vibrating in steel casing and augering out for the piles. Allow for preparation of work platforms beside and over the river.
c. Undertake ground improvement at the abutment locations such as stone columns or ground replacement. (note that ground improvement may not be able to be completed at the south abutment until the new bridge is operational. This is due to a potential clash with the traffic lanes coming off the bridge. Allow for re-establishment of ground improvement plant and machinery)
d. Construct reinforced concrete piles, potentially incorporating inclinometer tubes for assessment of post seismic deflection.
e. Form up pile columns with an extension of the pile casing and pour reinforced concrete pile columns
f. Form up and cast reinforced concrete hammerheads and abutment sill beams.
g. Prepare bearings ready to receive precast prestressed beams.
h. Supply and Install Precast beams providing temporary restraint and stability.
i. Cast diaphragms, shear keys and backwalls. Incorporate linkage bars.
j. Prepare formwork for deck pour, mainly around outside of precast beams and incorporating bridge curve.
k. Establish joint hardware and other cast-in items
l. Cast deck
m. Incorporate precast barriers with a cast-in-situ joint into the deck.
n. Construct MSE abutments incorporating settlement slab, stormwater control and wingwalls.
o. Traffic changeover to new bridge
p. Complete ground improvement at south abutment if required.

q. Complete landscaping improvements and all other civil works
r. Tidy up and disestablish

3.1.3 Construction materials and durability

Construction materials for this option would include the following:

- Stone Columns for ground improvement
- MSE wall (steel straps) and compacted fill
- Reinforced Concrete
- Prestressed Concrete
- Plain Structural Steel (pile casings)
- Galvanised steel (barrier top rail and cast inserts)
- Neoprene or Natural Rubber for joint glands and bearings

A 100-year design life is expected to be achieved for durability of the above materials. Exceptions to this include wearing components being deck joints and bearings which may be replaced during the lifetime of the structure.

Performance requirements for the above are laid out in the Bridge Manual. The required level of Quality Assurance and Testing should be identified within the specification for this work as part of the contract documents.

3.1.4 Maintenance requirements

Maintenance requirements for prestressed concrete superstructures are relatively low. They are a proven durable solution given good detailing. There are no internal components for inspection. A methodology for bearing replacement (after 50+ years) should be incorporated into the detailed design. Deck joints are a vulnerable component on all highway bridges and these may require maintenance within 20 years.

3.1.5 Cost estimate

The preliminary cost estimate for the bridge construction under this option is $5.8M -10%/+20% as detailed in Table 3.1 below. The cost estimate is limited to construction of the bridge only and so excludes MSE, ground improvement, approaches, surfacing, and fees etc.

			A - Prestressed Concrete		
	Spans		3	20	m Super T
	Spans		4	30	m Super T
	No. piers				6
	Total length (m)				180
	Total Structure Cost ($M)				$ 5.81
	Total Structure Cost ($/m2)				$ 2,987
Item	Description	Unit	Quantity	Rate	Sub-Element Totals
6	**Bridges**				
6.1	Substructure (includes piling, foundations, piers, abutments and bearings)				
	Preparation of Abutment/Pier sites				
	Abutments	ea	2	$ 20,000	$ 40,000
	Piers	ea	6	$ 10,000	$ 60,000
	Cylinder Foundations to Abutment				
	Supply and Install 1050 dia Steel Casing & Excavate 20m deep	m	80	$ 2,500	$ 200,000
	Supply and Install Precast Concrete End Plugs	ea	4	$ 5,000	$ 20,000
	Pile Concrete Construction	ea	4	$ 30,000	$ 120,000
	Cylinder Foundations to Piers				
	Supply and Install 2100 dia Steel Casing & Excavate 20m deep	m	120	$ 5,300	$ 636,000
	Pile Concrete Construction	ea	6	$ 85,000	$ 510,000
	Construct Piers				
	Construct Columns	ea	6	$ 35,000	$ 210,000
	Construct Crossheads	ea	6	$ 45,000	$ 270,000
	Construct Abutments				
	Capping Beams (includes bearing plinths, headwall, and sidewalls))	ea	2	$ 65,000	$ 130,000
	Transition slabs	ea	2	$ 20,000	$ 40,000
	Wingwalls (non-integral)	m2	2	$ 30,000	$ 60,000
	Filter Drains and Select Fill	LS	1	$ 7,000	$ 7,000
6.2	Superstructure				
	Supply and Install Super T beams				
	External Beams (20m) 2/span	ea	6	$ 38,750	$ 232,500
	Internal Beams (20m) 3/span	ea	9	$ 38,333	$ 345,000
	External Beams (30m) 2/span	ea	8	$ 46,500	$ 372,000
	Internal Beams (30m) 3/span	ea	12	$ 46,000	$ 552,000
	Construct Diaphragms				
	Abutment	ea	2	$ 35,000	$ 70,000
	Pier	ea	6	$ 40,000	$ 240,000
	Construct/Pour Deck Slabs				
	20m span	ea	3	$ 66,667	$ 200,000
	30m span	ea	4	$ 100,000	$ 400,000
	Pier Linkslab	ea	6	$ 4,000	$ 24,000
	Service Covers to Bridge Deck	ea	2	$ 2,500	$ 5,000
	Supply and Install Bearings				
	Abutment	ea	10	$ 1,000	$ 10,000
	Pier	ea	60	$ 1,000	$ 60,000
	Expansion Joints	ea	2	$ 35,000	$ 70,000
	Barriers				
	Supply and install precast barriers to bridge	m	360	$ 1,000	$ 360,000
	Supply and install precast barriers to abutments wing wall	m	22	$ 1,400	$ 30,800
	Supply and install steel handrail	m	360	$ 240	$ 86,400
	Supply and install expansion joint cover plates and fixing	LS	1	$ 10,000	$ 10,000
	Bridge deck surfacing	m2	1800	$ 50	$ 90,000
	Anti-Graffiti Protection	m2	1	$ 30,000	$ 30,000
	Date and Loading Panels, Survey Pins, and new BSN signs	LS	1	$ 4,000	$ 4,000
6.3	Rip-rap scour protection to abutments	m3	2600	$ 120	$ 312,000
	Totals				$ 5,806,700

Table 3.1 Preliminary Cost Estimate for Option A

3.2 Option B – Composite Steel and Concrete Superstructure

3.2.1 Structural form and mode of behaviour

Typical structural steel superstructures are of plate girder or ladder-deck construction, with detailing guidance provided by Heavy Engineering Research Association Report R4-144:2012

For a preferred economical span of 30 m, continuous plate girder beams 1100 mm deep may be selected. These are typically supported on elastomeric bearing and they have a nominal 200 mm thick in-situ deck slab.

For the 130 m radius curve, the plate girders can be fabricated in a curved shape to maintain the span length at 30 m provided there is sufficient bracing.

Shear keys would be provided at piers and abutments to transfer lateral loading to the substructure.

As illustrated in Figure 3.2 below, the substructure would consist of a single column pier and a hammerhead. The pier column, nominally 1500 to 1800 mm diameter would be continuous from a larger single pile. Pier piles are expected to be in the order of 1800 mm to 2100 mm diameter being sufficient size to a) support gravity loads and b) resist lateral earth pressure demands resulting from liquefaction and lateral spreading.

Typical details are shown in Figures 3.2 to 3.3 below.

Figure 3.2 SH 25 Kopu Bridge Replacement, Thames
(retrieved from http://www.stuff.co.nz/waikato-times/life-style/people/6293826/Cross-that-bridge)

Figure 3.3 SH 1 Mercer Off-ramp

At the abutments, the approach embankment would most likely be constructed of a mechanically stabilised earth wall using steel straps and structural facing panels. Ground improvement would also be provided at the abutment locations. A sill beam, a backwall and a settlement slab would be required at each abutment. These may be supported on a pair of bored piles (say 1050 dia) or directly onto the MSE wall (dependent on adequate stability and acceptable displacement requirements being met).

3.2.2 Likely methods of construction

Conventional methods of construction would be employed for a bridge of this type. An outline is provided below:

a. Establish on site, establishing environmental controls, site access, site clearance and enabling works such as service relocation (eg overhead lines)
b. Establish piling rig, vibrating in steel casing and augering out for the piles. Allow for preparation of work platforms beside and over the river.
c. Undertake ground improvement at the abutment locations such as stone columns or ground replacement. (note that ground improvement may not be able to be completed at the south abutment until the new bridge is operational. This is due to a potential clash with the traffic lanes coming off the bridge. Allow for re-establishment of ground improvement plant and machinery)
d. Construct reinforced concrete piles, potentially incorporating inclinometer tubes for assessment of post seismic deflection.
e. Form up pile columns with an extension of the pile casing and pour reinforced concrete pile columns
f. Form up and cast reinforced concrete hammerheads and abutment sill beams.
g. Prepare bearings ready to receive plate girders.
h. Supply and install plate girder providing temporary restraint and braces for stability.
i. Cast diaphragms, shear keys and backwalls. Incorporate linkage bars at abutment.
j. Place permanent formwork (or partial depth precast) for cast in-situ deck pour. Install fully precast deck cantilevers with transverse stitches.

k. Establish joint hardware and other cast-in items
l. Cast deck
m. Incorporate precast barriers with a cast-in-situ joint into the deck.
n. Construct MSE abutments incorporating settlement slab, stormwater control and wingwalls.
o. Traffic changeover to new bridge
p. Complete ground improvement at south abutment if required.
q. Complete landscaping improvements and all other civil works
r. Tidy up and disestablish

3.2.3 Construction materials and durability

Construction materials for this option would include the following:

- Stone columns for ground improvement
- MSE wall (steel straps) and compacted fill
- Plain structural steel (pile casings)
- Reinforced concrete
- Structural steel plate girders
- Prestressed concrete (partial depth precast deck)
- Galvanised steel (barrier top rail and cast inserts)
- Neoprene or natural rubber for joint glands and bearings

A 100-year design life is expected to be achieved for durability of the above materials given good detailing and good corrosion protection coatings. An exception to this is wearing components of deck joints and bearings which may be replaced during the lifetime of the structure.

Performance requirements for the above are laid out in the Bridge Manual. The required level of Quality Assurance and Testing should be identified within the specification for this work as part of the contract documents.

3.2.4 Maintenance requirements

Maintenance requirements for steel and concrete composite superstructures are relatively low. They are a proven durable solution provided there is good detailing and good corrosion protection. The coating system for the structural steel would be specified to achieve at least 40 years to first maintenance. Alternatively, if weathering steel is assessed as viable, then a coating system may not be required extending the life of the corrosion protection system to 100 years. Weathering steel, if adopted, can be vulnerable to graffiti where the girders are accessible causing damage to the patina, however in this location we expect clearance from the ground to be sufficient to minimise this risk.

A methodology for bearing replacement (after 50+ years) should be incorporated into the detailed design. Deck joints are a vulnerable component on all highway bridges and these may require maintenance within 20 years. The number of deck joints is minimised due to the continuous structure only requiring them at the abutment locations. There are no internal components for inspection.

3.2.5 Cost estimate

The preliminary cost estimate for the bridge construction under this option is $6.1 M -10%/+20% as detailed in Table 3.2 below. The cost estimate is limited to construction of the bridge only and so excludes MSE, Ground Improvement, approaches, surfacing, and fees etc.

			B - Steel Plate Girder		
	Spans		6	30	m Plate Girders
	Spans				
	No. piers				5
	Total length (m)				180
	Total Structure Cost ($M)				$ 6.09
	Total Structure Cost ($/m2)				$ 3,133

Item	Description	Unit	Quantity	Rate	Sub-Element Totals
6	**Bridges**				
6.1	Substructure (includes piling, foundations, piers, abutments and bearings)				
	Preparation of Abutment/Pier sites				
	Abutments	ea	2	$ 20,000	$ 40,000
	Piers	ea	5	$ 10,000	$ 50,000
	Cylinder Foundations to Abutment				
	Supply and Install 1050 dia Steel Casing & Excavate 20m deep	m	80	$ 2,500	$ 200,000
	Supply and Install Precast Concrete End Plugs	ea	4	$ 5,000	$ 20,000
	Pile Concrete Construction	ea	4	$ 30,000	$ 120,000
	Cylinder Foundations to Piers				
	Supply and Install 2100 dia Steel Casing & Excavate 20m deep	m	100	$ 5,300	$ 530,000
	Pile Concrete Construction	ea	5	$ 85,000	$ 425,000
	Construct Piers				
	Construct Columns	ea	5	$ 30,000	$ 150,000
	Construct Crossheads	ea	5	$ 40,000	$ 200,000
	Construct Abutments				
	Capping Beams (includes bearing plinths, headwall, and sidewalls))	ea	2	$ 65,000	$ 130,000
	Transition slabs	ea	2	$ 20,000	$ 40,000
	Wingwalls (non-integral)	m2	2	$ 30,000	$ 60,000
	Filter Drains and Select Fill	LS	1	$ 7,000	$ 7,000
6.2	Superstructure				
	Supply and Install Steel Plate Girders incl bracing, splicing, shear connectors, and corrosion protection				
	Curved (30.0m) 4/span	ea	8	$ 110,000	$ 880,000
	Straight (30.0m) 4/span	ea	16	$ 95,000	$ 1,520,000
	Construct/Pour Deck Slabs				
	Supply and Install Partial Depth Precast	ea	6	$ 30,000	$ 180,000
	30m span	ea	6	$ 85,000	$ 510,000
	Pier Linkslab	ea			
	Service Covers to Bridge Deck	ea	2	$ 2,500	$ 5,000
	Supply and Install Bearings				
	Abutment	ea	8	$ 1,000	$ 8,000
	Pier	ea	20	$ 1,100	$ 22,000
	Expansion Joints	ea	2	$ 35,000	$ 70,000
	Barriers				
	Supply and install precast barriers to bridge	m	360	$ 1,000	$ 360,000
	Supply and install precast barriers to abutments wing wall	m	22	$ 1,400	$ 30,800
	Supply and install steel handrail	m	360	$ 240	$ 86,400
	Supply and install expansion joint cover plates and fixing	LS	1	$ 10,000	$ 10,000
	Bridge deck surfacing	m2	1800	$ 50	$ 90,000
	Anti-Graffiti Protection	m2	1	$ 30,000	$ 30,000
	Date and Loading Panels, Survey Pins, and new BSN signs	LS	1	$ 4,000	$ 4,000
6.3	Rip-rap scour protection to abutments	m3	2600	$ 120	$ 312,000
	Totals				$ 6,090,200

Table 3.2 Preliminary Cost Estimate for Option B

3.3 How the options address the factors influencing design

The factors influencing design discussed below are those identified in Section 2 of this report. Table 3.3 below discusses the effect each factor has on both options. Cell shading in the table indicates points of difference between the options as follows:

KEY:	Neutral	Positive	Negative

Factor Influencing Design	A – Prestressed Concrete Superstructure	B – Steel-Concrete Composite Superstructure
Level of Service requirement	Full HN-HO-72, Importance Level 3, provision for services: All achievable with well understood methodologies	Full HN-HO-72, Importance Level 3, provision for services: All achievable with well understood methodologies
Foundation conditions	Weak Soils at risk of liquefaction and lateral spreading from design level ground shaking. Ground improvement likely to be required at the abutments Large diameter Bored piles with permanent casings recommended for foundations	Weak Soils at risk of liquefaction and lateral spreading from design level ground shaking. Ground Improvement likely to be required at the abutments Large diameter Bored piles with permanent casings recommended for foundations
Urban design and aesthetic considerations	Common highway bridge appearance utilising prestressed and reinforced concrete. Can be enhanced with the use of single pier columns & hammerhead and with a repeating motif cast into precast barriers Risk of the new larger and higher structure dominating the context of the existing heritage listed bridge.	Common highway bridge appearance utilising coated structural steel and reinforced concrete. Can be enhanced with the use of single pier columns & hammerhead and with a repeating motif cast into precast barriers. Risk of the new larger and higher structure dominating the context of the existing heritage listed bridge. Curved members are a point of interest and are usually pleasing to the eye. Considering the option of weathering steel, the less-common rusty appearance of the oxide patina risks suffering from a negative public reaction.
Geometrics	Horizontal curve and vertical curve achievable following well understood methodologies	Horizontal curve and vertical curve achievable following well understood methodologies
Hydrology	Hydrology impact can be minimised by single column piers Freeboard requirements to be carefully considered with regards to a) effect on existing bridges, b) debris risk, and c)flood loading	Hydrology impact can be minimised by single column piers Freeboard requirements to be carefully considered with regards to a) effect on existing bridges, b) debris risk, and c)flood loading

Constraints on Span Arrangement and clearances	Prestressed precast beams constructed only in straight segments. Span length to be reduced over the 130 m radius curve. Structural depth for simply supported beams not as efficient as continuous members	Curved members can accommodate 130 m radius with appropriate bracing. Vertical clearance to continuous composite members is close to optimal.
Constraints on construction methods	Bored piles with permanent casings recommended for the foundations. Ground Improvement recommended particularly at the abutments Mechanically stabilised earth abutments recommended Staging of construction activity and access provisions likely to be critical. Off-site staging area and working platforms in the river margin likely to be required. Working hours and noise limitations to be agreed. Reduced risk of fall from height with super-tees as precast flanges incorporate composite formwork.	Bored piles with permanent casings recommended for the foundations. Ground Improvement recommended particularly at the abutments Mechanically stabilised earth abutments recommended Staging of construction activity and access provisions likely to be critical. Off-site staging area and working platforms in the river margin likely to be required. Working hours and noise limitations to be agreed. Structural steel superstructure components are lower weight so crane demands reduced. Lighter weight superstructure reduces demand on the foundations Higher fall-from-height risk for plate girders until partial depth precast decking is put in place, however, manageable through well-understood methodologies.
Constraints on construction materials	No constraints on construction materials. Prestressed concrete superstructure and all components as per Bridge Manual requirements	No constraints on construction materials. Structural steel superstructure and all components as per Bridge Manual requirements. Weathering steel to be further considered at detailed design as it may be suitable in this location remote from the sea. Weathering steel may be preferred due to reduced long-term maintenance (no need to re-coat) and initial capital cost being similar to coated steel.
Interaction of construction with traffic flows	Lane closures on State Highway 1 limited to night time work to minimise traffic interruption Access likely to be from State Highway 1 at both ends	Lane closures on State Highway 1 limited to night time work to minimise traffic interruption Access likely to be from State Highway 1 at both ends
Site seismic hazard	Significant hazard from lateral spreading requiring robust foundations and ground improvement.	Significant hazard from lateral spreading requiring robust foundations and ground improvement.

Site seismic hazard	Relatively high zone factor (0.33) and substantial superstructure may induce high seismic inertia demands requiring robust piers and detailing	Risk from relatively high zone factor (0.33) is reduced by the use of lighter weight superstructure minimising seismic inertia demands on piers and foundations
Environmental considerations and constraints	Construction noise, hours of work and traffic noise will be require careful monitoring Construction requires work over a waterway. There is a risk of hazardous material entering the waterway. Environmental plans and processes should be in place to mitigate this risk. Other constraints for environmental considerations have not yet been defined.	Construction noise, hours of work and traffic noise will be require careful monitoring Construction requires work over a waterway. There is a risk of hazardous material entering the waterway. Environmental plans and processes should be in place to mitigate this risk. Future blast cleaning and coating of beams (if required) has potential for environmental impact, but able to be managed. Other constraints for environmental considerations have not yet been defined.
Side protection requirements	HT "F-shape" TL-5 barrier (1270 mm high including oval-section top rail	HT "F-shape" TL-5 barrier (1270 mm high including oval-section top rail
Access for inspection and Maintenance	Proven durable solution given good detailing. No internal components for inspection. Methodology for bearing replacement (after 50+ years) to be incorporated into the detailed design.	Proven durable solution given good detailing. No internal components for inspection. Methodology for bearing replacement (after 50+ years) to be incorporated into the detailed design.
Cost	**$5.8M -10%/+20%**	**$6.1M -10%/+20%**

Table 3.3 –Comparison of Factors Influencing Design

Based on the above comparison table considering cost and factors influencing design it is not clear that a recommendation can be made on a preferred option. The cost difference is negligible considering the -10%/+20% margin. Construction methodologies for both types are well understood. Seismic inertia demands may be less for the steel option but foundation design is likely to be governed by the weak ground conditions. Depth of continuous superstructure would reduce height of fill required at abutments and maximise freeboard.

4 Proposed Structure

4.1 Description of Structure

4.1.1 General Arrangement

The new bridge will operate as a typical two-lane highway. The proposed replacement will be approximately 189 m long and constructed on the upstream side of the existing bridge.

The trafficable width of the proposed bridge is 10 m comprised of two 3.5 m lanes and 1.5 m shoulders. When including an allowance of 0.4 m to 0.5 m for the barriers the expected total width is 10.8 m to 11.0 m.

The horizontal alignment is about two thirds straight and one third curved on a 130 m radius. A hogging vertical alignment may also be introduced to better control stormwater runoff back to the abutment locations before being piped to the river. A desirable geometric design speed will transition from a maximum of 70 km/h on northern approach to 50 km/h on southern approach with a 3% crossfall being maintained.

Spans may be either simply supported or continuous. Span lengths are likely to be in the order of 30 m reducing to approximately 20 m on the curved portion depending on the selected superstructure type.

For a simply supported precast super tee beam option, 1225 mm deep beams would be used to accommodate the longer 30 m spans. For a plate girder option the depth would be approximately 1100 mm deep for 30 m long continuous spans.

In-situ concrete topping would likely fall between 150 mm and 200 mm thick for these options.

Rigid concrete barriers are would likely be in the form of HT “F-shape” TL-5 barrier being 1270 mm high including an oval-section top rail. A repeating motif may be precast into the outside face of barriers.

Shear keys would be provided at piers and abutments to transfer lateral loading to the substructure. For simply supported superstructures, linkage bars and linkslabs would be used at the abutments and piers respectively.

4.2 Foundations and Substructure

The pier substructure may consist of a single column pier and a hammerhead. The size of the pier column would be dependent upon the tributary mass of the superstructure and hammerhead.

Pier piles are expected to be in the order of 1800 mm to 2100 mm diameter being sufficient size to a) support gravity loads and b) resist lateral earth pressure demands resulting from liquefaction and lateral spreading.

At the abutments, the approach embankment would be constructed of a mechanically stabilised earth (MSE) wall using steel straps and structural facing panels. MSE has demonstrated reliable performance under high intensity ground shaking. Ground improvement would also be provided at the abutment locations. Stone columns or ground replacement may be best suited for these conditions. A sill beam, backwall and settlement slab would be supported either by bored piles, say 1050 mm diameter, or directly on the MSE wall (provided design tolerances can be met).

4.3 Proposed Arrangements for Construction

The construction methodology and traffic management are as outlined in Sections 3.1.2. and 3.2.2. They are presented here as a merged list.

a. Establish on site, establishing environmental controls, site access, site clearance and enabling works such as service relocation (eg overhead lines)
b. Establish piling rig, vibrating in steel casing and augering out for the piles. Allow for preparation of work platforms beside and over the river.
c. Undertake ground improvement at the abutment locations such as stone columns or ground replacement. (note that ground improvement may not be able to be completed at the south abutment until the new bridge is operational. This is due to a potential clash with the traffic lanes coming off the bridge. Allow for re-establishment of ground improvement plant and machinery)
d. Construct reinforced concrete piles, potentially incorporating inclinometer tubes for assessment of post seismic deflection.
e. Form up pile columns with an extension of the pile casing and pour reinforced concrete pile columns
f. Form up and cast reinforced concrete hammerheads and abutment sill beams

g. Prepare bearings ready to receive precast prestressed beams.
h. Supply and Install Precast beams providing temporary restraint and stability.
i. Cast diaphragms, shear keys and backwalls. Incorporate linkage bars.
j. Prepare formwork for deck pour, mainly around outside of precast beams and incorporating bridge curve.

g. Prepare bearings ready to receive plate girders.
h. Supply and install plate girder providing temporary restraint and braces for stability.
i. Cast diaphragms, shear keys and backwalls. Incorporate linkage bars at abutment.
j. Place permanent formwork (or partial depth precast) for cast in-situ deck pour. Install fully precast deck cantilevers with transverse stitches.

k. Establish joint hardware and other cast-in items
l. Cast deck
m. Incorporate precast barriers with a cast-in-situ joint into the deck.
n. Construct MSE abutments incorporating settlement slab, stormwater control and wingwalls.
o. Traffic changeover to new bridge
p. Complete ground improvement at south abutment if required.
q. Complete landscaping improvements and all other civil works
r. Tidy up and disestablish

4.4 Risks and hazards considered

A list of hazards and risks that are expected to require special attention during the design phase and during construction are outlined below:

- Hydrological modelling and hydraulic effects of the new bridge on the vulnerable foundations of the existing bridge and confirmation of minimal impact on the KiwiRail bridge.
- Foundation conditions particularly the presence of weak soils at risk of liquefaction and lateral spread.
- Traffic management methodology requiring both lanes of State Highway 1 to remain open during over peak periods.
- Relocation of high voltage transmission lines
- Proximity to the existing bridge for construction clearances
- Protection of the existing Category A listed bridge
- Sequencing of ground improvement at the abutments near the live traffic lanes
- Risk of discovery of archaeology sites, eg, pre-1900 bridge structure, Maori heritage items
- Staging and platforms for construction beside and within the river channel
- Environmental controls

4.5 Estimated cost

The preliminary estimated cost for the bridge construction is $5,800,000 -10%/+20%. The breakdown of this figure is provided in Sections **Error! Reference source not found.** of this report.

4.6 Recommended design requirements and standards

Design requirements and technical approvals are presented in the following documents and standards

- Highway Structures Design Guide 1st ed. May 2016.
- Bridge Manual which includes
  - design philosophy,
  - importance level
  - foundation design
  - structural design,
  - building code compliance,
  - urban design requirements,
  - inspection and maintenance,
  - supplier designed components,
  - anti-graffiti measures,
- Research Report 364 Standard precast concrete bridge beams 2008
- HERA Report R4-97:2005 New Zealand Weathering Steel Guide for Bridges Amendment 1 Oct 2013
- Protective coatings for steel bridges 1st ed. Amendment 0, February 2014
- Landscape guidelines (Final Draft) September 2014
- Historic heritage impact assessment guide for state highway projects

- Statutory agreements, consents, property agreements, landowner agreements, and stakeholder agreements
- ZH/MS/01 Safety in design minimum standard for road projects
- OPermit bridge structural data guide first ed. Amendment 0, April 2016.

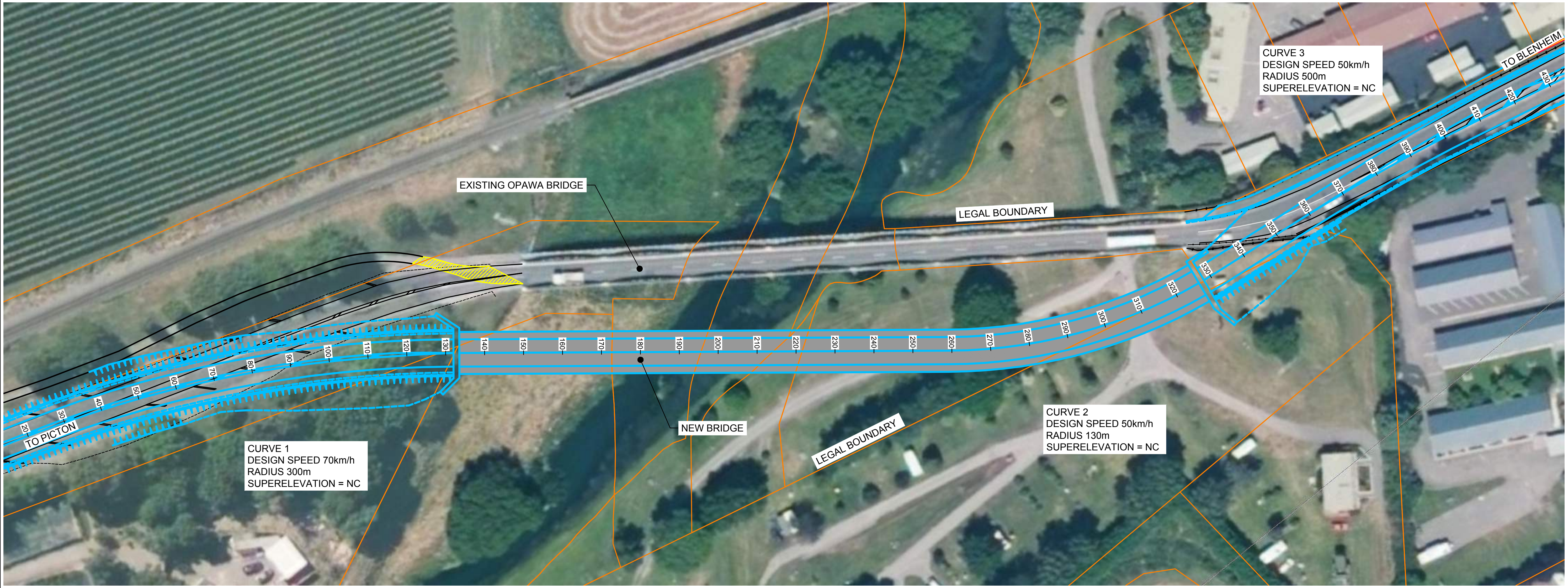
5 Recommendation

While the preferred bridge alignment has been identified, a preferred superstructure option for replacement of Opawa River Bridge could not be determined at this stage. Either Option A Prestressed Concrete Superstructure or Option B Structural Steel Superstructure may be most suitable. We recommend further detailed analysis once the constraints and factors influencing design are better defined and a more detailed cost estimate is prepared. We recommend both of these options are further considered and the preferred solution concluded in the Structure Options Report prepared during the Design and Project Documentation phase.

Opus International Consultants Ltd
19 Henry Street
PO Box 563, Blenheim 7240
New Zealand

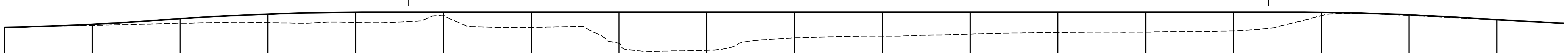
t: +64 3 520 9500
f: +64 3 520 9501
w: www.opus.co.nz

APPENDIX G – PRELIMINARY ALIGNMENT SCHEME DRAWINGS



NOTE
EXISTING PAVEMENT MARKING SHOWN BLACK.
PROPOSED MARKING SHOWN BLUE.

NEW BRIDGE



Datum R.L. 0.00

PROPOSED LEVEL	6.20, 6.33, 6.91, 7.84, 8.20, 9.25, 9.68, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.70, 9.64, 9.40, 9.08, 8.50, 8.07, 7.97
EXISTING LEVEL	6.65, 7.16, 7.29, 7.32, 8.96, 6.21, 2.59, 0.96, 3.79, 4.20, 4.65, 5.03, 5.14, 5.40, 8.89, 8.94, 7.93
CUT/FILL	0.00, 0.02, 0.26, 0.84, 1.03, 1.96, 2.36, 2.46, 2.16, 2.08, 0.74, 3.49, 7.11, 8.74, 5.91, 5.50, 5.05, 4.67, 4.56, 4.30, 3.88, 3.71, 3.04, 0.75, 0.04, 0.14, 0.14, 0.07, 0.04
VERTICAL GEOMETRY	2.12% 9.04m; 4.60% 4.98m; VC: 30.0m K: 6.20; 7.44% 0.50m; VC: 49.0m K: 6.59; -0.00% 7.52m; 0.00% 1.50m; 0.00% 193.00m; 0.00% 1.50m; 0.00% 1.50m; VC: 40.0m K: 6.67; -6.00% 7.18m; VC: 40.0m K: 20.00
HORIZONTAL ALIGNMENT	L=109.12m R=300.00m; L=127.80m; L=72.66m R=130.00m; L=23.90m; L=53.54m R=500.00m
STATION	60.00, 80.00, 100.00, 120.00, 140.00, 160.00, 180.00, 200.00, 220.00, 240.00, 260.00, 280.00, 300.00, 320.00, 340.00, 360.00, 380.00

Blue Option Centreline
SECTION BETWEEN CH: 40.00 AND 400.00

CONCEPT

Revision	Amendment	Approved	Revision Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
S.ALLEN	F.WESTERGARD	08.08.2016
Drawn	Scales	
S.ALLEN	1:500 (A1) 1:1000 (A3)	

Project
NEW ZEALAND TRANSPORT AGENCY
MR 223. SH1 WAIRAU AND OPAWA BRIDGES
DETAILED BUSINESS CASE

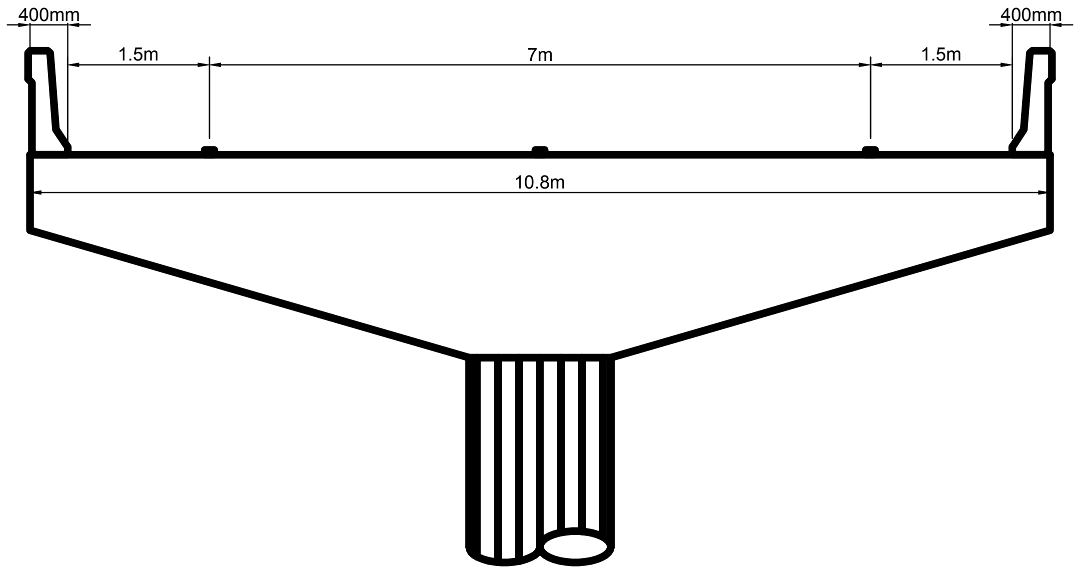
Sheet
SH1 OPAWA RIVER BRIDGE REPLACEMENT
BLUE OPTION

Project No.	Sheet No.	Revision
5-MB982.03	C01	

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Original Sheet Size A1 [841x594] Plot Date 2016-08-08 at 12:17:20 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\Blue Option - 50kph Concept Design.dwg C01

NOTE
EXISTING PAVEMENT MARKING SHOWN BLACK.
PROPOSED MARKING SHOWN BLUE.



TYPICAL BRIDGE CROSS SECTION
N.T.S.

CONCEPT

1:250 @ A1 1:500 @ A3 0 4 8 12 16 20 24 m

Revision	Amendment	Approved	Revision Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

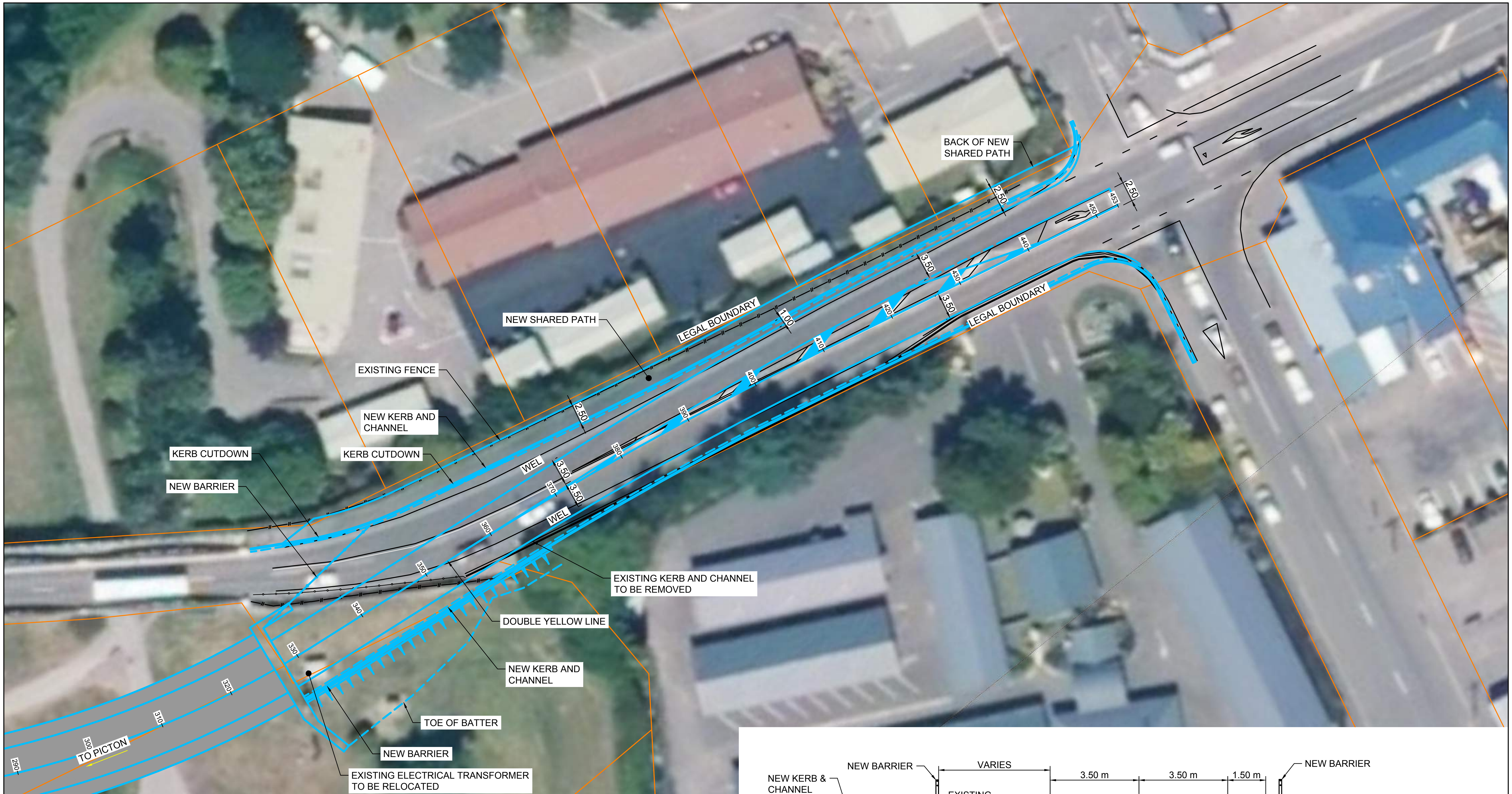
Project
NEW ZEALAND TRANSPORT AGENCY
MR 223. SH1 WAIRAU AND OPAWA BRIDGES
DETAILED BUSINESS CASE

Sheet
SH1 OPAWA RIVER BRIDGE REPLACEMENT
BLUE OPTION - NORTH APPROACH LAYOUT

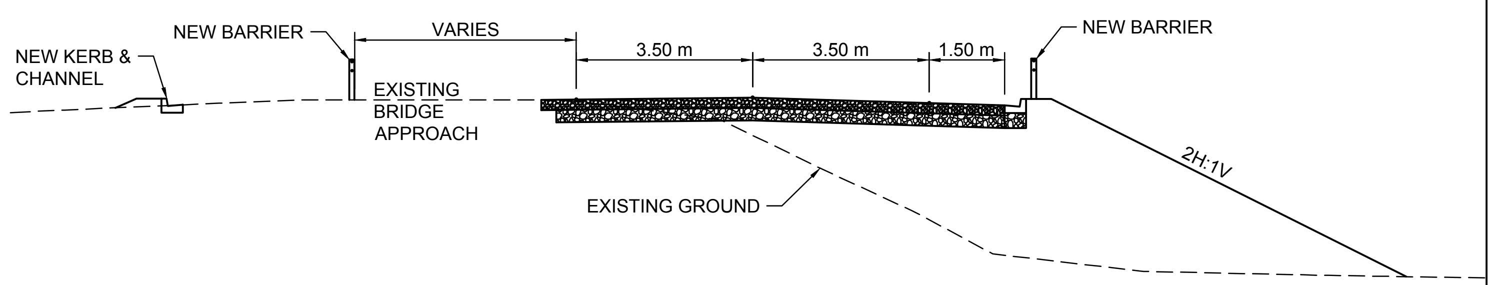
Designed	Approved	Approved Date
S.ALLEN	F.WESTERGARD	08.08.2016

Drawn	Scales	Project No.	Sheet No.	Revision
S.ALLEN	1:250 (A1) 1:500 (A3)	5-MB982.03	C02	

Original Sheet Size A1 [841x594] Plot Date 2016-08-08 at 12:16:39 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\Blue Option - 50kph Concept Design.dwg C02



NOTE
EXISTING PAVEMENT MARKING SHOWN BLACK.
PROPOSED MARKING SHOWN BLUE.



TYPICAL APPROACH CROSS SECTION

N.T.S.

CONCEPT

Revision	Amendment	Approved	Revision Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
S.ALLEN	F.WESTERGARD	08.08.2016
Drawn	**Scales**	
S.ALLEN	1:250 (A1) 1:500 (A3)	

Project
NEW ZEALAND TRANSPORT AGENCY
MR 223. SH1 WAIRAU AND OPAWA BRIDGES
DETAILED BUSINESS CASE

Sheet
SH1 OPAWA RIVER BRIDGE REPLACEMENT
BLUE OPTION - SOUTH APPROACH LAYOUT

Project No.	Sheet. No.	Revision
5-MB982.03	C03	

1:250 @ A1 / 1:500 @ A3 — 0 4 8 12 16 20 24 m

APPENDIX H1 – URBAN AND LANDSCAPE DESIGN FRAMEWORK

Opus International Consultants Ltd
Blenheim Office
19 Henry Street
PO Box 563, Blenheim 7240
New Zealand

t: +64 3 520 9500
f: +64 3 520 9501
w: www.opus.co.nz

DATE	10 August 2016
FILE	**MR 223 SH 1 Opawa Bridge Replacement**
SUBJECT	**Concept Urban and Landscape Design Framework**

Scope

The purpose of this draft Concept Urban and Landscape Design Framework[1] (ULDF) is to scope the urban design, connectivity, aesthetic and landscape design considerations and opportunities that arise relative to the proposed replacement of the Opawa River Bridge on State Highway 1 (SH1) on the northern edge of Blenheim.

The purpose of an Urban and Landscape Design Framework (ULDF) is to ensure that the urban and landscape design concepts for large scale and /or complex highway infrastructure projects are integrated with the surrounding environment, aligned with the expectations of the local community, while also meeting the NZ Transport Agency's fiscal and whole-of-life expectations. This project and therefore its ULDF, differs from large highway 'corridor' projects in that its focus is a relatively short, replacement bridge, coupled with the retention of the existing bridge due to its heritage values. As such, this ULDF concentrates on the proposed and existing bridge and the immediate environs as opposed to the far broader expectations of a highway corridor ULDF.

Information and direction provided by the Project's Indicative Business Case report and by supporting structural and conservation plan/heritage reports has been taken into account in the preparation of the draft ULDF. These documents contain numerous historic and current site photos of the existing bridge and its environs. Of particular note, Section 3.2 – Assessment of Cultural Heritage Significance of the Project's Conservation Plan outlines the significance of the existing bridge in terms of architectural, aesthetic, cultural, historic, social and other heritage aspects.

Introduction and Context

The existing SH1 Opawa River Bridge is recognised as distinctive 'gateway' marker on the northern edge of Blenheim, being the crossing point of the Opawa River, the banks and channel of which has historically and continues to 'contain' the northern expansion of the town. The bridge is a listed heritage structure; being one of the first, if not, the first reinforced concrete bowstring bridge built in New Zealand. The bridge is marked with two relatively narrow traffic lanes and has a connected footpath on the downstream side of the bridge structure.

The high traffic volumes using the bridge, means that the existing bridge no longer meets State highway level of service requirements, which necessitates its upgrade or replacement.

[1] Per comms: Sam Bourne, Principal Specialist - Urban Design and Landscape, Highways and Network Operations - Network Outcomes, NZ Transport Agency, Auckland and David McKenzie, Technical Principal – Landscape Architecture, Opus, Christchurch; 3 August 2016

As at June 2016, following completion of NZ Transport Agency's indicative business case, the preferred options is to:

a) construct a new road bridge upstream and

b) change the use of the existing bridge to a cycleway/pedestrian bridge only.

The change may also correspond with a transfer of ownership or responsibility of the existing bridge.

The context of the proposed bridge has to consider a number of factors:

- Existing landscape;
- Heritage values;
- Visual effects and design possibilities; and
- Implications on nearby land owners.

NZ Transport Agency guiding documents

Relevant Transport Agency documents that guide the urban and landscape design input to the Project are:

Transport Agency Urban Design Guidelines 'Bridging the Gap', 2013

The Transport Agency 'Urban Design Guidelines - Bridging the Gap' provide guidance to project managers and consultants responsible for the planning, design and implementation of Transport Agency projects. This document provides policy and guidance for the integration of land use and transport, with the aim of seeking to improve what good urban design means in a transport project

'Bridging the Gap' sets out ten fundamental urban design principles. These principles reflect the Transport Agency's expectation for the integration of urban design in all phases of transport projects and the desired inter-disciplinary approach to addressing urban design issues. The document also incorporates the New Zealand Urban Design Protocol (2005), Crime Prevention through Environmental Design (CPTED) requirements and provides Urban Design and Landscape Framework (ULDF) guidelines amongst other things.

The intent of these urban design guidelines has been carried through into this draft ULDF.

Transport Agency Landscape Guidelines (Final Draft), 2014

The Transport Agency 'Landscape Guidelines' replaces the Guidelines for Highway Landscaping. These guidelines recognise the important contribution landscape thinking, landscape planting, landscape design, implementation and management provides in the delivery of quality infrastructure. The guidelines outline the key considerations and critical steps to be followed when assessing, designing, constructing and maintaining highway landscape assets.

The intent of these landscape guidelines has also been carried through into this draft ULDF.

Transport Agency P39 Standard Specifications for Highway Landscape Treatments, 2013

The 'P39 Standard Specifications for Highway Landscape Treatments' set out the minimum performance, quality and workmanship standards for highway-related landscape projects. Alongside the specifications, there will be landscape plans and planting schedules produced, specific to the Project. These will form part of the construction contract and pricing package.

Though not required at this early phase of developing the Opawa River Bridge replacement project, the expectations of the 'P39' specification are acknowledged in drafting this ULDF.

Bridge Design Objectives
For a number of Transport Agency's current Roads of National Significance projects the following over-arching design principles have been applied to bridge structures; be they river bridges, rail overbridges, underpasses and/or overpasses.

Where bridges are visible from surrounding communities and/or the highway, the following general objectives apply:

- Develop a set of design consistencies for bridges according to type (who experiences the structures) and hierarchy.
- Aim to make a positive contribution to the surrounding environment and communities.
- Ensure new bridges complement their context with an appropriate form, scale, design and quality, and consider the relationship to existing bridges (road and rail).
- Ensure all users are considered and catered for. All local road bridges should cater for pedestrian and cyclist access.
- Consider the design quality of the bridge: amenity, aesthetics, of the experience, safety, accessibility, and landscape design.
- Aim to make a positive contribution to highway users and the driving experience.
- Consider the opportunities for consistency of bridge elements across the broader State highway network.
- Ensure the bridge location and geometry fits in well with the wider movement network, making a positive contribution to the urban form.

Additional to these general objectives, a number of which are not relevant to a single bridge replacement project, the following principles apply to the specific design of bridges:

Accessibility (pedestrian and cycle)

- Where practicable, ensure that adequate width is allowed for on at least one side of urban local road bridges for pedestrian and cycle pathways. Where there is high pedestrian/cyclist use, or potential for significant growth, consider facilities on both sides.
- Where practicable, create new connections to existing pedestrian and cycle networks or desire lines. For example, a pedestrian and cycle connection to Opawa River banks from both the proposed bridge and the existing bridge.

Barriers

- Ensure that barriers are fully visible, with clean, uninterrupted, continuous lines.
- Ensure that barriers extend well past abutments to transition the bridge into the landscape.
- Enhance the barrier surfaces through use of colour, form, and materials informed by the local topography, history, landuse and ecology.

Context

- Bridges should complement their context. This means considering factors such as, but not limited to: topography, location of watercourses, the rural or urban setting, bridge visibility, existing valuable vegetation or ecology features, proximity to houses

or open spaces and the presence of pedestrian/cycle paths across or in the vicinity of the bridge.
- Consider how a new bridge will aesthetically tie in or contrast with other bridges nearby. For example, the existing road and rail bridges over Opawa River.
- Ensure that colour is not a dominant feature in rural settings.

Form and scale
- Consider the 'family' of bridges when designing the form of the bridges. For example, establish if such a design form or style 'relationship' is appropriate between the currently proposed Opawa River highway bridge and the future Wairau River highway bridge, which is 8 km to the north.
- A favourable design outcome is more likely to result from strong formal or visual integrity among the basic parts (bridges, ramps, retaining walls, etc.), than it is from an overlay of "decorative" or "mitigating" elements.
- If closed abutments are used in urban setting, ensure the edges have a 'finished,' clean appearance to approaching traffic.
- Ensure the ratio of height and span are carefully considered to achieve balance, and create a simple, elegant whole.
- Ensure that bridge length and position takes into account river/stream characteristics and hydraulics. Ensure that barriers and handrails compliment the bridge form.

Landscape development
- Where suitable, plant the bridge approaches and any sloped abutments to provide integration into the surrounding landscape, and reduce the visual effect of barriers.
- Consider the natural topography - could it be an advantage to the bridge design?
- Where practicable, plant or grass the embankments on bridge approaches with slopes 1h:2v or flatter.
- Consider view shafts of the local landscape features (e.g. the Richmond Ranges, the avenue tree planting to the north and Opawa River) from the bridge.

Safety
- Consider the safety of all users.
- Ensure path widths cater for both pedestrians and cyclists safely without collisions.
- Ensure lighting design at interchange bridges (quantity, location and type) creates a safe environment for pedestrians, and prevents vandalism. Pedestrians and motorists often have quite different lighting needs. Sometimes, separate installations are required for each user group.
- Consider CPTED principles when designing bridges and planting layouts. Natural surveillance should be encouraged and ensure pedestrians can be seen while using the bridge.

Services
- Conceal drainage systems from all views, within the bridge structure.
- Ensure services are hidden from viewing points (including views from river walkways).

Maintenance
- Select durable materials and finishes, and use anti-graffiti coatings, where required.
- Adopt Whole-of-Life principles in the selection of materials, joints, bridge bearings and the like.

Opawa River Replacement Bridge Objectives
The surrounding landscape has a number of important elements which should be addressed as part of the bridge upgrade. Within the 'footprint of the existing and proposed bridges, there is an opportunity to clean up the river channel and provide ecological restoration of the river edges through planting local native riparian shrub and grass species. This would help filter stormwater entering the river, creating a healthier environment and provide habitat and shade to encourage native fauna such as fish and bird species to reside there.

As highlighted in the Projects Conservation Plan[2], consideration needs to be given to the heritage values of the existing bridge.

The Opawa River Bridge is one of the first – if not the first – reinforced concrete bowstring bridges in New Zealand, and is the only known example of the bowstring arch truss type that now remains in the country. As a structure the bridge is in largely original condition, with the majority of its original fabric and detailing intact; and, though it is arguably a heavy and somewhat cumbersome design, it is a striking example of engineering that was highly innovative at the time of construction. The Opawa River Bridge has provided the town of Blenheim with a crucial connection to the north for almost exactly a century, and is an integral part of the town's historic development. The unique design of the structure, and its importance as Blenheim's northern gateway, mean that the bridge is intrinsically connected to the identity of the Blenheim community. The structure also has strong associations with the Public Works Department; especially father-and-son engineers, R. W. and J. D. Holmes. The Opawa River Bridge, therefore, is a structure of exceptional cultural heritage significance that is of national importance

Given the distinctive design and history of the existing bridge, it is anticipated that the proposed bridge will have clean and modern lines so as not to detract from the character of the existing bridge. This consideration will be a focus as the form, barrier treatments and such of the proposed bridge are developed going forward.

The bridge replacement will also be a great opportunity to provide Blenheim with an enhanced 'gateway' egress to and from the town. At present the entrance to Blenheim when arriving from the north is somewhat ill-defined. Early consultation with local iwi indicates the possibility of having several large pou (wooden carved poles) placed on the eastern side of the bridge between the existing bridge and the railway that will be seen before crossing into Blenheim, capturing the story of the local significance of this area. This would have historical, cultural and social benefits. The pou could be up-lit creating an impressive entrance not only during the day but also at night. A selective palette of native tree and shrub planting on both sides of the bridges would further enhance the 'gateway' aspect of this opportunity.

Pedestrian and cyclist access over the bridges is a major consideration for this project. At present pedestrians and cyclists have to cross the busy highway to use the pedestrian/cycle path on the downstream side of the bridge. Local parents have concerns about letting their children cycle to school due to the large volume of traffic and particularly heavy transport crossing the bridge. Those concerns should be incorporated into the proposed design to make it safer to use the bridge. Ideally a separate cyclist and pedestrian link on both sides of the river would be required. Footpaths leading up to the existing bridge need to be addressed. Currently there are no significant footpaths or cycle lanes leading up to the

[2] Opawa River Bridge, Blenheim Conservation Plan – prepared for NZ Transport Agency by Opus, August 2016

existing bridge at the southern end. These linkages would be incorporated into the gateway design, creating a greater opportunity for everybody to use the existing Opawa River Bridge.

Given that the proposed cross section for the proposed bridge from IBC is 10 m between kerbs being two 3.5 m traffic lanes with 1.5m shoulders either side, the intention is that the proposed bridge shoulders will provide for sport or confident cyclists and the existing bridge will provide for less confident cyclists and pedestrians.

Other opportunities include lighting up the existing Opawa River Bridge at night, creating a sculptural feature seen when driving into town. Consideration of the neighbouring Top Ten Holiday Park would need to be given so as to provide a suitable aesthetic outcome and minimise light pollution. Lighting under the existing and proposed bridges would also need to be provided to improve safety access for holiday park patrons and users of the riverbank paths.

A strong way of 'signalling' the existing bridge's new beginning in providing this important link would be to use a new surface treatment on the existing bridge deck that removes the old and tired highway surfacing and traffic lane markings and provides a more interesting, inviting and a fresh surface and route for pedestrians and cyclists. This could also include installation of street furniture placed to visually and physically break up the linear nature of the refurbished bridge deck. There may be opportunity to capture representation of some of the existing bridge design and built elements, such as the arching concrete bridge spans, in the refurbishing and re-use of the existing bridge.

As part of an overall integrated lighting design, a continuation of the lighting of the potential pou at the north end of the bridge could be carried through into the lighting the arched forms of the existing, but 'retired' traffic bridge, its refurbished deck and to the 'under-lighting' of both the existing and proposed bridges and of the pathways under the railway bridge immediately downstream.

A set of visualisations is attached that illustrates a number of the principles and opportunities outlined in this draft Concept Design Report.

David McKenzie
Technical Principal – Landscape Architecture
FNZILA (Reg.), Partner

APPENDIX H2 – URBAN DESIGN VISUALISATIONS

SH1 Opawa Bridge Replacement

BRIDGE VISUALISATIONS

AUGUST 2016

OPUS LANDSCAPE ARCHITECTURE AND URBAN DESIGN

DISCUSSION DOCUMENT
- ALL IMAGES ARE INDICATIVE ONLY

BRIDGE LOCATION PLAN

LEGEND:

- Existing Historic Bridge
- Possible Replacement Bridge Alignment
- Proposed 'Gateway' area
- Blenheim Town Centre
- Exisiting Rail Bridge

DISCUSSION DOCUMENT
- ALL IMAGES ARE INDICATIVE ONLY

VISUALISATION 1

Direction of Visualisation

Current View of the Existing Historic Bridge

Proposed View of a Possible Replacement Bridge

DISCUSSION DOCUMENT
- ALL IMAGES ARE INDICATIVE ONLY

VISUALISATION 1 - POSSIBLE REPLACEMENT BRIDGE

Direction of Visualisation

DISCUSSION DOCUMENT
- ALL IMAGES ARE INDICATIVE ONLY

VISUALISATION 2

DISCUSSION DOCUMENT
- ALL IMAGES ARE INDICATIVE ONLY

Direction of Visualisation

Current Bridge Approach

Possible Bridge Gateway Approach

DISCUSSION DOCUMENT
- ALL IMAGES ARE INDICATIVE ONLY

VISUALISATION 2 - POSSIBLE GATEWAY APPROACH

Direction of Visualisation

Opus International Consultants
Christchurch
12 Moorhouse Avenue
PO Box 1482, Christchurch 8140
New Zealand

t. +64 3 363 5400
f. +64 3 365 7858
w. opus.co.nz

APPENDIX J – CONSENTING STRATEGY

Opawa Bridge SH1

Consenting Strategy

Opawa Bridge SH1

Consenting Strategy

Prepared by	Donna Hills	Resource Management Planner/Communications	Opus International Consultants Ltd
Reviewed by	David Jackson	Senior Resource Management Planner	Nelson Office Level 1 Morrison Square, 77 Selwyn Place Private Bag 36, Nelson Mail Centre, Nelson 7042 New Zealand
Approved for Release by	Brent Morgan	Business Manager Blenheim/Project Team Leader	Telephone: +64 3 548 1099
			Facsimile: +64 3 548 9528
			Date: 31st August 2016 Reference: 5-MB982.03 Status: FINAL

Contents

Executive Summary

The SH1 Opawa Bridge was designed in 1912 and is a Heritage NZ Category 1 heritage place. The bridge is located on the northern edge of Blenheim and carries 9,800 vehicles per day of which 9% are heavy vehicles. Recent investigations have determined that the narrow carriageway of the bridge is not suitable for current or future traffic requirements, particularly heavy vehicles, and provides low seismic resistance.

Funding for construction under the Accelerated Regional Roads Package (AARP) has been allocated.

It is recommended that alterations be sought to the existing SH1 designation as the new alignment will be outside of the designation.

A range of regional consents under the Operative Wairau/Awatere Resource Management Plan (WARMP) and the Proposed Marlborough Environment Plan (MEP) will need to be applied for, including such activities as stream diversions, culverts, structures in stream beds, temporary water takes and discharges during construction, erosion, sediment and dust control, and discharge of fill material.

The MEP was publicly notified on the 9th June 2016 and the applicable regional rules take immediate effect. The new bridge will be subject to rules in both the WARMP and the MEP, but because the MEP is a proposed Plan, the weighting to be given to it will need to be considered.

Providing that an alteration to the current designation is applied for at the same time as the required regional resource consents, then no district consents are likely to be required as the designation would override the district rules.

Key aspects of the consenting strategy recommended are:

- Early and close collaboration between the design engineers and the environmental experts (ecological, heritage, noise) to identify potential opportunities to avoid or reduce the potential impacts i.e. reducing the need for stream diversions;
- Early engagement with the regulatory authority, to identify any potential significant consenting obstacles, and to establish an ongoing forum to discuss and resolve issues;
- Effective engagement with directly affected landowners, key stakeholders, Iwi, and the general public to help people understand the project and its benefits, and to seek to understand and, if possible, resolve issues prior to lodgement of the applications;
- Establishment of an effective and ongoing relationship with Iwi;
- Development of a robust, ‘fit for purpose’ Assessment of Environmental Effects to support the statutory applications;
- Careful consideration of the designation boundaries to ensure they are adequate for construction and ongoing operations and maintenance of the road and bridge, while also meeting the RMA requirement of being ‘reasonably necessary’. The existing designation for the bridge and its approaches will be uplifted.

- Particular attention should be given, in the application for the alteration to designation, to the need for the bridge;
- Agreement should be sought from the territorial authority as to the level of detail that is appropriate and necessary for the alteration to the designation application.

A number of the above processes have commenced and will be continued. This consenting strategy should be a ‘living document’ and be regularly reviewed as the design progresses, a preferred consenting path is chosen and more information becomes available from engagement with key stakeholders, iwi, the wider public, and the regulatory authority.

1 Introduction

This consenting strategy has been prepared by Opus International Consultants for the Agency. The purpose of this strategy is to provide the Agency with a recommended pathway to obtain all relevant statutory approvals for the Opawa Bridge upgrade/replacement under the Resource Management Act 1991 (RMA). This consenting strategy considers the planning mechanisms as well as the planning approval processes under the RMA, and other requirements such as under the Heritage New Zealand Pouhere Taonga Act.

The key components of the Consenting Strategy are:

- Summary of the environmental effects;
- Description of the RMA and other approvals required;
- Summary of alternative approval pathways and why;
- Scoping the technical assessments necessary to support the applications; and
- Recommendation as to the approach in preparing the necessary applications for designations and resource consent.

This document has been informed by the findings of stakeholder and community engagement undertaken during 2015/2016.

2 Purpose of the Consenting Strategy

The aims of the Consenting Strategy are:

- To secure the necessary consents and authorities required under the RMA and other applicable legislation to enable construction of the bridge to commence in later in 2017;
- To ensure the project meets the purpose, relevant principles and requirements of the RMA and other applicable legislation;
- To identify, as early as practicable, any risks to obtaining the necessary statutory approvals to allow the Agency to develop appropriate response(s) and manage those risks;
- To ensure that the project's environmental effects are properly scoped and carefully assessed;
- To facilitate an efficient and collaborative process of engagement with the consent authority; and
- To ensure all designation and consenting conditions control and manage the effects associated with establishing the bridge and upgrading parts of SH1 (where proposed), and provide for their continued operation, maintenance and further improvement in a manner that:
  - » is consistent with the Agency's objectives;
  - » is practicable to implement; and
  - » does not unduly constrain contractor flexibility and innovation.

3 Project Scope

3.1 The Project Route

This Consenting Strategy is developed on the basis of the preferred option identified in the Multi Criteria Analysis (MCA)[1], namely Option 8 which is a new 10.8m wide two lane bridge immediately upstream of the existing bridge.

The preferred option comprises the realignment of SH1 and a new bridge on the western (upstream) side of the existing Opawa Bridge.

3.2 Assumptions

The following assumptions have been made in undertaking the analysis to determine the recommended RMA approvals process:

- Further engagement with directly affected landowners, key stakeholders, Iwi, and the general public will be necessary as the bridge design is refined and mitigation measures are developed to address potential adverse effects;

- There may be amendments to the RMA passed during the period of securing RMA approvals. If that occurs, the project may need to be re-assessed against any changed RMA provisions prior to the preparation for hearings of any notices of requirement or applications for consent for the project so as to identify any new or changed risk.

4 Assessment of Alternative Routes and Environmental Effects

The route options and their potential impacts were assessed using Multi-Criteria Analysis (MCA). The MCA evaluated the options against transport-focussed and other environmental criteria, and the 'fit' with the project objectives. The MCA framework adopted had regard to the Agency's *z19 Environmental and Social Responsibility Standard*, and the *Environmental and Social Responsibility Screen* [2].

The overall scores are summarised in Appendix A. The MCA process established that Option 8 (a new bridge immediately upstream of the existing bridge) was the preferred option out of the 11 options considered

The scores provide an indication of those adverse effects that may be critical to the project. As a result of detailed design on the possible preferred option and an iterative process with respect to avoiding or mitigating environmental effects – the environmental impacts can be expected to change.

---

[1] *Source:* Indicative Business Case - Opus report to NZTA, 22nd April 2016.

[2] After discussion with the NZTA Planner it was agreed a further ESC screen was not necessary, since the MCA process and ESC screen as part of that was sufficient.

The detailed business case has been completed.

The most significant issues or effects, at this point, are considered to be:

- Urban design, and landscape and visual impacts at the gateway to Blenheim;
- Potential for erosion and sedimentation during construction, effects on water quality;
- Ecological effects, including terrestrial and freshwater;
- Archaeological and heritage effects;
- Cultural and related effects of concern to Iwi;
- Social and community impacts, particularly property acquisition;
- Noise & vibration impacts from construction and operation;
- Light spill;
- River hydraulics and flooding potential; and
- Loss of land from Top Ten Holiday Park and Grove Motel (expected to be resolved by purchase)

Benefits

The benefits of this project are as follows:

- Provision of a reliable passage for normal vehicles and heavy freight vehicles over the bridge, before and after any potential natural resilience;
- Continued economic efficiency for freight on SH1;
- Maintains the heritage bridge (unaltered);
- Provision of pedestrian and cyclist facilities across heritage bridge;
- Potential to enhance the gateway into Blenheim; and
- Potential to enhance the streamside environment of the Opawa River.

5 Required Approvals

The main approvals and consents likely to be required (or desirable) for the project are:

- Resource Management Act 1991 (RMA):
  - » Alteration to the existing designation to authorise the construction, operation and maintenance of the altered road approach(s) and the new bridge;
  - » Resource consents to authorise works in the watercourse, sediment discharge, water take, and earthworks;
  - » Potentially, resource consent to disturb contaminated soil under the National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health 2011 (this is discussed below).
- Heritage New Zealand Pouhere Taonga Act 2014:
  - » Authorisations to modify or destroy archaeological remains.

5.1 Relevant Statutes

- Resource Management Act.

  Under the Resource Management Act there is a national policy statement, and the following district/regional plans that apply – all of which are relevant:

  - Operative Marlborough Regional Policy Statement (MRPS)
  - Operative Wairau/Awatere Resource Management Plan (WARMP)[3]
  - Proposed Marlborough Environment Plan (MEP)

  In addition, there are two national environmental standards that require consideration:

  - National Environmental Standard for Air Quality 2004
  - National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011

  These are discussed further in section 5.3.1.

- Heritage New Zealand Pouhere Taonga Act 2014

5.2 Designations

5.2.1 Existing Designations

SH1 and the Opawa Heritage Bridge are both designated for roading purposes.

[3] These two plans have been combined and the new plan was publicly notified on the 9th June 2016

5.2.2 Alteration to Existing Designations

The existing designation will be altered to reflect the new SH1 alignment (which incorporates the bridge) and the existing designation will be uplifted.

5.2.3 Effects Envelope and Conditions

The intention is to ensure the altered designation (including any conditions) allow for an 'envelope of effects' to provide for degree of flexibility to:

- Provide project design and construction flexibility;
- Allow for contractor work areas, including temporary work areas;
- Minimise the need for further designation alterations and/or outline plans post detailed design; and
- Clearly provide for future reasonable asset operation, maintenance and improvement activities.

5.2.4 Designation Boundary

The proposed extent of the land required for the works will consider:

- The environmental effects of the project;
- Construction requirements; and
- Ongoing operational and maintenance requirements of all highway assets.

5.3 Resource Consents

Designations replace district plan controls on land above Mean High Water Springs. A designation does not have effect with respect to regional rules, nor the provisions of the National Environmental Standards (NESs) (unless the NES provides otherwise).

5.3.1 National Environmental Standards

The following National Environmental Standards may be relevant:

5.3.1.1 National Environmental Standards for Air Quality 2004

Resource consents are not likely to be required under this NES, however the NES will need to be considered as part of the Assessment of Environmental Effects.

5.3.1.2 National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health 2011

The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect

Human Health 2011 (NES Contaminants) applies to land as per clause 5(7):

"Land covered:

(7) *The piece of land is a piece of land that is described by 1 of the following:*

(a) an activity or industry described in the HAIL is being undertaken on it;

(b) an activity or industry described in the HAIL has been undertaken on it;

(c) it is more likely than not that an activity or industry described in the HAIL is being or has been undertaken on it.

There are sites close to the Opawa Bridge that are not currently listed as Hazardous Activities and Industries List (HAIL) sites, but are under investigation by MDC. In any event it is unlikely that they will be affected by the possible new bridge alignment. These sites are:

PN186650 – Potential orchard 1996-2008 and contractor yard;

PN145939 – Soil disturbance, import material/burn piles.

5.3.2 Operative Regional Plans

Marlborough District Council has two operative regional plans in place, although only the Wairau/Awatere Resource Management Plan (WARMP) affects the subject site. The new Proposed Marlborough Environment Plan was publicly notified early in June 2016 and the relevant regional rules take immediate effect.

There is also an operative Regional Policy Statement (RPS).

The consents that are expected to be required under the relevant plan are set out in the table below. This list will be refined as the design of the road re-alignment, new bridge and mitigation measures are further developed.

Regional Plans	Consents (Potentially) Required
Operative Wairau/Awatere Resource Management Plan (WARMP) Proposed Marlborough Environment Plan (MEP)	Structures in or over the beds of streams (bridge and piers) Discharges to water of sediment-laden stormwater Discharges to land and to erosion and sediment control facilities during construction Stream diversion/coffer dam (if necessary to install piers) Stormwater discharges from earthworks (Marlborough Roads have a global consent that may cover this) Land/Vegetation disturbance (earthworks)

Note: All of the above activities fall under Chapter 27 General Rules of the WARMP and Chapter 2 of the MEP, which are the regional rules.

Overall the consent activity status is likely to be Discretionary.

5.3.3 Marlborough Regional Policy Statement (RPS)

The RPS identifies three main river systems within Marlborough - the Wairau, Awatere and Pelorus River and their related tributaries and wetlands. The Opawa River converges at the mouth with the Wairau River, but is not a tributary[4] The RPS states that is important to recognise the linkage that freshwater ecosystems have with land and marine ecosystems. Land clearance, forestry, gravel extraction and river works can lead to increased sedimentation rates which may adversely affect freshwater quality and threaten the coastal environment.

Objective 5.1.2 – Freshwater Quality states that the water quality in Marlborough freshwater bodies be at a level which provides for the sustainable management of fish and plant life. Policy 5.1.3 – seeks to avoid, remedy or mitigate the reduction of water quality in wetlands, lakes, and rivers caused by contaminated runoff water entering from land and non-point source discharges.

Objective 5.1.10 – Freshwater Habitat states that the integrity of freshwater habitats and natural species diversity be maintained or enhanced. Policy 5.1.11 – Habitat disruption seeks to avoid, remedy or mitigate habitat disruption arising from activities occurring within wetland, lake or river systems. Structures and other such activities can disrupt the physical integrity of freshwater habitats, including the passage of fish, by displacement, smothering, or destruction.

Objective 7.1.14 – Community Infrastructure is made up of those components which enable a community to function. It includes land, air, and marine transport systems, water and power supply, telecommunications, waste disposal, and central and local government functions. Policy 7.1.15 (a) – Enables the safe and efficient operations of the land transport system consistent with the duty to avoid, remedy or mitigate adverse environmental effects. (b) Recognises a roading hierarchy as the guiding framework for the function of roads in Marlborough.

5.4 Archaeological Authorities

An Archaeological Assessment of the general area of the Opawa Bridge was done as part of the Indicative Business Case. This identified a number of known sites along the banks of the Opawa River, including two primary sites:

- P28/150 – The Opawa Bridge itself; and

  P28/151 – Old railway bridge piles which is a new discovery on the downstream side of the Opawa Bridge.

The closest site to the potential upstream alignment for the new bridge is P28/130 (middens) which is located approximately 390 metres away from the existing Opawa Bridge, and is therefore unlikely to be affected.

The Archaeological Assessment concludes with the following recommendations:

- An Heritage New Zealand Pouhere Taonga (HNZ) General Authority must be applied for;
- That the Built Heritage Assessment (BHA), Cultural Impact Assessment (CIA) and final earthworks footprint are provided to finalise the report in order to meet the requirements of a General Authority application;
- That prior to the work commencing on the property, all contractors and subcontractors are briefed on archaeological and cultural issues, and advised and the procedure;

[4] This has been confirmed with a Senior MDC Regional Planner

- That any cultural protocols advised by Tangata Whenua are acknowledged and provided for;
- That some earthworks will be carried out under the supervision of an archaeologist and iwi monitor;
- That any archaeological deposits identified during excavations are sampled, recorded and assessed according to established archaeological practice.

It is standard practice for a consent to include a condition outlining the process that must be followed in the event of any archaeological discovery. However, it may be prudent to obtain a General Authority from HNZ because in the event an artefact is discovered accidently during excavations, all work must stop, and a General Authority be applied for, which can be a lengthy process.

5.5 Reserves Act

There is no known land that will be affected by the Reserves Act 1977, at this stage.

5.6 Road Stopping

Not anticipated.

6 Approvals Pathway

6.1 Approvals Path

In this instance only one consenting authority is involved for both the alteration to the designation, and the regional consents required. MDC is a Unitary Authority with both territorial and regional functions under the RMA.

The statutory process is therefore relatively straightforward with no requirements for joint hearings where a project crosses over consenting authority boundaries.

It is not considered that the proposal meets the threshold under Section 142(3) of the RMA in that it is considered a matter of national significance that warrants direction to either a Board of Inquiry or the Environment Court.

It is considered that the usual process of lodgement of applications with MDC, and processing in the normal manner is appropriate for these applications.

6.2 Approvals Staging and Timeframes

Proposed staging and timeframes for approvals are outlined in the table below.

Stage	Approval document	Indicative timing for lodgement
1	**Heritage NZ General Authority [if needed]**	Late 2016-early 2017
2	**Notice of Requirement to alter the designation** **Regional Consents**	Late 2016 – early 2017

7 Recommended Consenting Strategy

7.1 Close Collaboration between Design and AEE

It is recommended that an early start be made on the design (scheme plan), and that there is an interactive, iterative process between design refinement, identification of consenting risk and development of mitigation options. The objective is to get a good understanding by the design experts and environmental experts of the opportunities and constraints in the design, and the potential for the mitigation of environmental effects.

7.2 Early Engagement with Regulatory Authorities

Linked to the early collaboration between designers and technical experts, is a recommendation for early and ongoing liaison with regulatory approval staff from the Marlborough District Council and Heritage NZ (if required):

- Explain the project, consenting process and timelines;
- Undertake site visits;
- Discuss likely effects and understand the regulatory authorities' prioritisation and ranking of potential effects so that they can be effectively addressed in the application and the AEE;
- Gain a greater understanding of potentially affected parties who will need to be consulted;
- Understand the consents needed, and the relevant policy framework;
- Discuss emerging issues and mitigation options and the formulation of workable conditions of consent that the consent authorities will recommend to the decision-makers; and
- Understand how the applications will be assessed and processed.

7.3 Engagement and Consultation

There is a separate Engagement Plan for this project which sets out the process for engaging with the community that is important in communicating about the project.

The purpose of the plan is to:

- Help people understand the benefits of the project, and for individuals and organisations to then support it at the submissions stage;
- Effectively engage with potentially affected property owners and occupiers, key stakeholders, Iwi, and the community, so that the project and its potential effects are properly explained; and their input is included, where practical, in the final design; and
- Seek to understand and resolve issues where possible prior to lodging of the applications, so that the adverse effects of the proposal are reduced, and the number and extent of opposing submissions is minimised.

7.4 Engagement with Iwi

Eight Iwi groups were originally consulted. This was narrowed down to three main groups with an interest in the location of the Opawa Bridge; Te Runanga o Rangitane, Ngati Apa ki te ra to and Ngati Rarua.

Consultation was held with these groups and their input included into the project.

Further to recent Statutory Settlements one of the original eight Iwi groups who indicated that they were not interested in consultation, may now be interested as the bridge is now located within their Rohe. Consultation is currently being undertaken with Ngati Toa Rangitira.

A structure for ongoing contact with Iwi during construction and post construction is also being undertaken to ensure that ongoing input is obtained in terms of design and artwork for the new bridge.

7.5 Review the Project Objectives

It is recommended that the project objectives for the proposed bridge be reviewed and refined to ensure they remain appropriate in terms of the scrutiny they will face under s171(1)(c) when the decision makers consider their recommendations on the notice of requirement (NOR).

The project objectives that relate to the strategic business case are:

Strategic Case Project Objectives

Investment Benefit/ Objective	Measure KPI
Objective 1 (70%) Increased throughput of freight and light vehicles and greater certainty of SH journey	Reduced coefficient of variation - standard deviation of travel time/average minutes travel time
	Minutes delay per kilometre
	Number of customer complaints (CRMS)
	Number of adverse media articles
Objective 2 (30%) Greater structural resilience to natural hazard events, resulting in increased availability & access.	Number of resolved significant road closures and detours urban >2hours (Vehicles)

Outcomes required of the recommended option as set out in detail in the DBC report are defined as:

Investment Benefit	Measure	Baseline	Target
Increased journey reliability	Mean Travel time, Standard deviation of travel time	Mean Travel time 1.3 min, Std Deviation 0.23 min	Mean travel time 1.1 min, Std deviation 0.14 min
Decreased journey time	Travel time delay	Current delay 0.5 min	Nil delay time
Improve comfort & customer experience	Number of customer complaints	3/annum and 7 annual plan submissions	Nil complaints
	Number of adverse media articles	18/annum	Nil complaints
Increased availability and access	Number of resolved significant road closures and detours	Minutes delay created over next 100 years in major seismic event	90% reduction

7.6 Assessment of Environmental Effects

Under the RMA the effects on the environment of an activity subject to an alteration to the designation (NOR) and consent application must be considered in sufficient detail to "satisfy the purpose for which it is required", and, among other things, must describe the mitigation measures to help prevent or reduce the actual or potential effects.

The recommended approach to the AEE is:

- Establish the scope of the assessments with the technical experts, and with input from MDC;
- Develop a consistent format for each contributing assessment;
- Develop guidance for authors for evaluation of effects to ensure consistency, in particular use of terms such as “minor”, “less than minor” and “significant”, and whether they are temporary or permanent;
- Ensure all relevant effects are assessed, but with a focus on the key adverse and likely determinative effects;
- Draft conditions to be reviewed and refined pre-lodgement with the technical experts (and in liaison with MDC if appropriate), and reviewed by the legal advisers; and
- Conditions should seek to minimise the need and/or number of subsequent management plans, and to avoid unlawful retention of discretion within the consent conditions to council staff.

The AEE for the bridge is expected to include assessments of:

- Landscape and visual effects
- Noise and vibration effects (construction and operational)
- Light Spill
- Heritage effects
- Urban design effects
- Cultural issues/effects on Maori
- Archaeological effects
- Ecological effects (land)
- Ecological effects (fresh water)
- Social and community effects (including recreational)
- Land use, traffic and transportation effects
- Water quality effects
- Hydrological effects
- Erosion and sedimentation
- Geotechnical engineering and resilience
- Business / property effects

- Effects on infrastructure and utilities
- Air quality effects
- Contaminated land (if applicable)

In addition there will need to be summary documentation of:

- The assessment of alternatives
- The assessment of statutory and non-statutory planning documents
- Design philosophy
- Construction philosophy and approach
- Strategic traffic assessment
- The community engagement process.

7.7 Careful Consideration of Designation Boundaries

It is important that the statutory approvals obtained, particularly the extent of the designation, cover all the land that will be required to construct, operate and maintain the new bridge.

The recommended strategy includes:

- Ensuring that the designation footprint is sufficient to allow construction, operation and maintenance of the bridge, including temporary construction, earthworks and mitigation, while ensuring the 'reasonably necessary' test is met. The width of the designation may need to be large enough to allow temporary construction activities but subsequently reduced post-construction to an area sufficient to allow for ongoing operations and maintenance;
- Ensuring that the width of the designation allows for flexibility for value engineering changes, safety in design, changes arising from detailed design or to achieve mitigation of adverse effects;
- That the designation includes all land and works needed to complete the project, including any mitigation measures; and
- The existing Opawa Bridge be transferred to MDC as the requiring authority and thereafter responsibility and maintenance be MDC's, and the Agency designation be removed.

7.8 Reasonably Necessary and Consideration of Alternatives

Given it will not be possible to avoid some impacts e.g. landscape and visual effects, some attention is likely to focus on whether the bridge is needed. Section 171(1)(c) requires regard to be had to whether the work and designation are reasonably necessary for achieving the objectives of the requiring authority. It will be important to have analysis in the application that demonstrates this threshold is met.

The other important matter in section 171(1)(b) is the need to give "adequate consideration to alternative sites, routes and methods". The issue of a Blenheim by-pass instead of a new bridge was raised in many submissions during the IBC/DBC consultation phase. Why that is not considered a viable option will need to be explained in the applications.

The MCA and IBC/DBC will form key parts of the application and AEE, and the evidence at any hearing should the applications be publicly notified.

7.9 Other Infrastructure and Utilities

Consultation was carried out with Marlborough Lines (ML) in the early stages of the project, prior to the completion of the IBC. There are transmission and power lines in the vicinity of the Opawa Bridge and ML indicated that these should be relocated underground or onto the bridge as part of the new bridge construction and SH1 re-alignment. Consultation was also had with Telco's regarding telecommunication lines, but they did not indicate any changes at that stage. Extensive consultation has also been carried out with all MDC utilities staff (Geoff Dick, Rivers Engineer and Mark Wheeler, Assets and Services Manager) and this will continue throughout the project.

7.10 Outline Plans

Section 176A(2)(b) provides that an outline plan need not be submitted to the relevant district council if *"the details of the proposed public work, project or work....are incorporated into the designation"*.

Retaining the option for an outline plan or plans will give more flexibility for detailed design and construction.

7.11 Written approvals

Where affected parties are willing, written approvals sought be sought and lodged with the applications.

8 Required Scope of Technical Assessments

This section considers the technical assessments required to support the applications for the proposed bridge. A detailed scoping of the individual assessments needed will be undertaken with each of the relevant experts, and with MDC consenting staff.

The scale of the effects – and the opportunities for avoidance or mitigation of those effects – will only be known once more work is done on the scheme design for the preferred alignment and bridge. An understanding of the engineering and transport requirements will help inform the likely environmental effects, and in turn, the environmental effects will help inform the final design. The level of understanding of the environmental effects will increase as the design and the AEE drafts are developed.

Technical Assessments Required		Likely Mitigation Required
Visual and Landscape Impacts	The Opawa Bridge acts as an entranceway to Blenheim and is therefore important is terms of visual and landscape impacts	It is important that the new bridge does not detract from the historical look of the existing heritage bridge

Technical Assessments Required		Likely Mitigation Required
Cultural	Iwi groups would like Pou on entranceway to Blenheim which has been shown on the initial visualisations and will be further developed during consultation with Iwi.	It's not expected that a full CIA will be required
Water Quality	Baseline stream water quality monitoring may be required by MDC.	Impacts during construction include sedimentation, water quality under the freshwater NPS, impacts on ecological values. Ongoing effects can affect water
Erosion & Sediment	Erosion and Sediment control plans	Silt fences, straw bales, detention ponds, other methods of controlling sedimentation as necessary
Hydrology	Water flows, flooding assessments	Ensure pier positioning does not restrict flood flows or deflect water onto stop banks causing flooding
Terrestrial & Instream Ecology	An Ecological report will be developed.	Keep works out of the watercourse as much as is practicable, minimise diversions/dams, provide sediment controls, plan works outside of fish spawning (Opawa River has a classification of CR/FS under Appendix J of the WARMP – important contact recreation and fish spawning river), seasons, provide for fish passage.
Transport	Transport issues include the justification for the bridge and effects on the existing network, including traffic times, congestion, connections, and safety.	The detailed study for the AEE will further refine the assessment of the preferred bridge option in terms of the transportation benefits, and in the case of any adverse effects, potential mitigation e.g. through design. In terms of construction effects, mitigation can occur via temporary traffic management. The existing bridge will remain open while the new bridge is under construction.
Noise and Vibration (construction)	The key issues are introducing new noise sources to existing environments. During construction, there are issues of construction noise and vibration.	Construction noise and vibration – works controlled/minimised during main tourist season (motorcamp, motel) and during normal working hours i.e not at night. Operate to NZS Construction Noise Standard.

Technical Assessments Required		Likely Mitigation Required
	A noise assessment has been carried out.	
Noise (operational)	A noise assessment has been carried out.	Ongoing general road noise can be mitigated to some extent by road surfacing materials/bunds/acoustic walls, deck joint choice
Social Impacts	Such as recreational access to the Opawa River may be temporarily affected during construction. Other impacts during construction, but effects expected to be minor.	Signage and alternative access.
Archaeological	There are a number of known archaeological sites in the proximity of the Opawa Bridge; two primary ones, the bridge itself and some old railway bridge piles. The closest site is middens within 390m of the bridge. An archaeological assessment has been done, which needs refining once the preferred alignment is chosen.	Report recommends that a general authority must be applied for from Heritage NZ as there is reasonable cause to suspect that unknown archaeological sites may be damaged or destroyed during required earthworks. Prior to any work commencing on site, all contractors and subcontractors must be briefed, and advised of the procedure to be followed if an artefact is discovered. Some earthworks will be supervised by and archaeologist and Iwi monitor.
Business Impacts/Property Acquisition.	The existing Opawa Bridge would remain open for traffic during construction.	No mitigation necessary, except for advertising, traffic management plans inc adequate signage. If property required for the work has already been purchased then this should not be an issue. Parties that have agreed to sell land should not be considered adversely affected for any consent/designation process. Early acoustic mitigation may be necessary
Contaminated Land	Sites identified, but NOT listed as HAIL sites, under investigation by MDC, not likely to be within new alignment	Consent would be required under the NES if there is any contaminated land within the works area. At this stage there does not appear to be any.

Technical Assessments Required		Likely Mitigation Required
Air quality	The key issues are dust and fumes during the construction phase, and ongoing. Probably does not warrant a special report.	Standard dust suppression techniques are expected to mitigate these effects.
Effects on infrastructure	There are transmission lines that traverse the project area which will be affected by the works. Telecommunication lines are present.	Marlborough Lines have been consulted during this process. Consult with various owners.

9 Concluding Comments

This Consenting Strategy includes the knowledge available at the time of writing. It should be revised regularly as the alignment and design of the bridge progresses, and the likely effects on the environment become better understood.

A preliminary meeting was had with a Senior Regional Consents Officer at MDC regarding which rules may be breached by the activity. His advice was that it was reasonably likely that the application would be notified due to the wider public interest in the replacement of the Opawa Bridge.

Continued close liaison with the regulatory officers from MDC will be important in determining what those effects and changes in design mean in terms of resource consents needed, and the assessments of effects to support the consent and NOR applications.

APPENDIX A – MCA

Opus International Consultants Ltd
Level 1 Morrison Square, 77 Selwyn Place
Private Bag 36, Nelson Mail Centre, Nelson
7042
New Zealand

t: +64 3 548 1099
f: +64 3 548 9528
w: www.opus.co.nz

APPENDIX K – ESR SCREEN

ENVIRONMENTAL AND SOCIAL RESPONSIBILITY SCREEN JUNE 2014

The purpose of the screen is to identify opportunities, inform the risk management process and ensure the environmental and social matters of a highway project have been addressed. The questions below have been categorised into five areas for ease of reference, however a number of the questions relate to multiple categories. Refer to the Environmental and Social Responsibility Screen Explanation for further detail.

PROJECT: Opawa Bridges
OPTION: 8
DATE: 16 June 2015

CATEGORY OF EFFECT	QUESTION	INFORMATION SOURCE	ANSWER (CIRCLE)	RESPONSE/NOTE
SOCIAL	Where is the project located?	NZTA GIS, Stats NZ	~~Urban/~~Peri-urban ~~Rural~~	SH 1 between Tuamarina and Blenheim on the Wairua Plains
	What is the construction timeframe?	Project Team	~~>18 months~~ <18 months	Estimated construction in 2017/18
	What are the designation requirements?	Resource Planner	~~New~~ / Altered Existing	Will require altered designation for new alignments
	Does the option enhance cycling infrastructure and improve access for cyclists?	Project Team, Regional Land Transport Plan	Y Yes ~~N~~	Planning for new cycle access where non presently exists
	Does the option affect community facilities i.e. libraries, open space etc?	District Plan	~~Y~~ N	NA
NATURAL ENVIRONMENT	Are there any significant natural features/landscapes?	District and Regional Plan and Policy Statement	Y ~~N~~	River and margins
	Will the project affect the coastal marine area, wetlands, lakes, rivers or their margins?	District and Regional Plan and Policy Statement	Y ~~N~~	River and margins
	Will the project affect areas of significant native vegetation or significant habitats of native fauna?	District and Regional Plan and Policy Statement	Y ~~N~~	Limited
	Are there any natural hazards e.g. fault lines, significant erosion, flooding etc?	District and Regional Plan and Policy Statement	Y ~~N~~	Near Wairau Fault line. Liquefaction potential
	Is the project located on a scenic route?	Tourism NZ	~~Y~~ N	No
	Will more than 0.5 hectares of vegetation be removed?	Project Team, NZTA GIS	~~Y~~ N	No
HUMAN HEALTH	What is the One Network Road classification?	State Highway, Asset Management Plan	National or Regional Regional or Collector	National Strategic Route
	Is the area of interest designated as a non-compliant airshed?	NZTA GIS, MfE Website	~~Y~~ N	No
	Are there educational sites in the area of interest?	NZTA GIS, District Plan	~~Y~~ N	Not expected
	Are there medical sites in the area of interest?	NZTA GIS, District Plan	~~Y~~ N	No
	Are there HAIL (contaminated) sites within 200m of the area of interest?	Regional Council	Y N	To be confirmed during investigations but not expected
CULTURE AND HERITAGE	Are there listed heritage sites/areas within 200m of the area of interest?	NZTA GIS, Heritage New Zealand Register, NZ Archaeological Association, District Plan	Y ~~N~~	Opawa Bridge is listed heritage item (HNZ)
			Y	No

	Are there sites/areas of significance to Maori within 200m of the area of interest?	Iwi	N	
URBAN DESIGN	Does the option enhance pedestrian infrastructure and improve access for pedestrians?	Project Team, Regional Land Transport Plan	Y ~~N~~	Yes
	Does the option enhance public transport infrastructure?	Project Team, Regional Land Transport Plan	~~Y~~ N	No
	Does the option enhance the development potential of adjacent land where appropriate?	Project Team, Strategies & District Plan	~~Y~~ N	No
	Does the option enhance community cohesion and accessibility including vehicular connectivity on the local road network?	Project Team, Strategies & District Plan	~~Y~~ N	No
	Does the option enhance the built environment, character and amenity?	Project Team	Y N	Yes

SUMMARY	New 2 lane bridge 10m wide - retain heritage bridge for pedestrian/cyclists - no seismic upgrade. Addresses all traffic issues, including pedestrian and cyclist issues. Does not address seismic issue on heritage bridge. Potentially returns heritage bridge to MDC and retains it for pedestrian/cyclists. Involves major works in watercourse for new piers. Increases safety for traffic, seismic events on new bridge but not on old. Retains heritage structure, and no seismic upgrade. Retains old bridge, but new bridge would have to be aesthetically designed to maintain/enhance gateway to Blenheim.

Completed by	Donna Hills, Resource Management Planner, Opus International Consultants
Reviewed by NZTA Project Manager	

APPENDIX L – ENGAGEMENT SUMMARY REPORT

SH1 Opawa Bridge Engagement Summary

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

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 www.nzta.govt.nz

Prepared By	Donna Hills	
Reviewed By	Brent Morgan	
Approved for Release By	Matthew Taylor	

Opus International Consultants Ltd
Nelson Office
Level 1 Morrison Square, 77 Selwyn Place
Private Bag 36, Nelson Mail Centre, Nelson 7042
New Zealand

Telephone: +64 3 548 1099
Facsimile: +64 3 548 9528

Date:
Reference:
Status:

Contents

EXECUTIVE SUMMARY

The New Zealand Transport Agency sought public feedback between May 11 and June 9 2016 on its proposal to replace the historic Opawa Bridge on State Highway 1.

The Transport Agency notified the public through a media release and newspaper advertisements in three local newspapers and on the Transport Agency's website. Two drop-in sessions of three and four hours offered the public an opportunity to ask questions on the preferred option and other aspects of the investigation.

A booklet with information about the investigation was made widely available. It included:

- *the problems identified with the existing bridge (that it is too narrow and has poor structural resilience);*
- *why the road and bridge are strategically important;*
- *why a Blenheim bypass is an issue that will be considered in a separate investigation;*
- *the preferred option;*
- *the benefits of investment; and*
- *how to give feedback including a form.*

A "Consideration of Options" report detailing the 11 options considered, the reasons why options had been discounted, and the reasons for selecting the preferred option was also prepared. The report and the booklet could be found on the project website and in hard copy for viewing at the Marlborough District Council, Marlborough Roads offices, and at Blenheim and Picton Libraries.

The public could submit feedback:

- *at the drop-in sessions;*
- *on the project website;*
- *by posting the feedback form to a Freepost address; or*
- *by submitting the form in boxes located at each of the public viewing locations.*

Individual meetings were also held with Iwi.

A total of 173 responses were received from individuals and stakeholders during the engagement period. The public was asked to provide feedback on four separate questions.

The main finding is that approximately 70% of all submitters favour a bypass to a new bridge or a bypass first, then a new bridge. The primary reasons cited are:

- *a new bridge will not solve the congestion problems in Blenheim; and*
- *the money is better spent on a long term solution.*

The remaining 30% of submitters generally support the preferred option. These submitters also prefer the idea of retaining the existing historic Opawa Bridge for pedestrians and cyclists and would like a safe route from one side of SH1 to the other.

The Key Stakeholders who made written submissions and three Iwi also support the preferred option of retaining the existing bridge.

The issue of the Blenheim bypass does not change the need to replace the Opawa Bridge. It remains a future option and will be considered, along with other State Highway corridor improvements, as part of the State Highway 1 Picton to Christchurch investigation.

1. BACKGROUND TO PUBLIC ENGAGEMENT

In early 2015 the NZ Transport Agency launched an investigation of the Opawa Bridge to improve travel on State Highway 1 north of Blenheim. The investigation of the bridge was identified as part of the Government's Accelerated Regional Roading Package, which provided funding to progress a selection of regionally important state highway projects to address economic efficiency, safety, and resilience issues on our regional transport networks.

The Opawa Bridge was identified as a high priority for replacement. Investigation identified that the bridge is too narrow for larger vehicles, and is susceptible to damage during earthquakes and heavy flooding events. A number of options were considered ranging from "do nothing", to "constructing a completely new bridge."

In January 2016 the Government announced a preferred option to build a new two-lane 10.8 metre wide bridge on the western side of the existing bridge, retaining the existing historic bridge for pedestrians and cyclists.

2. MATERIAL PROVIDED TO THE PUBLIC

The following material was made available to the public throughout the engagement period from 11 May to 9 June 2016:

- *The booklet containing the feedback form (Copy attached in Appendix A); and*
- *The options report (Copy attached in Appendix B).*

It was available on the Transport Agency's project website and at the following locations:

- *The Marlborough District Council office in Blenheim;*
- *Marlborough Roads office in Blenheim;*
- *Blenheim Library;*
- *Picton Library; and*
- *The public drop-in sessions.*

A project specific email address was set up for people to provide feedback.

3. NOTIFICATIONS TO ADVISE PUBLIC OF ENGAGEMENT

The public were notified about the investigation and the dates for engagement and feedback period by the following methods.

3.1 Media releases by Transport Agency

There were two media releases entitled as follows:

- *Have your say on the proposed new SH1 bridge over Opawa River – 11 May 2016*
- *Marlborough community has its say about Opawa Bridge replacement – 20 June 2016.*

Copies are attached in Appendix C.

3.2 Website updates

There were two website updates:

- *Engagement Opening – 10 May 2016*
- *Engagement Closing – 9 June 2016*

3.3 Advertising

Quarter page advertisements were placed in the Marlborough Express, Marlborough Midweek, and the Blenheim Sun newspapers (attached in Appendix C):

- *Engagement opens and base information about the investigation – 11 May 2016*
- *Information sessions and base information about the investigation – 18 May 2016*
- *Information sessions and base information about the investigation – 20 May 2016*
- *Base information about the investigation – 25 May*
- *One week left of engagement and base information about the investigation – 1 June 2016.*

4. PUBLIC INFORMATION DROP-IN SESSIONS

Two drop-in sessions were held on Thursday 19 May from 4pm to 7pm and on Saturday 21 May from 10am until 2pm at the Scenic Circle Hotel, Blenheim. These sessions provided the public with the opportunity to ask members of the project team questions about the options considered, and the preferred replacement option for the Opawa Bridge. Approximately 40 people attended each session, with some completing the feedback form on the day.

5. FEEDBACK RECEIVED

5.1 Methods to provide feedback

In addition to providing feedback at the public drop-in sessions, the public was able to provide feedback through the following methods:

- *In hard copy format into submission boxes at the public libraries, council offices, and Marlborough Roads offices;*
- *In hard copy format to a Freepost PO Box address;*
- *Emailed to the project email address; and*
- *Filling out an online survey via the project website address.*

5.2 Total number of responses received

The total number of responses received from individuals, organisations, key stakeholders, or other groups was 173. A breakdown of the submission format is provided in Table 1:

Number of Responses	Format
86	Hard copy feedback form
16	Email response
71	Internet survey
173	TOTAL

Table 1: Total Number of Responses by format

5.3 Feedback received on the questions asked

The answers to the four questions asked are provided in the following sub-sections. It is worth noting that many people chose not to answer the questions, but gave their opinion about a bypass which has been summarised under Question 4 – Anything else to consider.

5.4 Question about the Transport Agency's preferred option

Question 1 on the feedback form asked people what their opinion is about the Agency's preferred option and 142 submitters answered it. The responses were varied but are generally either for or against the preferred option or for a bypass. 33% of respondents to this question support the preferred option.

For Preferred Option	Against Preferred Option	Prefer Bypass Option (not a question in the survey)
46 (33%)	37 (26%)	59 (41%)

5.5 Question about the new bridge structure and design

Question 2 on the feedback form asked people to comment on what elements they would like to see reflected in the new bridge structure or its design and 97 submitters answered it. Common themes are:

- Maintain character of old bridge – 14 comments
- Modern, simple and elegant design, nothing fancy for new bridge – 13 comments
- Wide enough for heavy vehicles to pass – 11 comments.
- Provision for cyclists and a safe means of crossing SH1 for pedestrians and cyclists (such as an underpass) – 6 comments
- Functional and safe – 5 comments
- Good visibility with low side walls – 4 comments

The general opinion is that the new bridge should be simple, cost effective, have low sides, maintain the character of existing bridge, and be functional and safe. Commenters asked that the old bridge is retained and used for cyclists and pedestrians.

5.6 Question on the other options considered by the Transport Agency

Question 3 on the feedback form asked people to comment on the other options considered by the Agency and 101 submitters answered it. The responses are:

- 73 favour Option 11 – a bypass to get heavy traffic around Blenheim
- 1 favours Option 7 – a new bridge with wider lanes
- 4 do not favour a bypass – as it will adversely affect the commercial aspects of the CBD

Twenty-three responses to this question did not relate to the question asked. Comments refer instead to other Transport Agency projects and general issues about the existing bridge.

5.7 Question on other considerations

Question 4 on the feedback form asked about other considerations and 136 submitters answered it. Common themes are:

- 80 favour a bypass
- 4 favour a bypass first then a bridge
- 7 favour facilities for cyclists on old bridge and possibly new
- 5 favour safe means of getting from west to east over SH1 bridge for pedestrians and cyclists
- 5 favour nice landscaping and planting and gateway to Blenheim
- 5 favour protection of historic bridge.

Of the 80 submitters who favour a bypass, they cited these primary reasons: a new bridge will not solve the congestion problems in Blenheim or the money is better spent on a long term solution. Thirty responses were specific individual responses, unrelated comments, or no comment.

5.8 Overall summary of responses

An overall review of all 173 submissions indicates that 121 (70%) expressed a preference for a bypass, with the remainder generally supportive of progressing the preferred option.

The full spectrum of feedback is provided in Appendix D.

6. RESPONSES FROM ORGANISATIONS

6.1 Key stakeholders

Key stakeholders that responded are:

- NZ Automobile Association
- Marlborough Landscape Group
- Heritage New Zealand Pouhere Taonga
- The Marlborough District Council Reserves Department
- Bike Walk Marlborough.

Comments from the above stakeholders are summarised below, and the full submissions are attached in Appendix E.

NZ Automobile Association

The Council of the Marlborough District of the NZ Automobile Association advised full support for the construction of a new bridge across the Opawa River. They are also supportive of a Blenheim bypass in principle but note it is a completely separate issue to the replacement of the bridge.

Marlborough Landscape Group

The Marlborough Landscape Group highlighted that the Opawa Bridge is a grand entrance into Blenheim and a leafy and vegetative welcome is sought rather than hard structures. The group requested undergrounding of power lines, retaining as many established trees as possible and re-planting where appropriate. They supported retaining and using the historic bridge for cyclists and pedestrians.

Heritage New Zealand Pouhere Taonga

Heritage New Zealand stated that the Opawa Bridge is a Category 1 Historic Place on the New Zealand List/Rarangi Korero (1 of 3 listed in Blenheim), a significant local landmark and acts as a gateway to Blenheim. They consider keeping the bridge for pedestrian and bicycle traffic retains its gateway effect. They also raised concerns that there does not appear to be a commitment to the ongoing maintenance of the bridge, potentially allowing it to decay.

Marlborough District Council (Reserves Department)

The Marlborough District Council Reserves Department highlighted the current public access along the eastern side of the Opawa River. They suggested the project offers the opportunity to extend the Opawa Walkway under the existing and proposed Opawa Bridge to provide safer travel for the public and for the school children at Mayfair Primary from the eastern side of the State Highway.

Bike/Walk Marlborough

Bike/Walk Marlborough identified that cyclists and pedestrians wishing to use Grovetown Shared Pathway must cross Grove Road/SH1 prior to crossing the Opawa Bridge. They noted the options outlined do not address this issue and suggested an underpass/shared pathway that is supported by cycle lanes on both sides of the road as a possible solution. They also suggested to seek cycling/pedestrian specific design expertise in the design.

6.2 Iwi

The three Iwi groups that expressed an interest in the project were consulted during individual meetings: Ngati Rarua, Rangitane, and Ngati Apa. They accept a new bridge is needed and fully support the preferred option. They acknowledge the importance of keeping traffic going through the CBD from a commercial point of view. They are keen to be involved in the design, artwork and landscaping around the new bridge and an opening ceremony. The feedback recorded at these meetings is located in Appendix F.

7. SUMMARY

A total of 173 submissions were received from individuals, key stakeholders, and organisations during the engagement period of 11 May to 9 June 2016. The table below summarises the public response to Question 1 (142 responses to Question 1) about the preferred option and indicates that 33% of respondents support it.

For Preferred Option	Against Preferred Option	Prefer Bypass Option (not a question in the survey)
46 (33%)	*37 (26%)*	*59 (41%)*

The public was asked to provide feedback on four separate questions.

The main finding is that approximately 70% of all submitters to all questions favour a bypass to a new bridge or a bypass first, then a new bridge. The primary reasons cited are:

- ***a new bridge will not solve the congestion problems in Blenheim; and***
- ***the money is better spent on a long term solution.***

The remaining 30% of submitters generally support the preferred option. These submitters also prefer the idea of retaining the existing historic Opawa Bridge for pedestrians and cyclists and would like a safe route from one side of SH1 to the other.

The Key Stakeholders who made written submissions and three Iwi also support the preferred option of retaining the existing bridge.

The issue of the Blenheim bypass does not change the need to replace the Opawa Bridge. It remains a future option and will be considered, along with other State Highway corridor improvements, as part of the State Highway 1 Picton to Christchurch investigation.

APPENDIX A – BROCHURE AND FEEDBACK FORM

May **2016**

Tell us what you think about plans to replace the Opawa Bridge on State Highway 1

Building a new bridge for State Highway 1 over the Opawa River

Where we are today on the investigation

Last year the NZ Transport Agency launched an investigation of the Wairau and Opawa Bridges to improve travel on State Highway 1 north of Blenheim. The investigation of these bridges was identified as part of the Government's Accelerated Regional Roading Package, which provided funding to progress a selection of regionally important state highway projects to address economic efficiency, safety, and resilience issues on our regional transport networks.

We considered strengthening, replacing or duplicating both bridges. Following an earlier investigation, the Wairau Bridge was found to be in serviceable condition. It has been certified to carry heavier vehicles and can be effectively maintained. Replacement of this bridge may be considered in the future. The Opawa Bridge, however, was identified for replacement. Upgrading it is a high priority for the Marlborough District Council and residents.

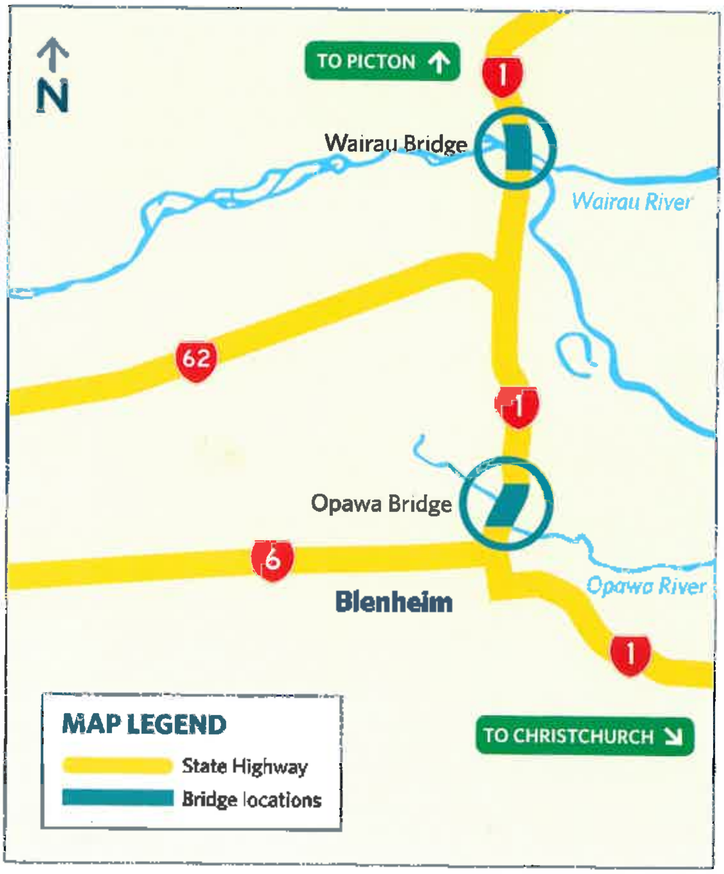
Early investigation of the Opawa Bridge confirmed it is too narrow for some vehicles, large freight vehicles in particular. We have also learned the bridge is vulnerable in an earthquake and is susceptible to damage from heavy floods.

In January 2016 the Government announced a preferred option: build a new two-lane bridge on the western side of the existing bridge. The existing bridge will be kept for pedestrians and cyclists. This proposal is estimated to cost between $14 and $17.5 million.

What we are asking of you

Now is your chance to review the investigation findings and give feedback on the preferred option. Read more information on **www.nzta.govt.nz/opawa-bridge-replacement** and fill out the survey in this brochure or online.

FEEDBACK DEADLINE:
Thursday 9 June 2016



New Zealand Government

The state of the existing bridge

As part of our earlier investigation, we have identified two problems with the State Highway 1 Opawa Bridge and the traffic flow over it:

Problem one: The bridge is too narrow

At 5.49m wide between kerbs, the bridge does not meet today's requirements, particularly for heavy commercial vehicles.

When large vehicles cross the bridge, they become a hazard, particularly if they cross the centre line. Many opposing vehicles must slow down or stop because they cannot pass, causing frequent delays and uncertain travel times.

Also, long traffic flows trail behind large freight trucks that travel along State Highway 1 heading to or departing from the interisland ferries. This adds to congestion on the bridge, making journey times unreliable.

Problem two: The bridge has poor structural resilience

The bridge's structure would not be adequately able to withstand a significant earthquake. Its structure could be affected as a result of shaking or liquefaction that could cause the bridge piers, or the entire structure, to collapse. Also, the bridge is vulnerable to significant flooding events as floodwater could undermine the bridge's central pier and cause partial bridge collapse.

Given the importance of the bridge to the transport network, we need to ensure we can keep this route open.

Why the road and bridge are strategically important

The Opawa Bridge is located on State Highway 1 between Picton and Blenheim. It is integral to the state highway network and the interisland ferries. It is also a vital freight link between the North and South Island via the Port of Picton, which is why the Government included investigating its replacement in the Accelerated Regional Roading Programme.

The Opawa Bridge, on the northern edge of Blenheim, spans 170m and carries 9,800 vehicles/day. It serves many functions in the region today, though it has changed little over its 100-year life. It:

- is a protected heritage item under the Wairau / Awatere Resource Management Plan
- is listed as a category 1 historic place by Heritage New Zealand
- is an important local gateway to Blenheim
- carries a considerable amount of inter-regional traffic. This is because Marlborough is an export-focussed producer of primary products
- is a key cycle route with plans underway to extend an off-road cycle path that serves as a transport corridor for local access between Spring Creek and Blenheim. This is something the Marlborough District Council, the Transport Agency, and Government (through its urban cycleway fund) are investing in.

We appreciate that the road and bridge are integral to the larger Picton to Christchurch state highway network. Some people have expressed an interest in building a bypass route to the east. This is a separate issue. We need to replace the Opawa Bridge now in order to address its identified problems, particularly as the majority of its current users will continue to use it to access central Blenheim from the north.

A bypass remains a future option, and will be considered as part of a separate investigation of State Highway 1 between Picton and Blenheim.

Feedback form

We would encourage you to read the information in the brochure and the supporting information on our website before completing the form: **www.nzta.govt.nz/opawa-bridge-replacement**. If you would like to submit responses with additional sheets, please be sure to attach them and post everything in an envelope or drop it into a submission box.

Q1. What is your opinion about the NZ Transport Agency's preferred option?

Q2: Tell us what elements you would like to see reflected in the new bridge structure or its design that we could include in our planning.

Q3. Do you have any comments on other options considered by the Transport Agency and if so why?

Q4. Is there anything else you want us to consider to further develop the project?

Thank you for your feedback.

Your feedback is public information

Please note that the NZ Transport Agency may publish any information that you give to us on this form, or provide it to a third party, and you may be individually identified as the submitter. Therefore, please indicate clearly:

- Whether your comments are commercially sensitive or, for any other reason, should not be disclosed.
- Any reason(s) why you should not be identified as the submitter of the feedback.

How to give feedback

There are a number of ways you can give us your feedback about our preferred proposal.

You can:

1. Attend one of our public information sessions to understand the proposal further (see dates listed overleaf)
2. Read the information on our website and fill out our online feedback form.
3. Fill in this feedback form and mail it to us by using the Freepost address on the reverse or post to: Marlborough Roads, PO Box 1031, Blenheim 7240
4. Fill in this feedback form and place it in the submission boxes at these locations, including Marlborough District Council (MDC) customer service centres and libraries:
   - MDC Customer Service Centre, Blenheim: 15 Seymour Street
   - Marlborough District Library, Blenheim: 33 Arthur Street
   - Marlborough Roads office, Level 1, Blenheim: The Forum, Unit 2.4, Market Street
   - MDC Customer Service Centre / Picton Library: 67 High Street

DEADLINE: Thursday 9 June 2016

Public information sessions

Please come along to one of our information sessions to speak to the project team about questions you may have on this investigation.

- Thursday 19 May. Scenic Hotel Marlborough, Marlborough Room, 4pm – 7pm
- Saturday 21 May. Scenic Hotel Marlborough, Chart Room, 10am – 2pm

For more information on the project and to read answers to frequently asked questions, visit the project website at **www.nzta.govt.nz/opawa-bridge-replacement** or email **opawa-bridge@nzta.govt.nz**

FOLD HERE

FreePost Authority Number 251610

Free

Marlborough Roads
PO Box 1031
Blenheim 7240

FOLD HERE

FOLD AND TAPE OPEN SIDES LEAVING SPACE FOR A LETTER OPENER / NO GLUE OR STAPLES PLEASE

Preferred option

The preferred option is to create a new two-lane bridge to the west of the existing bridge for vehicular traffic with pedestrians and cyclists using the existing bridge.

As part of our investigations, we developed a long list of all possible options to address the two problems. Thirteen separate options were investigated and assessed, including a do-nothing option, using a variety of criteria. You can read more about all of the options and the detailed analysis on our website, **www.nzta.govt.nz/opawa-bridge-replacement**.

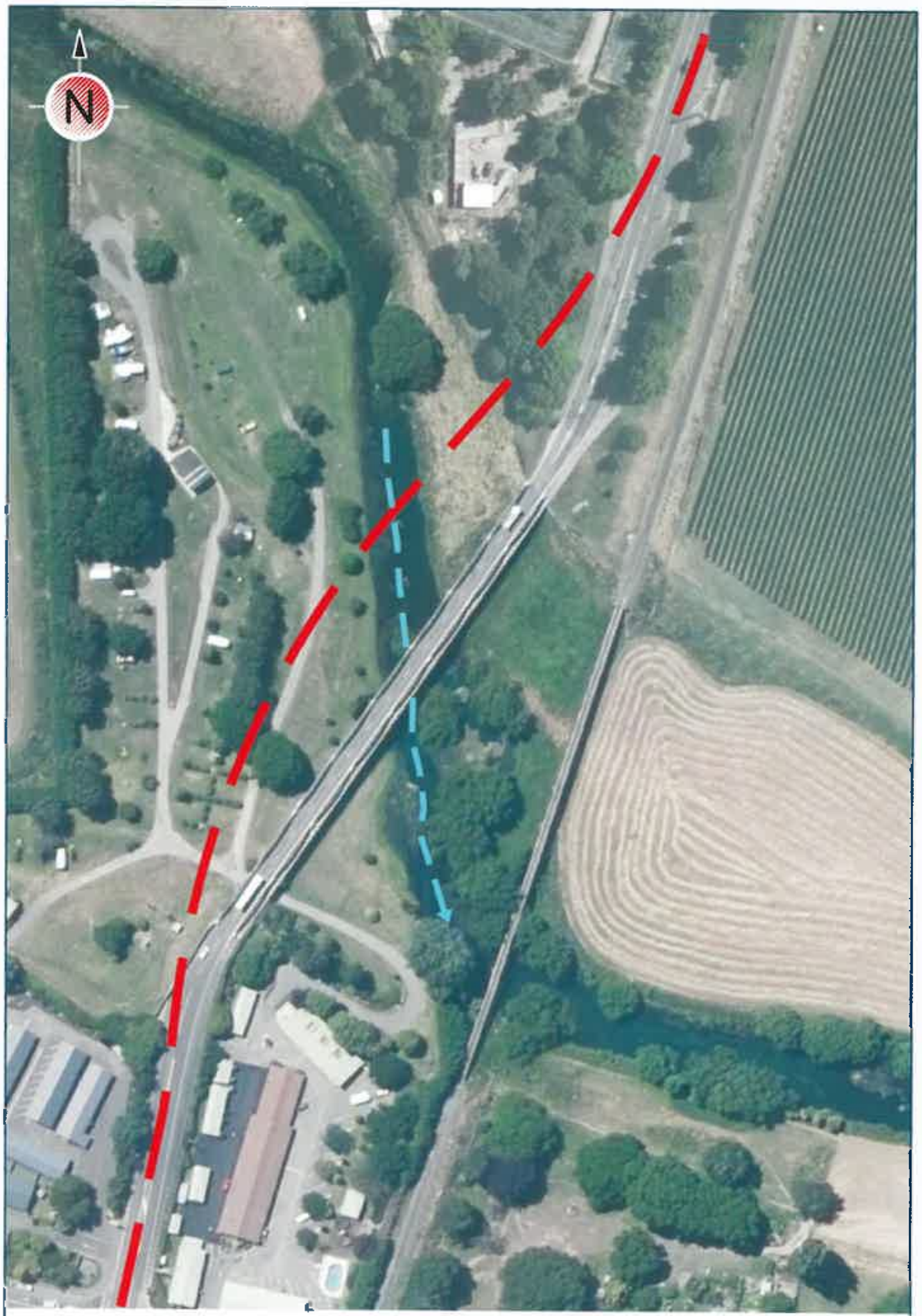
Taking into account all of the information investigated to date, including stakeholder, iwi, and affected landowner feedback, the preferred option is to build a new 10.8m wide bridge. This will operate as a full two-lane highway and cater for on-road cyclists with a 1.5m wide shoulder on each side.

We expect to keep the existing bridge and will continue to investigate its future use as a pedestrian and cycle only facility.

A western alignment (upstream) has the least impact on surrounding properties, provides better pedestrian and cyclist access, and requires less property acquisition.

This option resolves the identified problems and meets all criteria for vehicular traffic.

It is estimated to cost between $14 and $17.5 million.



Route of the proposed highway realignment to the west of the existing bridge.

Benefits of investment

At the heart of our investigation work is our key objective to keep people and goods moving along State Highway 1 between Blenheim and Picton. We want to:

- make journey times more reliable
- make sure freight moves efficiently
- make the region more resilient to natural disasters and
- support State Highway 1 as a strategic freight route between Picton and Christchurch.

The specific benefits of investing to address the Opawa Bridge's identified problems (including weightings) are:

- Benefit 1 (70%): Increased throughput of freight and light vehicles and greater certainty of state highway journey
- Benefit 2 (30%): Greater structural resilience to natural hazard events, resulting in increased availability and access.

How to give feedback

There are a number of ways you can give us your feedback about our preferred proposal.

You can:

1. Attend one of our public information sessions to understand the proposal further (see dates listed below)
2. Read the information on our website and fill out our online feedback form
3. Fill in the hard copy feedback form and mail it to us by using the Freepost address on the reverse or post to: Marlborough Roads, PO Box 1031, Blenheim 7240
4. Fill in the hard copy feedback form and place it in the submission boxes at these locations, including Marlborough District Council (MDC) customer service centres and libraries:
   - MDC Customer Service Centre, Blenheim: 15 Seymour Street
   - Marlborough District Library, Blenheim: 33 Arthur Street
   - Marlborough Roads office, Blenheim: Level 1, The Forum, Unit 2.4, Market Street
   - MDC Customer Service Centre / Picton Library: 67 High Street

FEEDBACK DEADLINE: Thursday 9 June 2016

Public information sessions

Please come along to one of our information sessions to speak to the project team about questions you may have on this investigation.

- **Thursday 19 May.** Scenic Hotel Marlborough, Marlborough Room, 4pm – 7pm
- **Saturday 21 May.** Scenic Hotel Marlborough, Chart Room, 10am – 2pm

Next steps

After the engagement period has ended, we will refine the preferred bridge replacement proposal taking on board the feedback received. We aim to seek Resource Management Act consents early in 2017.

In the meantime, we will continue to work with key stakeholders, potentially affected landowners, and the local community and seek input on the potential design of the replacement bridge. Should consents be granted, we expect construction would start in 2018.

Early 2017	Lodge the consent applications
Early 2018	Construction estimated to begin

Contact us

Website: www.nzta.govt.nz/opawa-bridge-replacement

Email: opawa-bridge@nzta.govt.nz

Phone: 03 520 8330

Post: Marlborough Roads office, Level 1, The Forum, Unit 2.4, Market Street, Blenheim

APPENDIX B – OPTIONS REPORT

SH1 Opawa Bridge

9th May 2016

CONSIDERATION OF OPTIONS

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

Disclaimer

The NZ Transport Agency has endeavoured to ensure material in this document is technically accurate and reflects legal requirements. However, the document does not override governing legislation. The NZ Transport Agency does not accept liability for any consequences arising from the use of this document. If the user of this document is unsure whether the material is correct, they should refer directly to the relevant legislation and contact the NZ Transport Agency.

More information

NZ Transport Agency
Published May 2016

ISBN [number]

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 www.nzta.govt.nz

Contents

EXECUTIVE SUMMARY

The Opawa Bridge is being investigated for potential replacement to provide better vehicle access on SH1 in Blenheim. The project is one of several State Highway projects approved for investigation under the Accelerated Regional Roads Package (ARRP) by the Government in June 2014. The project was identified to improve the journey and in particular provide improved access for high productivity motor vehicles (HPMV) on SH1 in Marlborough.

The Opawa Bridge is located on the northern edge of Blenheim in a 50km/hr speed zone. It is 170m long and carries 9,800 vehicles/day of which 9% are heavy vehicles. It has a narrow carriageway where larger vehicles cannot pass, causing frequent delays and uncertain travel times. The bridge structure has inadequate seismic resistance at less than 33% of National Building Standard and, more critically, is vulnerable to a 1 in 100 year return flooding event. The bridge is a Category 1 heritage place, indicating a place of outstanding significance. Any demolition or modification to the bridge will need to pass a high consenting threshold.

The first phase of the investigation was developed with contribution from key stakeholders and iwi. It found that the bridge is too narrow for two-lane vehicles including modern heavy commercial vehicles and it has inadequate seismic resistance to natural hazard events.

The second phase identified and assessed a long list of potential options that could solve the two problems. These included options that would upgrade the existing structure and replace or duplicate the bridge.

As a consequence of the option assessment process the following preferred option was identified:

- a new parallel 10.8m wide two-lane bridge on the western side of the existing bridge, which would be retained as a pedestrian and cycle bridge. The cost estimate for this option is $14 - 17.5 million, although it would not meet the criteria for National Land Transport Funding.

In January 2016, the Government announced Crown funding for the preferred option.

1. BACKGROUND

The State Highway 1 (SH1) Opawa Bridge project (the Project) is one of several State Highway projects approved for investigation under the Accelerated Regional Roads Package (ARRP) by the Government in June 2014. The Project was identified to improve the journey and provide improved access for high productivity motor vehicles (HPMV) on SH1 in Marlborough.

The New Zealand Transport Agency (the Transport Agency) is responsible for operating, maintaining, renewing and improving the state highway network. The SH1 Opawa River Bridge is integral to the state highway network and a key link to the interisland ferry. The ferry is a vital freight link between the North and South Island. While the bridge has significance to utility service providers and the Marlborough District Council, it is the Transport Agency that has sole responsibility for managing any investments necessary to maintain and improve the asset.

Following the decision to retain the interisland ferry terminal in Picton, addressing issues on the nationally strategic route between Picton and Blenheim regained importance.

The Opawa Bridge is located on SH 1 at RP 18/9.0 between Picton and Blenheim (refer Photo 1 and Figure 1). It sits on the northern edge of the Blenheim in a 50km/hr speed area.

- The photographs on the front cover show the bridge details and are described below, in clockwise order, from the top photograph:
- Side view of the 8 span bow string truss bridge with large top cord beams and short 5m high piers looking downstream from the Blenheim side
- A driver's view of the narrow 5.49m carriageway with high vertical concrete kerbs and the original horizontal pipe safety rails
- The narrow carriageway squeeze when freight vehicles cross the bridge, as they are forced to cross the centreline due the additional width of their side mirrors
- Circa 1920 newly opened bridge with unsealed carriageway and intended traffic.

Little has changed with the bridge over its 100-year life with the exception of carriageway sealing and pavement marking.

The bridge is 170m long and carries 9,800 vehicles/day, with 9% heavy vehicles.

Photograph 1: Opawa Heritage Bridge opened 1917

Figure 1: Opawa bridge location SH1S RP18/9.0

2. OUTLINING THE NEED FOR INVESTMENT

2.1 Organisational strategies and objectives

In recent years, the Transport Agency has focussed on delivering an efficient freight network to reduce the cost of doing business. HPMVs provide productivity benefits that help improve the competitiveness of New Zealand exports, reduce the cost of goods and grow our economy. Bridge upgrades have been a fundamental part of ensuring the State Highway network are capable of handling heavier trucks.

The Transport Agency purpose is to "create transport solutions for a thriving New Zealand." The desired outcomes are:

- Effective – move people and freight where they need to go in a timely manner
- Efficient – deliver the right infrastructure and services to the right level at the best cost
- Safe and responsible – reduce the harms from transport
- Resilient – meet future needs and endure shocks

The long-term organisation goals and medium term objectives that relate to this project are identified in Table 1.

Table 1: Transport Agency long-term goals and medium-term objectives

Long-term (2013-32) Goals	Medium-term (2013-2022) Objectives
Integrate one effective and resilient network for customers	Improve freight supply chain efficiency
Deliver efficient, safe, and responsible highway solutions for customers	Greater resilience of the state highway network
	Deliver consistent levels of customer service that meet current expectations and anticipate future demand
Maximise effective, efficient, and strategic returns for New Zealand	Align investment to agreed national, regional and local outcomes and improve value for money in all we invest in and deliver

Table 2 identifies high-level organisational strategy in support of an efficient and resilient SH1 transport network between Blenheim and Picton.

Table 2: Relevant organisational strategies and plans

Organisation	Organisational Strategies
Government	Government Accelerated Roading Package
NZ Transport Agency	GPS, Statement of Intent, Freight Plans, National Business Cases, National Infrastructure Plan
Marlborough District Council	Draft Regional land Transport Plan

2.2 Defining the problem /opportunity

An investment logic mapping workshop was held on December 2014 with:

- Marlborough District Council, represented by:
  - Councillors Terry Sloan (Chair of Marlborough Regional Transport Committee),
  - Geoff Evans (Deputy Chair of Marlborough Regional Transport Committee),
- Marlborough Automobile Association, represented by:
  - Humphrey Meyers (District Councillor),
- Marlborough Road Transport Association, represented by:
  - Peter Heagney (nominated representative),
- Marlborough Police, represented by:
  - Sergeant Barrie Greenall (Team Leader, Highway Patrol)

It was also attended by Transport Agency staff to gain a better understanding of the current issues and business needs. Further meetings followed in May 2015 to agree to the problems and opportunities for investment.

Two problems and their respective proportional weighting (in brackets) were agreed as:

Problem One (70%): *Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements, particularly heavy commercial vehicles, creating an out of context environment for a nationally strategic state highway.*

The kerb-kerb width of the bridge is 5.49m is significantly below the Austroads recommendation for 7.0m . The narrow carriageway can present larger vehicles as a hazard, particularly if they cross the centreline because opposing vehicles slow down or cannot pass. This causes frequent delays and uncertain travel times. If another wide vehicle is already travelling across the bridge, wide vehicles, freight and trucks are forced to stop in one direction. This creates travel time delays and journey time variations. As freight traffic increases and without intervention, the delays and journey time variations are expected to increase.

Travel time variability was calculated using the Austroads variability formula, which explores the relationship between the mean and the standard deviation. Summarised ERUC data indicates a medium classification (20-30% Variability).

The NZTA MapHUB Efficiency NET geomap Indicates a PM peak level of service E at the Opawa Bridge approach. The AM peak level of service is C. The drop in service is considered entirely due to delays caused by large vehicles being unable to pass in either direction at the same time, where generally a level of service A to C is considered acceptable. This narrowness creates public dissatisfaction.

Problem Two (30%): *Poor Structural Resilience - The bridge offers low seismic resistance, is at risk of bridge pier scouring and is significantly vulnerable to structural collapse.*

A detailed structural assessment (DSA) was completed in March 2015 on the Opawa Bridge. This assessment highlighted a number of potential seismic deficiencies with the bridge, including:

- Bridge span failure due to a lack of restraint at the end bearings
- Settlement of the bridge spans due to pier/pile subsidence caused by liquefaction, and the potential for bridge collapse

- Walking of heavy spans under longitudinal seismic shaking causing shearing in abutment piles

The report offers additional comment on flooding risk. The central bridge pier, located in the river channel thalweg, is at risk from scour in a 1 in 100 Annual Exceedance Probability (AEP)Flood. The existing pile depth is 7.57m from construction drawings and it is calculated that the piles could be completely exposed in a 1 in 100 AEP Flood event. With significantly reduced lateral support and additional horizontal pier loading from floodwaters, the central pier(s) could displace, leading to span failure.

2.3 Project benefits and key performance indicators

The benefits (with weighting in parentheses) and key performance indicators (KPIs) for the problems are shown in Table 3.

Table 3: Project benefits and KPIs

Investment Benefit	Measure KPI
Benefit 1 (70%) Increased throughput of freight and light vehicles and greater certainty of SH journey	Reduced coefficient of variation - standard deviation of travel time/average minutes travel time
	Minutes delay per kilometre
	Number of customer complaints
	Number of adverse media articles
Benefit 2 (30%) Greater structural resilience to natural hazard events, resulting in increased availability & access.	Number of resolved significant road closures and detours urban >2hours

3. CONSTRAINTS AND ASSUMPTIONS

Heritage values, archaeology

The Opawa Bridge was designed in 1912 and opened in 1917. The bridge is listed as a category 1 historic place by Heritage New Zealand and is a protected heritage item under the Wairau / Awatere Resource Management Plan (RMP). Any demolition or modifications to the bridge will require resource consent and approval from Heritage New Zealand for demolition or modification.

Hydrology

The current known hydrology is based on that used in the calibrated 2003 MDC MIKE 11 model for the Opawa River. For a 1 in 100 AEP event at this bridge the model indicate that:

- the design flow is 600m3/s
- the design water level is 6.77m above Nelson Vertical Datum 1955 (NVD55)

Geotechnical

The existing river bed geology contains silty layers of highly liquefiable soils to a depth of around 20-25m. This has a significant bearing on the construction estimate with any new bridge option requiring rock column ground improvements of the existing soils to prevent lateral spreading under earthquake loading. This work has been estimated to have a base cost of $1.6M dollars with a risk contingency of $800,000.

Utilities

The assumption has been made that all existing utilities have sufficient cover, but no onsite potholing has been undertaken.

4. ACTIVITY CONTEXT

4.1 Economic

The SH1 Opawa Bridge is a key structure on the National Strategic State Highway transport route enabling and supporting the growth of the New Zealand economy. In particular, the bridge enables freight access via the Port of Picton and the ferry link from the South Island to the North Island and back.

In addition, the structure enables considerable amount of inter-regional traffic. Marlborough is an export-focussed producer of primary products, principally from viticulture, aquaculture, and forestry. Marlborough is New Zealand's largest wine-growing region, and has diversified into manufacturing and other services that support and add value to the primary sector activity.

4.2 Geographic

The Opawa Bridge is located on SH1 near the northern threshold of the Blenheim township. The bridge is located within the 50km/hr speed zone, 300m south of the 100km/h to 50km/hr speed change on the northern urban fringe of Blenheim.

The Opawa River is a meandering silt-bed river bounded by stop banks. The bridge is situated on an S-bend in the river with the piers skewed about 47 degrees to the direction of flow.

The main trunk railway line runs on the eastern side of the highway and the rail overbridge is 100m downstream of the Opawa Bridge.

4.3 Environmental

The river environment at the bridge site is highly modified from its natural state due to manmade infrastructure, including road and rail bridges and the stop bank system.

On the eastern side of the highway is a formed off-road cycle path, which connects Blenheim to Spring Creek. The Opawa Bridge is a key cycleway link.

4.4 Social

The immediate southern approach of the Opawa Bridge passes beside motel accommodation and holiday camp ground accommodation. Further down Grove Road the land use changes to industrial and commercial.

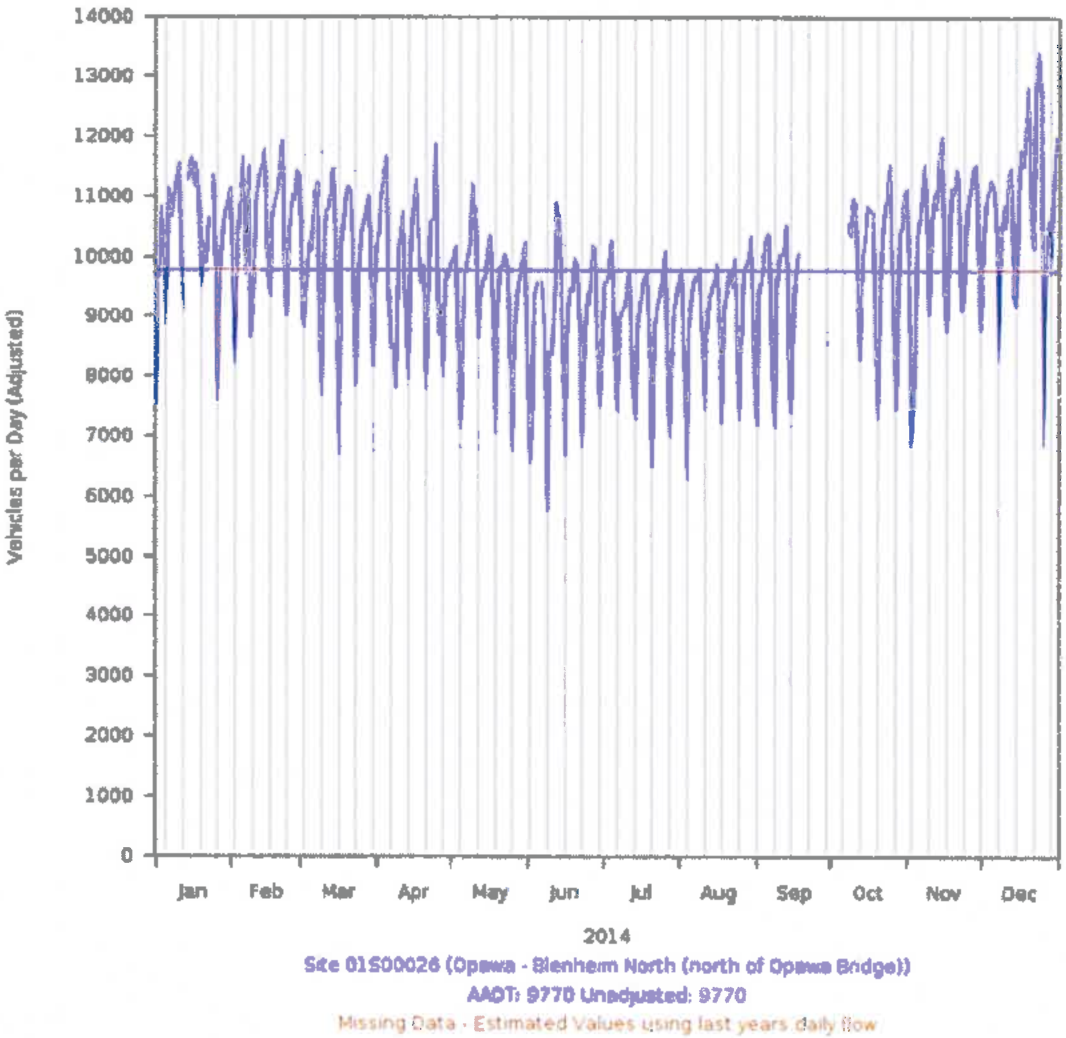
The Opawa Bridge on the northern approach is surrounded by rural agricultural activities, with one nearby residential property and a cluster of industrial/commercial buildings known as the Blenheim Research Centre. Both these properties share a common access point and are set back from the highway.

5. DATA ANALYSIS

5.1 Traffic volumes

A traffic monitoring site is located 100m north of the bridge. This provides classified traffic count information for SH1 for both traffic directions. Figure 2 shows the annual daily traffic data for 2014 and indicates 9,800 average annual daily traffic (AADT), with a summer peak of 13,500 veh/day and a winter low of 5,700 vehicles day. Further analysis indicates there are 9% heavy commercial vehicles. The Wairau Plains Transport Model 2008 forecasts annual traffic growth at this location of approximately 2.2%

Figure 2: Opawa bridge annual daily traffic

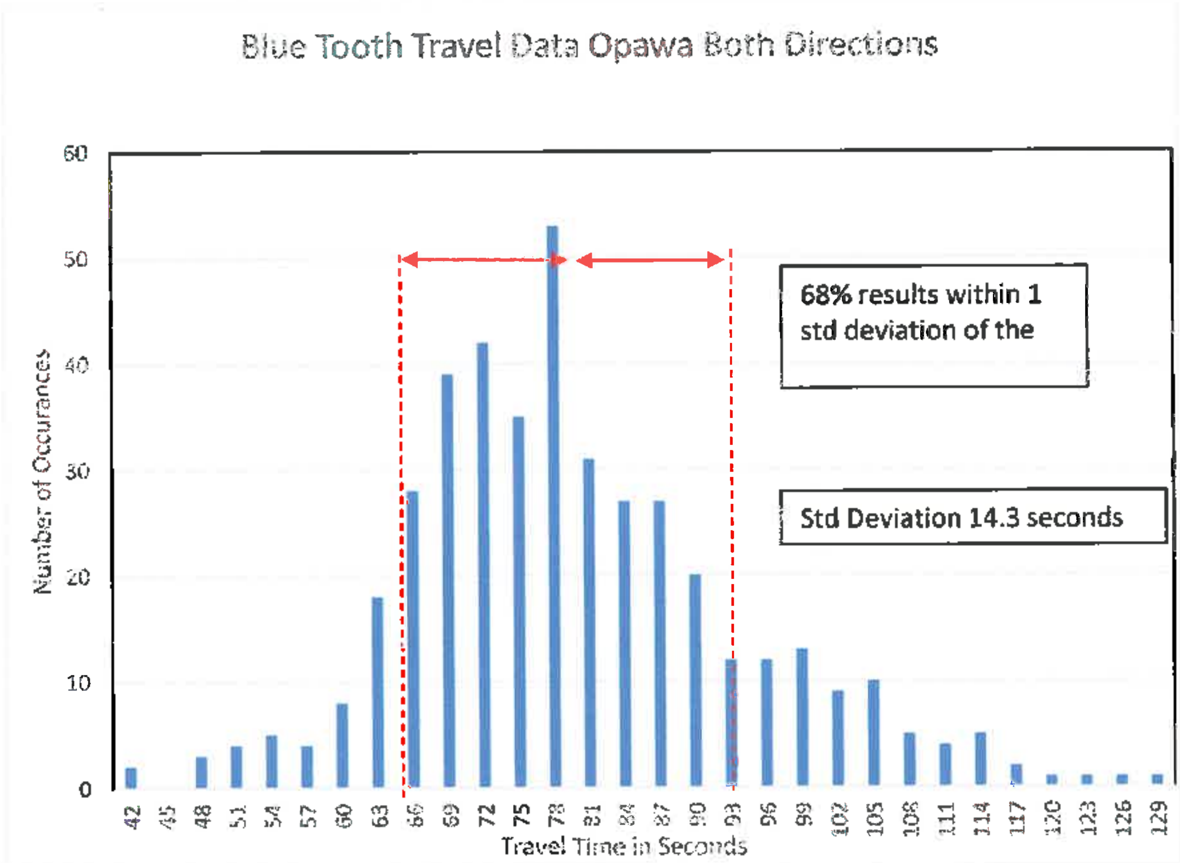


5.2 Journey travel time variation

The Transport Agency installed Bluetooth traffic sensors on this route to record the average travel times through the Opawa Bridge study area. The study area included both 100km/h and 50km/h speed zones. The results of a selected week/day typical hour are shown in Figure 3.

Statistical analysis of this data shows the mean travel time between sensors is 1 minute and 19 seconds with a standard deviation of 14.3 seconds. Sixty-eight percent (68%) of all travel time occurs within 1 standard deviation of the mean or between 1 minute 5 seconds and 1 minute 33 seconds. This measurement allows accurate monitoring of the variation or range of travel times.

Figure 3: Distribution of Bluetooth travel data, weekday hourly average.



5.3 Vehicle travel time delays and queuing

A one-day (8am to 4pm) traffic survey was undertaken on Thursday 12 March 2015. The focus of this survey was to record the frequency of delays created by wide vehicles and vehicles stopping to give way to wide vehicles travelling over the bridge in the opposing direction. The survey showed the following average weekday hourly delays:

- There were 25 delayed groups of vehicles per hour on average in both directions: 36% northbound and 64% southbound
- The average number of vehicles delayed per stoppage varied between 2 to 15 vehicles
- The average delay per stoppage ranged from 8 seconds to 30 seconds.

5.4 Public complaints

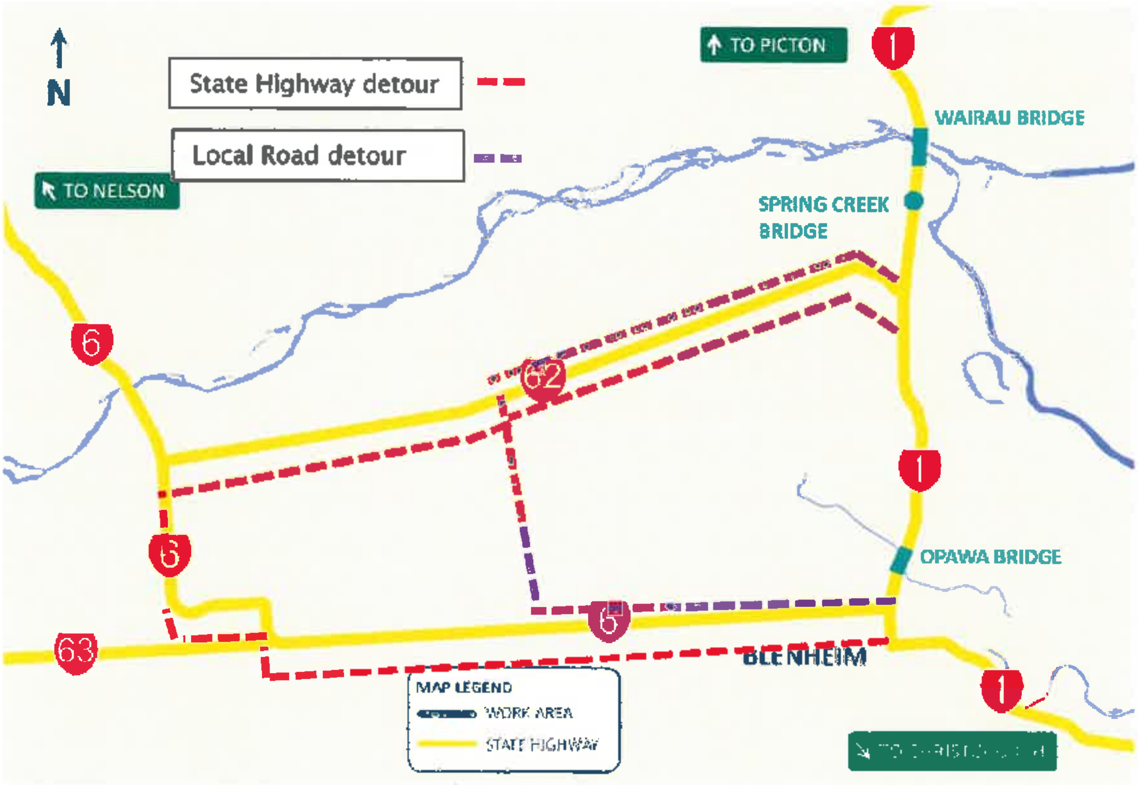
Three public complaints were received by Marlborough Roads concerning the Opawa Bridge in 2014, and eighteen letters were published in the Marlborough Express regarding the bridge between January 2014 and February 2015.

5.5 Detour additional travel time

Figure 4 shows the detour routes for freight and light vehicles if the Opawa Bridge is closed due to a natural hazard event. The detour route along state highways is via SH6 and SH62 and the average additional travel time is 19 minutes to travel this route.

A shorter detour route via local roads (Jacksons Road) exists. The average additional travel time is estimated as 12 minutes in both directions. Several other local roads may be suitable for light vehicles however these contain narrow carriageways, secondary urban streets, and single lane bridges and may result in considerable delays, pavement deterioration, and safety risks, if over used.

Figure 4: Detour route map



6. OPTIONS ASSESSMENT CRITERIA

The assessment criteria used for analysing the draft preferred option are as follows:

- Strategic outcomes - Are we solving the identified problem and achieving the KPIs?
- Cost optimisation - What are the financial and time implications?
- Implementation risks- Which options contain the greatest risks to successful implementation?
- Wider project impacts – Which options contain the greatest risks in terms of environmental and social screening?

7. OPTION DEVELOPMENT

A long list of options was developed to address the two identified problems. Eleven separate options were identified as possible solutions; they are summarised in **Appendices C2 and C3.** Cost estimates are provided in **Appendix D.**

A number of the options involve new bridges. A new bridge would require 10m separation from the existing bridge to ensure it would not be damaged from movement of the existing bridge (assuming the option did not include a structural improvement) during a natural hazard event. This requires land acquisition and designation for 25m either side of the existing bridge.

Consideration of the preferred alignment for a new bridge included:-

- Impact on the Blenheim Top 10 Holiday Park. The Holiday Park has three accommodation blocks that are within the footprint of an eastern bridge alignment and camping sites within the footprint of the western bridge alignment.
- Impact on the Grove Motel. The Motel is partly within the footprint of the western bridge alignment.
- Variable stream width
- Location of overhead power services
- Existing eastern alignment of the footpath on the existing bridge
- Existing eastern alignment of the walk/cycle path to Spring Creek

The western alignment is preferred for all of the new bridge options as it has the least impact on surrounding properties, provides better pedestrian and cycle access, and requires less property acquisition.

This section describes each option and considers the main advantages and disadvantages.

7.1 Do nothing

A do nothing option was considered. The existing bridge with its current lane width restriction has an estimated remaining life of 25-45 years. The bridge requires regular condition inspections on a six-monthly basis and after any moderate seismic event.

A do nothing approach is possible, but the bridge surface ride quality would deteriorate. There is a risk that the bridge joints would have accelerated deterioration and pier scour would continually get more severe. This could potentially shorten the remaining life of the bridge and risk damage to the heritage structure in a seismic or flood event.

7.2 Do minimum

The do minimum option includes undertaking some of the critical work identified in the 2015 detailed seismic assessment (DSA) such as pier scour protection, underpinning of the central piers, bridge resurfacing, and joint repairs.

Undertaking this work will mean the bridge is still at risk from failure in a seismic or flooding event. The rough order cost of this option is $0.7M.

7.3 Option 1: Structural and scour upgrade

The option proposes structural and flood mitigation work to reduce the risk of collapse in a seismic or flood event. This option does not alter the lane widths of the existing bridge.

This option includes a structural upgrade as identified in the 2015 DSA. In addition, a cycle/pedestrian shared path will be created on the eastern side of Grove Road.

Key advantages and disadvantages of option 1 are as follows:

Advantages

- Provides for benefit 2
- Retains the existing bridge
- Retains the 'gateway to Blenheim' benefit and associated traffic slowing effect
- Requires no additional land

Disadvantages

- Does not provide for benefit 1
- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure

The rough order cost of this option is $6M.

7.4 Option 2: Intelligent transport solution with a structural upgrade

The option includes the work proposed in option 1, but in additional proposes an intelligent transport solution with a wide vehicle detection system. The system could alert an approaching wide vehicle of another wide vehicle traveling in the opposite direction on the bridge. A variable messages sign would advise the wide vehicle to pull off the road and wait, allowing the unimpeded flow of light vehicles. Additional road widening would be required to create a safe vehicle pull off area.

Key advantages and disadvantages of option 2 are as follows:

Advantages

- Provides for benefit 1 for light vehicles
- Provides for benefit 2
- Retains the existing bridge

Disadvantages

- Does not provide for benefit 1 for freight
- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure
- High risk as the technology would require some development and implementation
- Approval from Transport Agency for a new traffic control device
- Additional road space would require property purchase

The rough order cost of this option is $8M.

7.5 Option 3: Central widening of existing structure and structural upgrade

The option includes the work proposed in option 1 and also involves cutting the existing structure down the centre of the deck and increasing the width of the deck to 9m. This would preserve the appearance of the heritage structure and resolve the narrow existing traffic lanes. While the option is feasible, it would require widened piers, new piles, and a temporary bridge during construction.

Key advantages and disadvantages of option 3 are as follows:

Advantages

- Provides for benefit 1 and 2
- Retains the existing bridge
- No significant property requirements

Disadvantages

- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure
- Significant technical and engineering construction risk
- Traffic delays and temporary bridge property requirements during construction would be significant
- Environmental effects from widened bridge piers and new piles

The rough order cost of this option is $16M.

7.6 Option 4: Widening of existing structure upstream and structural upgrade

The option includes the work proposed in option 1 and adds an additional 6m width on the upstream side of the existing bridge. This would resolve the narrow traffic lanes and partially preserve the heritage nature and appearance of the bridge side truss.

Key advantages and disadvantages of option 4 are as follows:

Advantages

- Provides for benefit 1 and 2
- Retains the existing bridge
- No significant property requirements

Disadvantages

- The strengthened structure retains the original materials and therefore would have less remaining life than a new structure
- Significant technical and engineering construction risk
- Traffic delays during construction
- Environmental effects from widened bridge piers and new piles
- The visual appearance of the bridge from the west would be altered

The rough order cost of this option is $12M.

7.7 Option 5: New 10.8m wide single lane bridge, operating in tandem with existing bridge with no structural upgrade

The option involves constructing a new 10.8m wide bridge upstream of the existing bridge. The new bridge would operate as one traffic lane with a shared walk/cycle path northbound with southbound traffic and existing shared walk/cyclepath on the existing bridge.

The existing bridge would have no structural upgrade, although a cycle/pedestrian shared path will be formed on the eastern side of Grove Road.

The new bridge could be converted to a two lane facility in the future when the existing bridge's remaining useful life is exceeded or if it is damaged beyond practical repair in a seismic or flooding event. The new bridge has sufficient width to be converted to two traffic lanes and two on-road cycle lanes. It would be necessary to construct a new pedestrian bridge if the existing bridge was unserviceable for pedestrians.

Key advantages and disadvantages of option 5 are as follows:

Advantages

- Provides for benefit 1
- Provides for benefit 2 for the new bridge
- Retains the existing bridge
- Confident cyclists provided with on-road cycle lanes so won't have to cross the road and use the shared path facility
- Minor construction delays
- New bridge can be converted to two traffic lanes in the future

Disadvantages

- Does not improve seismic or flooding risk of existing bridge
- Significant property requirements
- Increased operation and maintenance costs for two bridges
- In the future, the existing bridge may need to be replaced with a new pedestrian bridge at this point additional capital expenditure will be required to move all traffic onto the new bridge

The rough order cost of this option is $16M.

7.8 Option 6: New 7.3m wide single lane bridge, operating in tandem with existing heritage bridge with no structural upgrade

The option is similar to option 5 but involves constructing a narrower 7.3m wide bridge upstream of the existing bridge. The new bridge would operate as a one-lane northbound highway lane with the southbound traffic on the existing bridge.

The new bridge would not have a pedestrian/cycle shared path beside the traffic lane as option 5, but an on-road cycle lane only. This would allow the bridge to be used for two-way traffic in emergencies.

Key advantages and disadvantages of option 6 are as follows:

Advantages

- As option 5, but with reduced land requirements
- The new bridge can be used for two-way traffic in emergencies

Disadvantage

- As option 5

The rough order cost of this option is $15M.

7.9 Option 7: New 13.3m wide bridge, with pedestrian facilities, retaining the existing bridge with no structural upgrade

The option involves constructing a new two lane 13.3m wide bridge with on road cycle lanes and a footpath on one side. The existing bridge would not be structurally upgraded, but would retain the cycle/ pedestrian shared path.

Key advantages and disadvantages of option 7 are as follows:

Advantages

- Provides for benefit 1
- Provides for benefit 2 for the new bridge
- Retains the existing bridge
- Confident cyclists provided with on-road cycle lanes so won't have to cross the road and use the shared path facility
- Minor construction delays
- Operation and maintenance costs reduced from option 5 as existing bridge would not carry traffic

Disadvantages

- Does not improve seismic or flooding risk of existing bridge

- Significant property requirements
- Footpath on side of new bridge unlikely to be utilised and will require additional costs to connect footpaths at either end of the bridge

The rough order cost of this option is $19M.

7.10 Option 8: New 10.8m wide bridge retaining the existing bridge with no structural upgrade

This option is the same as option 7 but does not have a footpath on one side of the new bridge.

Key advantages and disadvantages of option 8 are as follows:

Advantages

- Provides for benefit 1
- Provides for benefit 2 for the new bridge
- Retains the existing bridge for public use
- Confident cyclists provided with on-road cycle lanes so won't have to cross the road and use the shared path facility
- Minor construction delays
- Operation and maintenance costs reduced from option 5 as existing bridge would not carry traffic

Disadvantages

- Does not improve seismic or flooding risk of existing bridge
- Significant property requirements
- In the future the existing bridge may need to be replaced with a new pedestrian bridge

The rough order cost of this option is $16M.

7.11 Option 9: New two lane 13.3m bridge replacing the existing bridge on the current alignment

The option involves demolishing the existing bridge and replacing it with a new two lane 13.3m bridge on the current bridge alignment, the new bridge would have on road cycle lanes and a footpath on one side.

Key advantages and disadvantages of option 9 are as follows:

Advantages

- Provides for benefit 1 and 2
- Confident cyclists provided with on-road cycle lanes
- Operations and maintenance cost reduced

Disadvantages

- Removes the existing bridge

- Traffic delays and temporary bridge property requirements during construction would be significant

The rough order cost of this option is $23M.

7.12 Option 10: Replace the existing bridge with a two lane tunnel

The option involves constructing a two-lane tunnel under the Opawa River to replace the existing Opawa Bridge.

Key advantages and disadvantages of option 10 are as follows:

Advantages

- Provides for benefit 1 and 2
- Would create a distinct 'gateway to Blenheim'

Disadvantages

- High cost
- The existing bridge can be retained without structural upgrade for walking and cycling access
- Significant engineering and technical challenges due to the presence of liquefiable insitu ground
- Significant environmental Impact and consenting issues

The rough order cost of this option is over $50M.

7.13 Option 11: Construct a Blenheim by-pass for through Traffic

The option is a complete by-pass on the eastern edge of the Blenheim urban area providing a new link for the Picton to Christchurch route. The bypass option would be in the region of 5km long, and as the Opawa River splits in two downstream of the existing bridge the bypass will include two new significantly-sized bridge structures. The existing bridge could be retained for local traffic and as the SH6 link to Blenheim and Base Woodbourne. The through traffic to the south of Blenheim is 2,600 veh/day, so 7,200 veh/day will still use the existing bridge.

Advantage

- Removes the through freight portion of traffic from the bridge and Blenheim

Disadvantages

- Local traffic would still use the existing narrow bridge therefore the strategic objectives are not fully met
- High cost
- Unlikely to be supported unless considered as part of a network wide investigation
- Challenging property acquisition
- Significant environmental impacts and consenting issues

The rough order cost of this option is over $50M.

8. OPTIONS ASSESSMENT AND EVALUATION

A preliminary options assessment has been undertaken. All options were considered in terms of satisfying the strategic outcomes.

Options 3 through 9 inclusive fully satisfy the strategic outcomes and were assessed against the remaining assessment criteria: cost optimisation, implementation risks, and wider project affects. Their rankings are summarised in Table 4.

Options 1, 2, and 11 do not meet the strategic outcomes and have been excluded from further assessment. Although Option 10 achieves the strategic outcomes, it was dismissed due to poor physical and financial viability.

Table 4: Assessment summary

Option		Score	Rank
Option 3	Widen & upgrade existing bridge	12.3	6
Option 4	Extend & upgrade existing bridge	12.4	5
Option 5	New northbound bridge (10.8m wide) with existing bridge southbound	16.0	2
Option 6	New northbound bridge (7m wide) with existing bridge southbound	14.4	4
Option 7	New 2-way parallel bridge (13.3m wide)	15.7	3
Option 8	New 2-way parallel bridge (10.8m wide)	16.2	1
Option 9	New 2-way replacement bridge (13.3m wide)	11.6	7

Options 5 and 8 were further refined and compared. Option 8 was preferable to option 5 for the following reasons:

- Lower implementation risks,
- Better cost optimisation, and
- Only slightly higher wider project impacts.

An aerial plan and cross section is provided in **Appendix C** as a potential alignment.

The preliminary options assessment documentation is provided in Appendix D.

APPENDICES

APPENDIX A -INVESTMENT LOGIC MAP

Appendix A: Investment Logic Map

INVESTMENT LOGIC MAP
Activity

PROBLEM ▶ **BENEFIT**

Narrow Bridge - The bridge at 5.49m wide between kerbs is not suitable for current traffic requirements

70%

Greater certainty of state highway journey

Investment Benefit: Increase reliability
Measure: Reliability - actual vehicles

Investment Benefit: Decrease journey time
Measure: travel time delay – by mode

Greater customer satisfaction.

Investment Benefit: Improve comfort & customer experience
Measure: Number of customer complaints (CRMS)
Measure: Number of adverse media

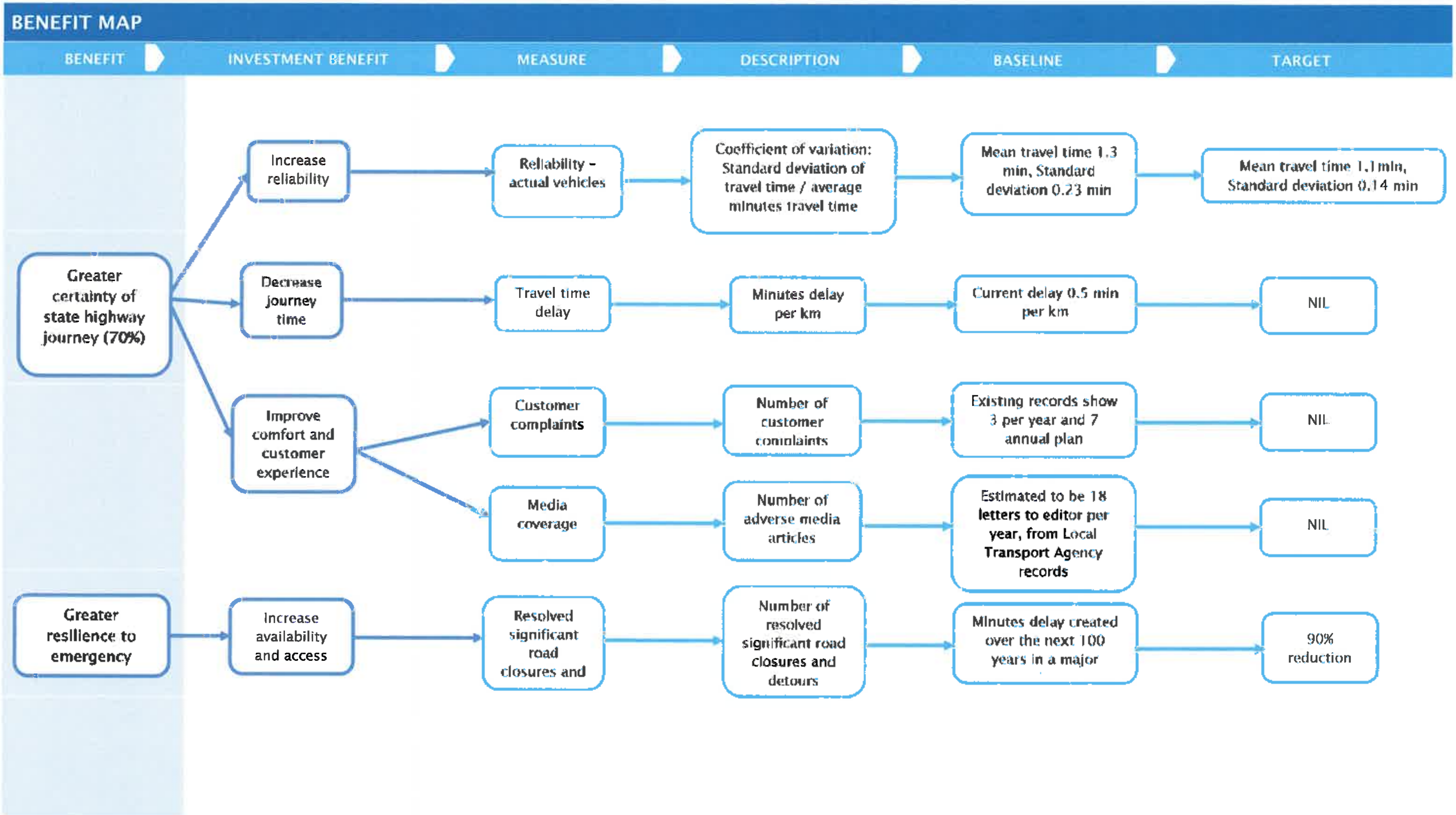
Poor structural Resilience - Low seismic strength and is at risk of bridge pier scour

30%

Greater route resilience to emergency events.

Investment Benefit: Increase availability & access
Measure: Number of resolved significant road closures and detours

APPENDIX B -BENEFIT MAP


BENEFIT MAP
BENEFIT
INVESTMENT BENEFIT
MEASURE
DESCRIPTION
BASELINE
TARGET
Greater certainty of state highway journey (70%)
Increase reliability
Reliability - actual vehicles
Coefficient of variation: Standard deviation of travel time / average minutes travel time
Mean travel time 1.3 min, Standard deviation 0.23 min
Mean travel time 1.1 min, Standard deviation 0.14 min
Decrease journey time
Travel time delay
Minutes delay per km
Current delay 0.5 min per km
NIL
Improve comfort and customer experience
Customer complaints
Number of customer complaints
Existing records show 3 per year and 7 annual plan
NIL
Media coverage
Number of adverse media articles
Estimated to be 18 letters to editor per year, from Local Transport Agency records
NIL
Greater resilience to emergency
Increase availability and access
Resolved significant road closures and
Number of resolved significant road closures and detours
Minutes delay created over the next 100 years in a major
90% reduction

APPENDIX C - PLAN OF ALIGNMENT

Appendix C2: Plan of Alignment and Options

Option (1)

Retain existing heritage bridge and seismic upgrade
- Seismic strengthening, $3.4 M
- Upgrade pedestrian / cycle handrail
- Upgrade drainage
- Upgrade footpath on southern approach
- Rough order cost: $8 M

Option (2)

Retain existing heritage bridge with seismic upgrade and wide vehicle pull out system
- Create truck pull off zone both ends with ITS over dimension / wide load detection system, $0.6 M
- Retain heritage bridge
- Rough order cost: $8 M

Option (3)

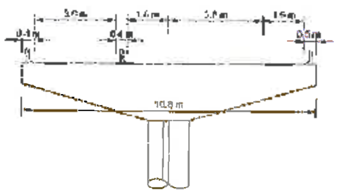
Widen existing bridge by cutting middle of deck and widening piers and deck
- Structural upgrade
- Achieve 9 m deck
- Rough order cost: $16 M

Option (4)

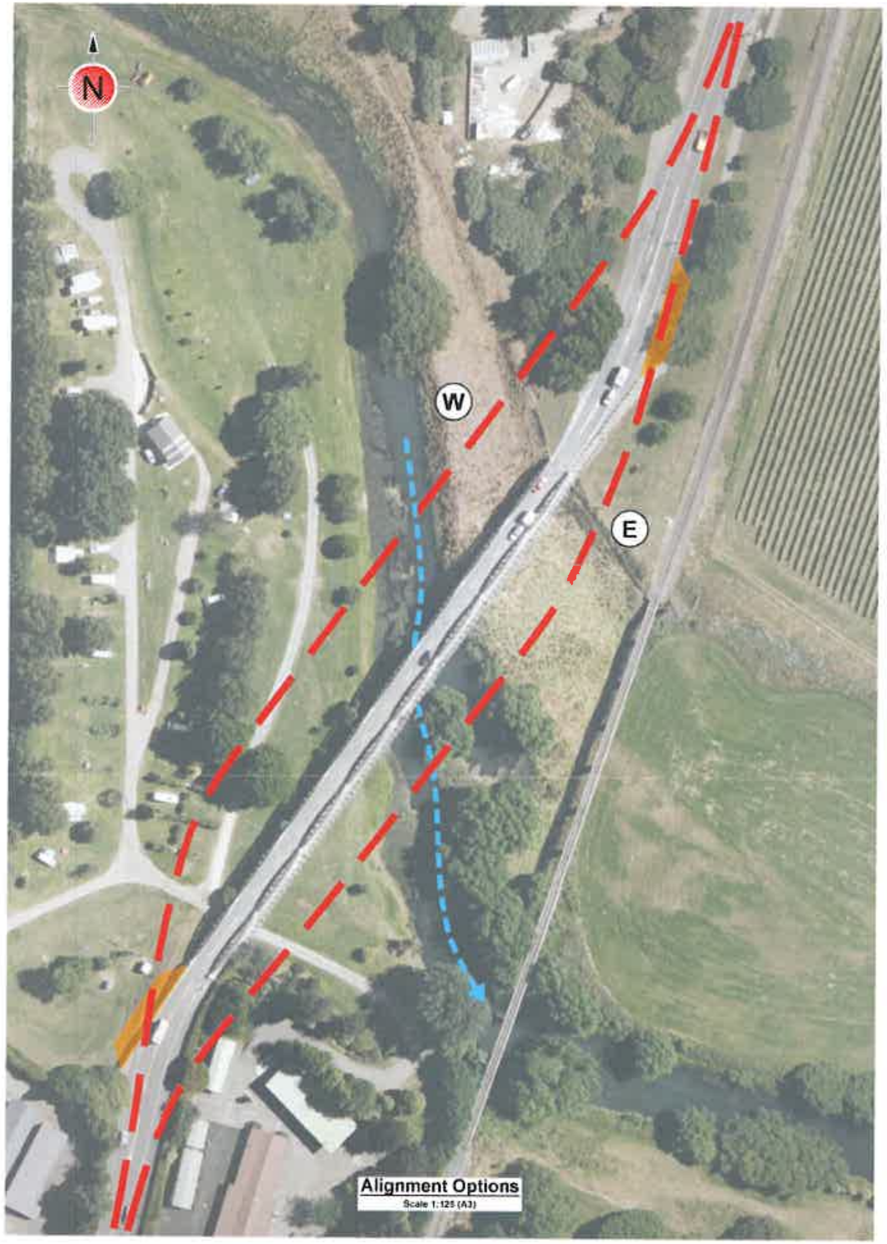
Widening bridge on western side by adding additional lane
- Structural upgrade
- Widen piers
- Add 6 m
- Rough order cost: $12 M

Option (5)

Retain existing heritage bridge for southbound, new single lane bridge for northbound traffic 10.8 m wide. No structural upgrade of heritage bridge.
- New structure can operate as two lane bridge in emergencies
- Rough order cost: $16 M

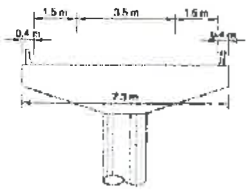


Option 5



Option (6)

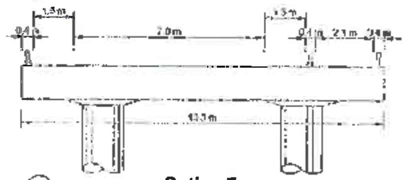
Retain existing heritage bridge for southbound traffic. New single lane bridge for northbound traffic 7.3 m wide (No footpath). Structural upgrade of heritage bridge. •
Rough order cost: $15 M



Option 6

Option (7)

New 2 lane bridge 13.3 m wide •
No structural upgrade of old bridge •
Old bridge returned to MDC
- Rough order cost $19 M

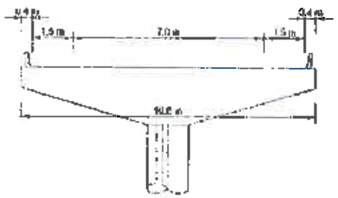


Option 7

Option (8)

New 2 lane bridge 10.8 m wide, pedestrian / cycle use old heritage bridge
- No structural upgrade
- Heritage bridge returned to MDC as walk / pedestrian bridge •

Rough order cost $15 M



Option 8

Option (9)

New 2 lane structure on existing alignment 13.3 m wide
- Demolish existing bridge
- Rough order cost $23 M

Option (10)

Tunnel option
- Rough order cost $50 M

Option (11)

By-pass option
- Rough order cost $50 M

APPENDIX D – MULTI CRITERIA ANALYSIS

Projects	MR223 Opawa Bridge - Multi Criteria Analysis											
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
Strategic Assessment Criteria	Measurement	Upgrade existing bridge	Upgrade existing bridge and install TTS system	Widen & upgrade existing bridge	Extend & upgrade existing bridge	New southbound bridge (7.5m wide) with existing bridge southbound	New northbound bridge (?m wide) with existing bridge southbound	New 2-way parallel bridge (13.3m wide)	New 2-way parallel bridge (11.0m wide)	New 2-way replacement bridge (13.3m wide)	Tunnel	Blenheim bypass
Strategic Objectives												
Objective 1 (70%) Improve Reliability & Decrease Journey Time. Greater certainty of State Highway journey	Reduced coefficient of variation - standard deviation of travel time/average minimum travel time	1	4	7	7	7	7	7	7	7	7	7
	[illegible] delay per kilometre	1	4	7	7	7	7	7	7	7	7	7
	Number of customer complaints (KPMS)	1	5	7	7	7	7	7	7	7	7	3
	Number of [illegible]	1	5	7	7	7	7	7	7	7	7	3
	Reason for score	[illegible] of Bridge	[illegible]	Widens bridge		Duplicates bridge		Replaces bridge				Reliable journey on new SH1 bypass, no change on existing link (new SH6A)
Objective 2 (30%) Increase Availability & Access. Route resilience to natural events	Number of resolved significant road closures and detours [illegible]	7	7	7	7	7	7	7	7	7	7	3
	Reason for score	Strengthens to full seismic and flood loading		Strengthens to full seismic and flood loading		New bridge to full seismic and flood loading					New tunnel to full seismic and flood loading	Resilience on new SH1 bypass, no change on existing link (new SH6A)
Other Criterion												
Cost Optimisation												
Investment Cost (Range)				$14 to $18M	$10M to $12M	$13M to $16M	$13M to $15M	$15M to $19M	$13M to $16M	$19M to $23M		
Investment Cost Score				3.8	7.0	4.9	5.2	3.9	4.9	1.0		
Economic/BCR (Low Medium High)				2	3	2	2	2	2	1		
	Reason for score			Medium cost solution with marginal benefits								
Operational Costs if significant (Range) - Over next 20 years				4	4	4	4	7	7	7		
	Reason for score			High maintenance costs on aging structure				Low maintenance costs				
Construction Delays (Low Medium High)				1	1	7	7	7	7	1		
	Reason for score			High construction delays		Low construction delays				High construction delays		
Life estimate of solution (short term, medium term, long term)				4	4	7	4	7	7	7		
	Reason for score			Shorter term solution		Long term solution	Medium term solution	Long term solution				
	SUBTOTAL Cost Optimisation			4	4	5	4	5	6	3		
Implementation (Risk)												
Technical				1	1	7	7	7	7	7		
	Reason for score			[illegible]		Low complexity standard bridge design						
Operational				4	4	7	4	7	7	7		
	Reason for score					Standard bridge operation						
Stakeholders/Public/Property				4	3	4	4	5	5	1		
	Reason for score			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Environmental				4	4	3	3	3	3	2		
	Reason for score			[illegible]		[illegible]				[illegible]		

Safety			6	6	7	6	7	7	7		
Reason for score			[illegible]								
Accessibility & Social Inclusion			7	7	7	7	7	7	7		
Reason for score			Improved accessibility for all road users								
SUBTOTAL Implementation			4	4	6	5	6	6	5		
Wider Project Impacts (Environmental Impact and Social Responsibility Screen)											
Social			5	5	5	5	5	5	5		
Reason for score			[illegible]								
Natural Environment			5	5	4	4	3	4	2		
Reason for score			[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		
Human Health			5	5	5	5	5	5	5		
Reason for score			[illegible]								
Culture and Heritage			4	3	7	6	6	6	1		
Reason for score			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
Urban Design			5	4	5	4	3	3	2		
Reason for score			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
SUBTOTAL Wider Project Impacts			5	4	5	5	4	5	3		
Overall Other Criterion Assessment											
TOTAL			12.3	12.4	16.0	14.4	15.7	16.2	11.6		
Ranking (Option to take forward)			6	5	2	4	3	1	7		

Scoring key

1	Low Benefit / High Cost
3	
5	
7	High Benefit / Low Cost

Complexity	Initial Compilation (June 2015): [illegible] (Opus) Transportation Engineer Donna Hills (Opus) Resource Management Planner Martin Crundwell (Opus) Civil & Structural Engineer	MCA Workshop ([illegible] April 2016) Participants: 1. [illegible] (Opus) Team Leader 2. [illegible] (Opus) Deputy TL 3. Donna Hills (Opus) RMA Planner 4. Andrew Adams (NZ Transport Agency) Project Manager Design 5. Frank Porter (NZ Transport Agency) Marlborough Manager 6. Andrew James (NZ Transport Agency) Project Manager [illegible] 7. [illegible] (Opus) Transportation Planner 8. Martin Crundwell (Opus) Technical Reviewer	Technical Review (April 2016): [illegible] (Opus) Civil Engineer [illegible] (Opus) Technical Principal Landscape Architecture [illegible] (Opus) Research Management Planner [illegible] (Opus) Transportation Planner [illegible] (Opus) Structural Engineer	

APPENDIX C – MEDIA RELEASES

NZ TRANSPORT AGENCY
WAKA KOTAHI

Have your say on proposed new SH1 bridge over Opawa River

11 May 2016 05:07 pm | NZ Transport Agency

The NZ Transport Agency is inviting people in Marlborough to participate during a month-long period of public engagement kicking off today on a proposal to move State Highway 1 traffic to a new bridge over the Opawa River.

NZ Transport Agency regional director Raewyn Bleakley says the Transport Agency will be gathering public feedback from today through to Thursday 9 June on this preferred option.

The new 10.8m wide, two-lane bridge is planned to be built on the western side of the existing bridge, which has the least impact on surrounding properties, provides better pedestrian and cycle access, and requires less property acquisition. The existing bridge, which is a Heritage NZ Category 1 Heritage Place, would be used as a pedestrian and cycle bridge.

Investigation of the new bridge was launched in 2015 as part of the Government's Accelerated Regional Roading Package. In January 2016, the Government announced its preference for this option to replace the existing SH1 route.

Ms Bleakley says it's time to hear what the community thinks about the new bridge option.

"We've analysed all of the available options that would make this crucial part of the state highway more functional. The Government has also said that it wants to see a new bridge built. It's now time for us to share the details of our investigation and ask how you feel about where we're headed.

"As historically significant as the Opawa Bridge is, it does present us with two key problems as a state highway route. It is too narrow and not suitable for current traffic requirements, especially large freight trucks which are a key part of the nation's strategic state highway programme. Also, it has inadequate seismic resistance, and it is susceptible to damage from heavy floods.

"I'm pleased the option we're presenting includes keeping the existing bridge for pedestrians and cyclists. Although the Transport Agency won't be undertaking any seismic strengthening of the bridge, it will still be important to walkers and cyclists."

Materials including a feedback form can be found at the Blenheim and Picton Libraries, the Marlborough District Council Customer Service Centre in Blenheim, as well as at the Marlborough Roads office. Two public information sessions will be held in May:

- Thursday 19 May. Scenic Hotel Marlborough, Marlborough Room, 4pm-7pm.
- Saturday 21 May. Scenic Hotel Marlborough, Chart Room, 10am – 2pm.

Background information is now available on www.nzta.govt.nz/projects/opawa-bridge-replacement (http://www.nzta.govt.nz/projects/opawa-bridge-replacement) .

For more information please contact:

Felicity Connell
Media Manager | Central Region
NZ Transport Agency

T: 04 8974667
M: 021 507 990
E: Felicity.Connell@nzta.govt.nz

The NZ Transport Agency works to create transport solutions for all New Zealanders – from helping new drivers earn their licences, to leading safety campaigns to investing in public transport, state highways and local roads.

Tags

Media release Central

NZ TRANSPORT AGENCY

Marlborough community has its say about Opawa Bridge replacement

20 Jun 2016 05:46 pm | NZ Transport Agency

A month of public engagement with the Marlborough community on the proposal to move State Highway 1 traffic to a new bridge over the Opawa River closed last week.

NZ Transport Agency Regional director Raewyn Bleakley says the level of engagement from the local community has been pleasing on the proposal to build a new two-lane bridge on the western side of the existing Opawa Bridge, with 179 people submitting feedback and approximately 90 people attending two public information sessions.

"Public engagement is important in informing any of the proposals we prepare. I want to thank everyone who shared their thoughts on the proposal, came to a public information session or filled out a feedback form," Ms Bleakley says.

On 11 May the Transport Agency asked for feedback on the preferred option for a new two-lane bridge. As part of its investigation, the Transport Agency identified that the existing bridge was too narrow and unsuitable to meet current transport needs. It would also be vulnerable in an earthquake and heavy flooding. With a new bridge constructed, the existing bridge, which is a Heritage NZ Category 1 Heritage Place, could be used as a pedestrian and cycle bridge.

Ms Bleakley says although the preferred option is to build a new bridge it was important for the Transport Agency find out how the local community felt about the problems with the bridge and the proposal to fix them.

"The feedback we received confirmed what the local community has been saying for some time - that the Opawa Bridge has been inadequate in serving the local needs of residents, let alone the needs of all road users of the state highway system."

"Some people also took the opportunity to let us know that they would like a bypass which would allow heavy vehicles to detour around Blenheim township.

However, a bypass of Blenheim does not change the need to replace the existing Opawa Bridge. It's important to do this first because the majority of the Opawa Bridge's users will continue to use it to access central Blenheim from the north. We also need to ensure we keep State Highway 1 open between Picton and Christchurch because the highway and the bridge are integral to the state highway network, particularly for freight.

A bypass remains a future option and will be considered, along with other State Highway corridor improvements, as part of the separate investigation of State Highway 1 between Picton and Christchurch."

Ms Bleakley says the next step is to refine the preferred bridge replacement proposal, taking on board the community feedback.

"We'll continue to work with key stakeholders, including the Marlborough District Council, potentially affected landowners, and the wider community to seek input on the potential design of the new bridge.

The Transport Agency expects to seek Resource Management Act consents early in 2017 and anticipates construction would start in 2018.

More information about the Opawa Bridge replacement project, including the full consideration of options is on the Transport Agency's website www.nzta.govt.nz/projects/opawa-bridge-replacement (http://www.nzta.govt.nz/projects/opawa-bridge-replacement)

For more information please contact:

Felicity Connell
Media Manager | Central Region
NZ Transport Agency

T: 04 8974667
M: 021 507 990
E: Felicity.Connell@nzta.govt.nz

The NZ Transport Agency works to create transport solutions for all New Zealanders – from helping new drivers earn their licences, to leading safety campaigns to investing in public transport, state highways and local roads.

Opawa Bridge Replacement

Building a new bridge for SH1 over the Opawa River

Until Thursday 9 June, the NZ Transport Agency is seeking your views on the preferred proposal to replace the Opawa Bridge on State Highway 1 with a new two-lane bridge on the western side of the existing bridge. The existing bridge will be kept for pedestrians and cyclists.

Last year the NZ Transport Agency launched an investigation of the Wairau and Opawa Bridges to improve travel on State Highway 1 north of Blenheim. It was identified as part of the Government's Accelerated Regional Roading Package (ARRP), which provided funding to progress a selection of regionally important state highway projects in order to address economic efficiency, safety, and resilience issues on our regional transport networks.

Following the investigation, the Wairau Bridge was found to be in serviceable condition. The Opawa Bridge, however, was identified for replacement and we know upgrading it is a high priority for Marlborough District Council and residents.

In January 2016 the Government announced a preferred option to build this new bridge at an estimated cost between $14 and $17.5 million.

Last week to have your say

It's the last chance to review the investigation findings and give feedback on the preferred proposal. Read more information on **www.nzta.govt.nz/projects/opawa-bridge-replacement** and fill out the survey online.

Feedback deadline: Thursday 9 June 2016

For more information

PLEASE VISIT: **www.nzta.govt.nz/projects/opawa-bridge-replacement** or **Blenheim and Picton Libraries, Marlborough District Council Customer Service Centre,** and the **Marlborough Roads office**

EMAIL: **opawa-bridge@nzta.govt.nz** PHONE: **03 520 8330**

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

Opawa Bridge Replacement

Building a new bridge for SH1 over the Opawa River

Until Thursday 9 June, the NZ Transport Agency is seeking your views on the preferred proposal to replace the Opawa Bridge on State Highway 1 with a new two-lane bridge on the western side of the existing bridge. The existing bridge will be kept for pedestrians and cyclists.

Last year the NZ Transport Agency launched an investigation of the Wairau and Opawa Bridges to improve travel on State Highway 1 north of Blenheim. It was identified as part of the Government's Accelerated Regional Roading Package (ARRP), which provided funding to progress a selection of regionally important state highway projects in order to address economic efficiency, safety, and resilience issues on our regional transport networks.

Following the investigation, the Wairau Bridge was found to be in serviceable condition. The Opawa Bridge, however, was identified for replacement and we know upgrading it is a high priority for Marlborough District Council and residents.

In January 2016 the Government announced a preferred option to build this new bridge at an estimated cost between $14 and $17.5 million.

Have your say

Now, is your chance to review the investigation findings and give feedback on the preferred proposal. Read more information on **www.nzta.govt.nz/projects/opawa-bridge-replacement** and fill out the survey in this brochure or online.

Feedback deadline: Thursday 9 June 2016

Come talk to us

Please come to the following public information sessions and speak to a member of the project team with questions or get help with giving your feedback.

Thursday 19 May. Scenic Hotel Marlborough, Marlborough Room, 4pm – 7pm

Saturday 21 May. Scenic Hotel Marlborough, Chart Room, 10am – 2pm

For more information

PLEASE VISIT: **www.nzta.govt.nz/projects/opawa-bridge-replacement** or **Blenheim and Picton Libraries, Marlborough District Council Customer Service Centre,** and the **Marlborough Roads office**

EMAIL: **opawa-bridge@nzta.govt.nz**

PHONE: **03 520 8330**

Opawa Bridge Replacement

Building a new bridge for SH1 over the Opawa River

Until Thursday 9 June, the NZ Transport Agency is seeking your views on the preferred proposal to replace the Opawa Bridge on State Highway 1 with a new two-lane bridge on the western side of the existing bridge. The existing bridge will be kept for pedestrians and cyclists.

Last year the NZ Transport Agency launched an investigation of the Wairau and Opawa Bridges to improve travel on State Highway 1 north of Blenheim. It was identified as part of the Government's Accelerated Regional Roading Package (ARRP), which provided funding to progress a selection of regionally important state highway projects in order to address economic efficiency, safety, and resilience issues on our regional transport networks.

Following the investigation, the Wairau Bridge was found to be in serviceable condition. The Opawa Bridge, however, was identified for replacement and we know upgrading it is a high priority for Marlborough District Council and residents.

In January 2016 the Government announced a preferred option to build this new bridge at an estimated cost between $14 and $17.5 million.

Have your say

Now, is your chance to review the investigation findings and give feedback on the preferred proposal. Read more information on **www.nzta.govt.nz/projects/opawa-bridge-replacement** and fill out the survey in this brochure or online.

Feedback deadline: Thursday 9 June 2016

Come talk to us tomorrow and Saturday

This week you can come to the following public information sessions and speak to a member of the project team. We look forward to seeing you there.

Thursday 19 May. Scenic Hotel Marlborough, Marlborough Room, 4pm - 7pm

Saturday 21 May. Scenic Hotel Marlborough, Chart Room, 10am - 2pm

For more information

PLEASE VISIT: **www.nzta.govt.nz/projects/opawa-bridge-replacement** or **Blenheim and Picton Libraries, Marlborough District Council Customer Service Centre,** and the **Marlborough Roads office**

EMAIL: **opawa-bridge@nzta.govt.nz** PHONE: **03 520 8330**

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

Opawa Bridge Replacement

Building a new bridge for SH1 over the Opawa River

Until Thursday 9 June, the NZ Transport Agency is seeking your views on the preferred proposal to replace the Opawa Bridge on State Highway 1 with a new two-lane bridge on the western side of the existing bridge. The existing bridge will be kept for pedestrians and cyclists.

Last year the NZ Transport Agency launched an investigation of the Wairau and Opawa Bridges to improve travel on State Highway 1 north of Blenheim. It was identified as part of the Government's Accelerated Regional Roading Package (ARRP), which provided funding to progress a selection of regionally important state highway projects in order to address economic efficiency, safety, and resilience issues on our regional transport networks.

Following the investigation, the Wairau Bridge was found to be in serviceable condition. The Opawa Bridge, however, was identified for replacement and we know upgrading it is a high priority for Marlborough District Council and residents.

In January 2016 the Government announced a preferred option to build this new bridge at an estimated cost between $14 and $17.5 million.

Have your say

Now, is your chance to review the investigation findings and give feedback on the preferred proposal. Read more information on **www.nzta.govt.nz/projects/opawa-bridge-replacement** and fill out the survey online.

Feedback deadline: Thursday 9 June 2016

For more information

PLEASE VISIT: **www.nzta.govt.nz/projects/opawa-bridge-replacement** or **Blenheim and Picton Libraries, Marlborough District Council Customer Service Centre,** and the **Marlborough Roads office**

EMAIL: **opawa-bridge@nzta.govt.nz** PHONE: **03 520 8330**

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

APPENDIX D – FEEDBACK SPREADSHEET

What is your opinion about the NZ Transport Agency's preferred option? - Open-Ended Response	Tell us what elements you would like to see reflected in the new bridge structure or its design that we could include in our planning. - Open-Ended Response	Do you have any comments on other options considered by the Transport Agency and if so why? - Open-Ended Response	Is there anything else you want us to consider to further develop the project? - Open-Ended Response
should do the job	a bridge as wide as the seddon bridge with no pedestrian or cycle traffic allowed	The town needs a BYPASS that is a no brainer you would understand this if you had to drive a heavy vehicle through the town	
No comments			Consideration of public access along the Opawa River - so that there is a connection between the eastern side of the State Highway and the western side allowing possible access to Lansdowne Park. This would allow safe passage for school children without having to cross the State highway.
I agree that the Opawa Bridge needs replacing, but at what cost? Surely it would make more sense to put in a single lane on the western side of the existing bridge and when completed remove the existing bridge to an appropriate site for preservation. Then the second lane of the new bridge could be built where the old bridge was.			It should be a priority to build a bypass as a new bridge is not going to ease the considerable congestion on Grove Road and Main St. These roads are not built for the type of heavy traffic we see on the roads now, so I feel you should be putting more urgency into a bypass. Traffic going to Nelson already has a bypass in Rapaura Road, but the higher density traffic heading south must negotiate some very tight round-a-bouts and narrow streets. Both of these projects are long overdue as Blenheim is the gateway to the south and as such deserves much more consideration than has been given.
Agree the project plan is workable and indeed logical	No Comments	No comments	I believe that your estimate of "75% of traffic has Blenheim as its destination" is grossly incorrect and it should be tested scientifically before proceeding with the Opawa Bridge. I believe a much more practical option is to build the bypass which will be needed within 10 years in any case. So build that road and bridge now. It will be cheaper in the long run.
agree	sufficient width for inexperienced drivers to safely navigate		
Option 11 Bypass. The 3 roundabouts plus all the other intersections are just too dangerous for trucks going through our town.	An underpass for cyclists (& pedestrians) under & across. This means can get safely across the SH 1 in the east (joins the cycle lane north of Blenheim) - west direction (Landsdowne Park & Mayfield school side).	Long term planning is needed by both local council, the government & NZTA to create a long-term solution to the growing traffic, freight on road situation. Expensive in the short term is NOT so expensive in the long-term. Plan for future growth in road users, freight & town growth.	If you would do a random survey of Opawa Bridge users specifically, to get their views, rather than do public consultation in this fashion, (survey monkey, on line) your data would be more valid, reliable and thus valuable.
From my experience recreational and competitive cyclists needs are quite different. Competitive cyclist rarely use shared walk/ride paths on the side of bridges where social riders and pedestrians generally always do. My wife uses the spring Creek cycle way most Sundays and always uses the pedestrian / access where I have ridden across numerous times in a bunch and but myself and never have. I think it is important that the new Bridge cater for both, my preference would be option 7 at 13.3 meters wide Currently the bridge is so narrow that when I ride across weather in a bunch or by myself I use the centre of the lane, as the bridge is only 170meters long no one tries to overtake. I think if option 8 (currently the preferred option) was approved it would be more dangerous to competitive cyclists. At 10.8 meters vehicles will attempt to overtake regardless of oncoming traffic.	I'd like to see cycle lanes in both directions and the old bridge used for pedestrians and recreational cyclists	Currently the bridge is so narrow the traffic slows down and the is no attempt to overtake. Because of this it really isn't a safety hazard to cyclists. The preferred option will speed up traffic and some motorist will attempt to overtake cyclists. This combination could be leathal	In conjunction with the new bridge I support a heavy traffic bypass
I think it is the correct decision.	I would like to see something of the character of the old bridge reflected in the new one, especially as they'll be side by side on SH1 - very visible in a beautiful setting.	1 - I think a by-pass is a good idea, after the new Opawa Bridge. 2 - I think freeing up the bottle neck at the present Opawa Bridge will move that congestion into the town at the roundabouts. 3 - Though the Wairau Bridge is not being considered for replacement, I think an urgent matter in regard to that bridge is the provision of a foot/cycleway on at least one side. With small communities on each side of the bridge, increased cycling (local and tourists) this is an important safety issue.	If you want to contact me I am Bob Barnes 22 Hilton Pl Blenheim 027 274 9802 (m)
It Is not the right option.	No bridge at all - leave as is	NO	Yes put a bypass in instead of a new bridge!!!

The preferred option is possibly the worst option as it doesn't help with heavy traffic congestion in Blenheim in particular Grove Road and Main Street.	Not go ahead with the bridge structure but put in a heavy traffic By-Pass to allow traffic to by-pass Blenheim if required.		
1. I support the new bridge and its' proposed location. 2.I support your preferred option for the old bridge retention as a walking/cycling facility but submit that investigation should be done and implemented contemporaneously with the new bridge.	Clear approach visibility, suitable speed restrictions given it is on the town boundary, this could lessen design criteria re weight/speed/impact? Must be wide enough and have an intended life of 100 years.	Yes! A heavy/thro traffic by-pass is essential and should be investigated and put on the programme asap. Journey time and reliability will have greater benefit via a by-pass than the Opawa Bridge replacement.	SH1 by-pass!
I think that a new bridge is required but the results of it are not correct. It will NOT increase traffic flow as the congestion on Grove road will not improve unless a bypass is created to take the heavy vehicles and trucks out of the town.	That traffic can enter and exit the bridge without needing to turn on or off it . In other words enough clear road either way to see the bridge ahead of time..	I see no improvement structurally l for the existing bridge so how long will it last in its present state even for foot and bicycle traffic	The Bypass is paramount PLEASE
While it is a reasonable solution of the existing issues it is very short term thinking and while cheaper in the short term will mean greater long term cost.	Sympathetic to the old bridge	Option 11 should be the preferred option as a new bridge does nothing to solve the problem of congestion at the rail crossing in the roundabout. As a regular CHCH to Picton traveller the number of trucks has increased markedly in the last few years and now almost every one has an H plate. With a govt that is determined to undermine rail freight a bypass is going to have to happen soon. It seems a waste of money to do the project twice! Having just had a trip through Hawkes Bay and Eastland and observed the amount of major road construction on minor state highways the under expenditure on SH1 in the South Island is very obvious.	
I consider this option as a 'band aid' solution. The traffic flow through Grove Rd and then Main Street will still be slow and congested. Having traffic lights on the existing bridge would be a cheaper alternative.	A new bridge/bypass to the East via Grovetown and Riverlands for heavy traffic. The existing bridge is fine for most cars, light trucks and campervans. The Riverlands option merges nicely with the Truck stop facilities, wineries at Riverlands etc.	As per Q2.	A bypass just makes so much more sense.
Not wise or economical move.	No cheap products from China!	Build one new bridge on the bypass only save the cost of two bridges.	Do the bypass only.if people want to go into Blenheim they will..
I think the preferred option is not good.			I reckon the best way to go is to build another bridge next to the old one & have one bridge for southbound traffic & one bridge for northbound traffic. It would also reduce the cost of the project also
Agree. The existing bridge needs replacement notwithstanding the need for a thru traffic bypass for Blenheim	Good visibility for vehicle occupants, i.e. minimal side walls and lowest possible intrusion on river and surrounds.	A thru traffic and heavy vehicle bypass for Blenheim is essential and should be progressed now.	Is the existing bridge time expired and how costly is its future maintenance likely to be
It will only address part of the congestion problem of large tucks and other ferry traffic traveling through Blenheim		Do it right the first time and incorporate a bypass	Heavy trucks have to negociate three small roundabouts through Blenheim, including one with a railway track throgh it. Its congested now and a new bridge is very much a partial fix to the problem.
It won't do anything to alter the gridlock in Grove Road and Main Street. The Railway round about is dangerous now with the traffic. More heavy trucks will make it more so		I believe the by pass should be built now, especially for heavy traffic, the same as in Timaru. All heavy traffic is routed completely away from the town, and light traffic is also away from main street.	That the by-pass does not need to go from Tua Marina. have a look at Lower Wairau/ Aberharts Road, would kill two birds with one stone, making Ross Lane safer for traffic crossing the rail line
OK yes we still need a vehicle safe bridge		Still need a by-pass BEFORE the bridge is built Don't have the main ferry and truck traffic using this bridge	Do the by pass first then the bridge

I think building a new bridge isn't the appropriate option and the estimated cost involved will be waste of NZTA money. You may build a new bridge now but it still defeats the real issues of what will only be ongoing problems of heavy trucks, wide vehicles and increasing traffic over time coming through Blenheim. It's bad enough now having traffic backed up Main Street to the round about with a railway line through it at peak times and frustrating for traffic wanting to get through to Picton that doesn't want or need to go through town. In the long run a bypass is inevitable and more realistic as trucks, freight as well as Blenheim will only increase in size. The longer a bypass is put off the more it will cost later on. It's a no-brainer. I would rather see the cost of a new bridge spent on a bypass.		Yes!! A bypass!!! You're saying the Benefits of a new bridge are: 1) make journey times more reliable 2) make sure freight moves efficiently 3) support state highway 1 as a strategic freight route between Picton and Chch If large freight trucks are such a key part of the nation's strategic state highway programme then build a bypass not a bridge. The benefits of a bypass covers all of the above. When people get off the ferry the majority will have already eaten and fuelled up. I believe there will be those who will want to stop in Blenheim, look around and will do so, but there will be those who want to get on the road to their next destination, who have a schedule and can do so via a bypass. A bypass for vehicles carrying freight would lose 15- 20mins or more waiting & negotiating the Grove Road bridge and 3 roundabouts to get through town and out the other side whereas a bypass turning off somewhere between Grovetown and Grove Road bridge coming out to Riverlands would be a huge timesaver and less frustrating for all concerned. In the end the issue isn't about the retail sector losing patronage and income. The retail/hospitality sector is an issue they need to look at that themselves to attract & keep business in town. Ashburton, Temuka and I'd imagine a lot of other towns be it big or small throughout the country have bypasses to keep un-necessary heavy vehicles traffic flow away from the	
I agree, replace bridge first, but then serious consideration must be given to a Blenheim Bypass.	A modern simple design that will enhance the river view. The Awatere Bridge at Seddon looks great		
That the proposed new bridge will not solve the problem of congestion on Grove Road, through the 3 round-a-bouts, and Main Street. Every vehicle that arrives in, or leaves the South Island from Picton, other than those travelling to Nelson/West Coast, goes through this route. It becomes extremely dangerous if there is a serious accident south of Blenheim, as there is just no alternative to clear traffic. I live in Budge Street, and I have to negotiate into and out of all this traffic, so I have first-hand knowledge of what it can be like, vehicles built up as far north as Grovetown/Spring Creek, or up Redwood Street, and back into the town itself. That is when the round-a-bout with the train going through it becomes such a hazzard.	Probably, after studying the plan, a much wider merging lane in Grove Road it-self, and most definitely larger round-a-abouts	There must be a by-pass, or at least a truck by-pass; the truck units are getting larger, and they just don't fit the road and round-a-bouts.	Ideally, both a new bridge, AND a by-pass, as a huge volume of the traffic going either North or South is never going to stop in Blenheim itself. Certainly not the freight. If the by-pass is not put in place, there will inevitably be a very serious accident at some stage. The business people of the town will have to do far more in the town before travellers will stop and eat or shop or stay over; there is not the incentive.

Fully support the new bridge	The new bridge should be simple, elegant, curving and low as possible. As such our new bridge will not visually 'compete' with our beautiful old bridge. The side barriers would look really smart with the 'bass relief' type designs set into them, similar to those Ive seen on Auckland's motorway system. Our designs could include Maori art and/or references to our region's history. This would be really spectacular on the outside of the barrier facing the old bridge. The old bridge could incorporate an explanation on a story board as well as a QR code to an app to provide an audio explanation. Take this a step further and we can have a 'Sound and light show' at night with coloured LED lights illuminating each panel to tell a story. On the subject of lighting: Could the roadway lighting be in-built in the barriers to enhance the clean smooth bridge lines? This would also reduce the ambient light for the campers. The lighting should certainly be 'eco', so LED and taking this a step further; could this be the country's first solar lit bridge, using a solar and battery system? We are 'sunny' Marlborough after all! The road surface should be quiet, so as not to disturb the campers below, and free-draining so it's safe when wet. Rainwater should be ducted off the bridge so road contaminants don't pollute our river. The bridge deck should be wide enough for two full	I strongly object to a by-pass around Blenheim. This would have an extremely adverse effect on commerce in the town and the town's future growth.	I would like to see plenty of native landscaping utilised. These plantings should be on the edges of the bridge approaches at each end and at the town end integrate into the Marlborough Landscape Group's streetscape development on Grove Rd. Plantings should include Marlborough Daisies. The abutments should have plantings also, but one of them could be vertical and incorporate a recreational rock-climbing wall. To enable pedestrian and cycle access to both sides of the bridge/SH1 road we need a pathway running under the new bridge at the town end. It would be really good if this pathway could incorporate a picnic area and perhaps even a kayak launching and swimming place, however this may encroach on the camp ground's land. The old bridge perhaps should be painted to protect it and to enhance the lighting effect from spot lights. The bridge deck should be laned for walkers, cyclists and those viewing. Allowance should be made for mobile stalls or coffee carts. Nice user-friendly transitions at each end are needed onto footpaths and cycleways.
I support a purpose built bridge that will ensure that the traffic that uses it is catered for e.g. large truck/trailer units, campervans, caravans etc. It must feel safe for all people to be using it.	I would want the safety aspect carefully considered, not the infrastructure itself as you will have that well covered but the various users perceived safety when using it. The design should complement the existing bridge and blend in.	It is good to have bikes and walkers having a safe passage, although I am not clear about how the access to that will be achieved, I have to cross Grove Road on a bike every day and it is a nightmare.	Yes as I said above, the access for walkers/bikers to their bridge - It is huge, don't want anything that interrupts the flow of traffic but need to be able to safely get to the access way for the bridge.
I support the building of a new bridge in the position selected given the following proviso; 1. the bridge is sympatric in design to the physical environment including the current historic structure and adds interest to providing a "Gateway to Blenheim" 2. that the new road layout provides easy, safe access to the old bridge for recreational cyclists and walkers (with buggies) 3. the new bridge is wide enough to allow the 1.5m wide strip for non-vehicle traffic who choose not to use the original bridge 4. that the new design helps to control vehicle speed to not exceed the 50km maximum currently in place 5. that NZTA works closely with the MDC to maximise opportunities to develop any possible riverside reserve access 6. That interpretive panels are provided at both ends of the existing bridge to explain the historic significance of the structure	I would like to see an interesting design that provides, as much as safety constraints allows, a platform to view the existing bridge and reserve below. There are plenty of new NZTA bridges that have lovely art work incorporated into the concrete panels – Grapes perhaps! The new bridge has the potential for using LED lighting to highlight the old structure and perhaps a feature in itself on the new bridge. I know beauty is in the eye of the beholder, however I believe it is possible to have beautiful bridges. Usually on those structures there is an element of interest, something unique, I would hope that NZTA's design brief would seek the "wow factor" for Blenheim's Gateway.	I am opposed to a bypass route to the east of Blenheim, based on personal observation of the decline and "death" that occurred to small settlements along SH1 in the north island each time the state highway was straightened, widen and townships bypassed. The commercial businesses on Grove Road will suffer directly and the town of Blenheim as a whole if the vast majority of tourist traffic is "bypassed" straight south. Sorry all the reassurance in the world that it wouldn't have an effect is not matched by reality I have observed. The investment needs to go into the Kaikoura coast section of the highway to make that road safer for trucks to use and for everyone else on the road.	If you (NZTA team and your contractors) make as good a job as you did of Lions Back realignment for example, with landscaping and replanting then I'm sure that the historic Opawa Bridge will be protected, walkers and cyclists will be provided for and traffic will move freely over an attractive new bridge with the least possible impact on the camping ground below. Blenheim benefits and SH1 has a better route for the bigger vehicles moving freight.
option 8,good to have such a wide bridge but what about traffic lane width at each ends especially the southern end.	design to reflects Marlborough and the surroundings,do not build an eyesore completion on time and within or under budget	retain ownership and upkeep of old heritage state one bridge as mdc can not be trusted to maintain rate payers monies for this project which will still be used by non Marlborough residents.	as part of full travel plan remove rail line from roundabout at Main /Sinclair/Redwood sts.

By pass should be the first option.	Keep the old Bridge.	Dash wood pass needs straitning up with passing lane from new bridge at bottom to top.	Fast tract by pass.
Hi I feel we need the bypass for the trucks,there is a large amount that pass through & there is no way they will come into the town.			the bridge could be built at a later date, Claudie Fallen
too narrow, for extra $3m get double the	Why not have a joint bridge with the railway bridge as this will need to be replaced soon, the road can be parallell to the rail route until the nelson road roundabout.	option 7 slightly more expensive but twice the number of lanes, cost per lane much better, will never need to be be widened in future	twin car lane bridge, with pedestrians and cyclists using the old one, if on the same bridge signs to say cyclists only single file, they often ride in packs 2-3 wide on marlborough roads
The preferred option is a good one. The bridge must be replaced to "earthquake proof" access to Blenheim.	Nothing fancy. Just a strong structure that does the job. Same as the "new" bridge across the Awatere river just north of Seddon	NO	A by-pass from Spring Creek to Mudhouse Road, Riverlands for State Highway One. The route through Blenheim is a real bottleneck and slows traffic flow on the strategic state highway one markedly causing great frustration to locals and south bound traffic alike. Local business and other self interest groups miss the point that tourists and wine lovers are still going to come in to spend time in Blenheim for the wineries etc anyway.
I think its a great idea to build a new bridge.	It would be nice to see one that has a similar design to the old bridge, in a nod to its history.		A bypass around Blenheim. It wont stop tourists. If people want to go into Blenheim they will. A bypass is needed for all of the trucks that fo theough the town, and would especially of value during harvest when all of the extra teucks are on the road. I believe it would prevent numerous grape spills...
Is an improvement on what is available now.	Simplistic. Doesn't need to be a feature. Something that gets traffic safely from a to b.	It would be great if we lead all passing through traffic via a bypass. It's proven a success in a lot of towns around the world. We will need it eventually why not save a few extra years and get it done. Realise this is complicated but not impossible.	as above
It is a good second option but I would like to see use of the existing bridge as a cycle and pedestrian bridge to be enforced (i.e. they should not be able to use the new bridge)	A clear view of traffic on approach/departure. Style of bridge does not matter to me.	My preferred option would be for a bypass. The existing Opawa Bridge is wide enough for standard sized vehicles and if the majority of large vehicles (i.e. freight trucks) are able to avoid the busy intersections along Grove Road it has to be better for their business to have a quicker route whilst also freeing the bridge for local traffic which generally can cross without issue.	I would like a new bridge but not at the cost of a bypass. I believe a bypass is the # 1 option with a new bridge a # 2 option (the cheaper option but not necessarily best for long term planning).
They should put the monies into a by-pass	Scrap the new bridge and build a by-pass	The new bridge is not needed, it will not help with the congestion along Grove Road through 3 roundabouts and along Main Street, but a BY-PASS will. This would be the worst part of State Highway 1 in New Zealand. And there are a few more.	BUILD A BY-PASS NOW. IT WILL HAVE TO BE DONE SOMETIME IN THE FUTURE. AT WHAT COST???
codswallop	none	a bypass	yess a bloody bypass
Poor short term solution that does little to alleviate existing and growing future traffic problems along Grove Rd and Main St and associated roundabouts	Leave existing bridge as is, but provide for a long-term solution by means of a heavy and wide vehicle bi-pass south along Vickerman St to the Butter Factory Corner, State Hghy 1 Riverlands	Similar expenditure for bridging the Opawa River, comparative low-cost bridge required over Roses Overflow and compensation for only to 2-3 land owners over private land beyond the existing legal extents of Vickerman St.	Look beyond the immediate needs towards a long term solution for traffic problems in Blenheim.
It is completely wrong and ill informed.. They have looked at the bridge in isolation ignoring the other problems.		This bridge could be widened by removing the sides and adding a cantilever extension of the roadway of 1 m to each side with low walls. All work could be done from scaffolding on the outside so road closure would be unnecessary.	A bypass is what is urgently needed to remove SH1 from the worst traffic engineering in NZ at the New World corner.
build a bypass	leave it the way it is ,,it slows traffic down coming into town ,,	the number of trucks mostly come off and on the ferry's, post freight only ones stop and pick up in blenheim nelson freight goes spring creek road,the rest go straight through chch,only shop owners want all traffic the folk that want to come into town will still come,just look at other towns	

A very short term solution to a long term problem.	Make it wide enough so that the wine harvesting machines can use it and traffic can still flow.	Think long term. Build the bypass to riverlands. Trucks don't need to go through town and forced to go around roundabouts.	Think long term. Build the bypass to riverlands. Trucks don't need to go through town and forced to go around roundabouts.
I support the chosen option. I like that the old bridge will be kept for pedestrians and cyclists.	Would be nice if the new bridge could have some similarities to the old one, so they tie in together.	Regarding the Wairau Bridge, while I understand the reasons for not replacing it at this stage, I think at the very least it would be worth looking at the option of a pedestrian/cycleway clipon. Its a very dangerous bridge to cycle/walk across and it a big barrier to a potential cycleway between Blenheim and Picton.	Currently when cycling north, it is quite difficult at times to get onto the pedestrian/cycleway on the eastern side of the bridge. You either have to cross the road down at the Dodson St intersection and cycle on the shoulder against the flow of traffic to access the bridge, or cycle up to the bridge and then wait for a gap in traffic to dart across to the other side. When there is a lot of traffic, neither option is pleasant. I would like to see some consideration go into improving this situation, maybe through a separated footpath/cycleway on the eastern side of the road.
What were the other options, none were presented at the roadshows. A by-pass from Grovetown thru to Riverlands is the option considered by truck drivers like myself. In the vintage season the roundabouts, south of the bridge, are a curse, three in a row. To travel on Grove Rd / Main St at anytime between 3.00pm and 5.30pm is insane, namely with school pickups / college students / home bound workers. Truckers could effectively gridlock SH1 by travelling indian style or going round the roundabouts to cause frustration to travelling public. Thankyou			
Not even an option, take a bypass just south of Grovetown	nil	A bypass was on the books years ago and most people agreed more do now take a vote	nil
I think this is a great option, with the least impact on land, land users, and in close proximity to the historic bridge...and the gateway into the town centre.	I would like to see future proofed design options- i.e. will it allow for additional lanes to be added easily should it be required in the future. Future flooding- global warming means this is only a matter of when. Is this considered.How will it complement the existing bridge, or not? How will NZTA let people know that the bridge is still accessible for pedestrians and cyclists- will cycleways leading up to each side of the bridge be installed?		
It will be a waste of ratepayers money, especially If you are looking at a bypass in the future! It won't lighten the traffic around the roundabouts or crossing the train lines!! We will still have heavy traffic loads along the main roads!	As part of the design - maybe a vine with grapes on which will represent the many vineyards in Marlborough	Build a BYPASS like many other towns! It eases all the congestion! The lorries can head straight to CHCH (or wherever they are traveling to) and it saves further expense for the ratepayers! Let's plan ahead for the future!	Get more freight to go on the trains instead of the roads!!!
I'm not convinced. Has the NZTA done a survey of the projected traffic flows if a Northern bypass starting at Riverlands was built? The only really urgent issue at the moment is that the Opawa Bridge is too narrow for full size trucks - as I know from driving a truck during the recent grape harvest. Only one truck can be on the bridge at a time and large campervan drivers often cause havoc by not realising that there is not room for them as well until it is too late. By replacing the current bridge all you will do is enable more heavy trucks to clog up the roundabouts in Grove Road. Are you also planning to do something about the roundabout with the railway line running through it as well?		The Northern bypass should be fully investigated as an option. What percentage of heavy trucks currently using the Opawa Bridge would use the bypass instead? Trucks carrying grapes to Riverlands from the Northern and Western growing areas during harvest would also use the bypass and and thereby reduce heavy traffic through Blenheim (and consequent spillages of grapes). If the bypass was implemented why would there be an urgent need to replace the Opawa Bridge?	Replacing the Opawa Bridge is a short term fix for a currently urgent need. The implementation of a properly researched Northern Bypass would do so much more for the development of Blenheim that I think it is short-sighted of NZTA to waste money on a short term partial solution. If you are not intending to start building the Opawa Bridge replacement until 2018 then what is the time frame for the Northern Bypass - 2030? And make sure that you do not line the approaches to the bridge with those dangerous wire so-called 'safety barriers'. It's no wonder the ACC costs for motorcyclists are so high when you install things like these.

I think a bypass starting at the Nth. end of the Opawa Bridge & go east on the inside of the rvr. bank with a low level road that would very rarely be effected by flooding. Cross the river at Rose's overflow with a large culvert, from there continue to SHW 1 just south of the Blenheim boundary. The bridge over the Opawa close to this point wouldn't need to be very long, saving cost.			If the proposed new bridge is continued with, Grove Rd needs to made into a 4 lane street with much larger roundabouts to cope with the current traffic flow. Every year the traffic is building up and causing a lot of hold ups. If there was a bypass it would be handy to be able to go around the bypass to save time.
Ill advised	N/A	A new bridge might make it easier for large trucks to cross and take away the "fear factor" from car drivers but it won't take heavy traffic away from town. They still have to negotiate roundabouts and contend with regular traffic. A bypass would solve the problem.	No
It deals with the immediate problem, not the long term. It is right to replace the bridge because of safety aspects. However we need a by-pass to take the traffic away from Grove Road.	I have no preference on design but it must be functional and safe.	Grove Road Blenheim is a real bottleneck for traffic on SH1. Heavy traffic and/or private vehicles need to be diverted from this area to ensure safety is maintained. We have this problem now and just replacing the bridge will not fix this problem.	You need to look at the longer term problems this section of SH1 has. Serious thought needs to be given to a bypass, not just lip service and saying it is too expensive. This has been done in other towns and works extremely well. Also doing it more on SH1 in the Waikato (Cambridge).
I feel it is the wrong decision as it will still bring 1000 freight movements daily into our already congested Grove road, Main Street thoroughfare. The money is being wasted when a bypass from Grovetown would deliver a far more efficient and intelligent solution.	I do not support the bridges	See number one comment	Stop the project, create a bypass.
It is only a temporary fix there will still be congestion coming into Blenheim - there should be a bypass	Keep existing bridge for local traffic and build bypass		
Yes this is the best option , but it is not the correct or best use of Tax payers money.	No comment	As a life time Blenheim resident I feel very strongly on this whole issue. The transport problem of State Highway 1 and main trunk railway passing through urban Blenheim needs addressing as a whole intergrated and planed issue. Our town fathers have unfortunately not sensible addressed this issue in the past. The fact that no sensible planing appears to have been put in place. To spend money to not address the real issue. A new bridge fixes some problems ,but just shifts the actual long term problems a few hundred meters. A BYPASS is inevitable . So let's plan accordingly. Look at the health of Both the bridges crossing the Wairau , road and Rail. Look at most sensible alternative routes for both Road and Rail.. Yes it may take many years to put in place but , we can't ignore it. So let's stop wasting time money and energy on side issues.	Perhaps a bridge over the Opawa to link the Riverlands SH 1 with Vickerman St . This is not a final fixes as joining back to the existing SH1 would be difficult . Installing lights on the presant Grove Rd bridge might be a very short term fix.
I like 2 separate bridges	continue the scallop shapes	why is the new bridge to be on the up side? the side nearest the sea would be a more direct path past the railway and station thence to main street	there are very few walkers and cyclists and no way planned for them so best for one bridge to take traffic to picton and the other to take traffic to blenheim
Looks great - a good solution for the new bridge!			

My opinion is : I do not like the preferred bridge option. Although the bi-pass is a more expensive option, long term it would have its benefits. The main concern I have is Grove Road with so many heavy vehicles going around 3 round abouts with the main one having the train track as well. Has any one from NZ Transport Agency travelled along these or observed these areas and seen the trucks camper vans etc especially about 30 minutes after arriving off each ferry at Picton, they aren't planning on stopping in Blenheim. I read in the Express paper 1000 trucks travel this way every day and this is expected to increase. I have read letters from truck drivers complaining about having to drive through Blenheim is nobody listening to them? I think NZ Transport Agency needs to look at other options seriously before they make this decision.		Unfortunately the Transport Agency is not seriously considering how their plan is going to affect our lovely Blenheim town nor how much it will cost to keep the standard of the roads up because of the heavy trucks using Grove road and Main Street. They obviously haven't observed the long and large trucks manipulating the roundabouts and what this does to the road surface especially in the summer in our warm climate. Another consideration is the number of pedestrian crossings on these roads considering it is a main highway. I don't think any other towns in NZ have to cope with this as most other towns have bi-passes now. I think a hard look should be taken of this as Whe travelling any distance in NZ it is always appreciated being able to bi pass towns unless planning to stop there. I think this should be taken into consideration when they are planning the changes to our bridge . Please stop and consider all this before final decisions are made after all it is our town.	Yes consider the drivers of trucks, tourists in campervans etc I really like the roundabouts but I bet they would prefer not having to deal with these.
This looks like a good option	wide and open. a great entrance to blenheim	No	Make sure it goes ahead. The current bridge is not at all adequate for todays needs. Regular inconvenient wait times for trucks to pass are a nuisance and it is long overdue for replacement.
Stupid - Build the Bypass and most of the traffic won't even need to come into Blenheim as it will travel directly on to its destination in the North or South of Blenheim.	Build the By Pass for Blenheim - then if new bridge is still needed you could make it a single lane one which would be a cheaper option	Please listen to the drivers of Blenheim who have to put up with the major congestion through Blenheim from Main Street to Grovetown due to the amount traffic wanting to just get through Blenheim when it is mixed with the traffic of Blenheim - Build the Bypass and solve all the problems!!	Read above entries and Build the Bypass, before the cement of the bridge is even set you'll have to start on the bypass anyway so save us poor taxpayers some money and build the bypass NOW
It seems the best option given all the factors involved	Good elegant design. Wide enough for the big trucks, harvesters etc to use in both lanes. Not necessarily for cyclists - they could use the old bridge not the new one	A bypass is too expensive and Blenheim would suffer, I think. Go with the bridge as planned and as soon as possible, please.	no
Fine	no high sides please	no	make it happen ASAP
logical option and very necessary	Simple but functional	No thank you	No thank you
I like it. we live in Budge street, one of the streets near the south end of Opawa Bridge, so it should mean a smoother entry on to state highway 1 from and into Budge street. At present when large vehicles have to wait at bridge entrance it causes congestion on state highway 1 making entrance to and from side streets hazardous .	Just to make the bridge wide enough to accommodate the large vehicles that are on today's roads so that other motorists can stop feeling anxious about crossing the present bridge	No	No
I think it would be an improvement BUT is a dumb idea when to achieve the desired result the money from this and the deferred Wairau project must be put towards a bypass. Directing more and bigger trucks into a already congested town roading system is just not the answer I'm afraid. Anyone who lives/works here can see that!!!		See the answer contained in 1 above. If a bypass has not been considered. Why?This is the main and only route for traffic wishing to travel south.Just like SH1 south there is no other option.Get it right.	Think again. Is this the best use of the money to get the desired result.
First class	Some unique design elements only used on this bridge.	Just get on with it.	no.
negative	negative	Iwould like to see abypass option actioned conjestion caused on grove rd is terrible and heavy transport is without doubt going to increase	not really i think general consensus around blenhiem is for a bypass

not good,will not ease congestion on Grove road	none	YES!!! Build a bypass along Vickerman street.Other towns have bypasses and they do not seem to be detrimental to the viability of the towns	build bypass now!
I feel the bypass would make more sense I travel from Budge street to riverlands every day and the traffic flow at peak times is hideous. I have seen traffic backed up to the opawa bridge Also backed up from the sweeper as you come in to main street from the south side of town so the bridge will help this flow HOW??	I am pleased the old bridge stays	BYPASS	turning into and out of riverlands estate dangerous. I have seen several close calls here. I feel the 70km zone should be across STH 1 across this intersection and make the give way from Riverlands state a stop sign
Fantastic	good vision (for passengers) over the side to the river and countryside.	No	Will the bridge also 'bridge' the campground below?
This is an illconsiderred option.The proper option for Marlborough is a blenheim by pass starting spring creek way and coming out near the industrial estate at riverlands. To plan long term for interisland traffic to continue to be routed down Grove Road and mainstreet is plain ignorant and NOT in keeping with other oustanding projects, like the Kapiti expressway, created by your organisation. I think their is widespread agreement with my comments. The mayor is sidestepping the issue. My father and grandfather and I were all born in Blenheim so we do have a feel for the place. You do have the opportunity to revisit the current "stupid" proposal. I regret having to be so forthright	There is nothing I can offer except to say that if your looking for ideas have a look at the Kapiti expressway.	You do not mention the obvious correct alternative , or even comment on it as a matter considerred and dropped. This is BAD.	I think you will get alot of public feedback at your meetings at the Scenic Hotel -I will be their with a number of others. Thank _You for the opportunity to comment and appologise for being so Blunt. Regards
Benefits (1) make journey times more reliable, and (2) make sure freight moves efficiently is erroneous; it is just one of four bottlenecks on SH1 in Blenheim (other three are roundabouts). PLEASE build a bypass		Please do not burden future Blenheim residents with a grid-locked SH1 through the town . Please build a bypass east of the town now, not 'sometime in the future'	Build a bypass (maybe using the money not currently required for the Wairau bridge at Tua Marina)
I think the existing bridge could last another 100 years if a bypass was built taking ferry traffic, in particular heavy trucks away from this bridge and the grove road roundabouts.	Use these funds to construct a new bridge on the bypass route.Also why could the existing bridge not be rehashed by additions to straighten it and maybe make it a little wider? The bypass is the priority.	Build a roundabout a the Aberhearts road intersection,cross the railway line there and build the bypass through St Andrews or the bottom of main street.	The old bridge is narrow but very seldom do you I ever see vehicles over the center line.Two big trucks can pass but their mirrors are a problem.The widest things are boat trailers.The volume of traffic will only increase so lets forget about a new bridge here and construct a bypass. My proposal still keeps traffic close to Blenheim,and the bypass would go through a bit of vineyard land,across the river and out onto mainly bare land meeting the main road again at St Andrews.Some houses may have to be purchased or relocated.
I think it is a waste of tax payers money. As I believe with the increasing traffic and bigger trucks the whole situation will have to be looked at again in a very few years time.			The only real way forward to handle Blenheim's growing traffic problems is a by-pass along Vickerman street. This would not only get rid of the big truck problem but also the grape harvest problem as all the grape trucks from Lower Wairau, Springcreek and Rarangi plus Dillons Point would have a straight drive through to the wineries. No traffic hold ups and no grape spills. The way they go now in comparison is rediculous
I think it is short sighted and not cost effective to build a bridge and not a bypass	A bypass should be constructed NOW	The traffic congestion in a town the size of Blenheim is discusting	No comments
Not good	No comments	Traffic away from Gove Rd! put in the bypass around Blenheim	Let us not forget, the "Bottle necking" at the other end of Town, Grove Road/Main Street?
Does not solve the problem of he 3 roundabouts ahead	None	It has to be a bypass to get the A & B trains & other big trucks out of Grove Road. The bypass would be signposted trucks only	No comments
Although the Opawa bridge needs upgrading the bypass should be addressed first as this would relieve congestion in town. Upgrading the bridge with no bypass merely causes more of a bottleneck at the roundabouts	Separation of cyclists from main traffic	Prioritise the bypass - see Q1	Prioritise the bypass
I think it is the preferred option. Great to keep the old bridge for pedestrians and cycles	No comments	Will a two lane bridge be big enough for the future? Should we not plan for the next 10 years?	No comments
A lot of money for a bridge	If this bridge must be built, be wide enough for two trucks to be side by side on the bridge	By pass	No as we need a bypass. The trucks are using Dillons Point Road as thie by pass now. We live live in Dillons Point Road, very annoying

Absolutely disastrous	Leave the bridge alone! I live in Picton and see the congestion in Blenheim regularly	Bite the bullet - find the money to put a by-pass through from Grovetown to south end of Main Street. Money has been found for beautiful highways between Nelson and Motueka! And anything for Auckland!	A new bridge WILL NOT solbe the horrendous problem with high truclks coming and going the the Cook Strait ferries, and having to manouvre through 3 roundabouts (one over the main trunk line) before they get onto the highway going south
I would prefer the by-pass if it were an option	My concern if for safe and stress-free entrance and exit from Budget Street. The bridge will affect this as bunched-up traffic coming south into Blenheim deters more timid drivers from merging into the traffic flow. People often stop in the roadway, too afraid to venture onto Grove Road. The area of Riversdale has over 1200 households plus backpackers and NMIT. The only access by road is from Grove Road over the rail line. A better merging solution would be welcome via roundabout or more amenable merging lane. There can be a long wait to turn north onto Grove Road from Budget Street. I actually often go left and then turn right off Grove Road to make by way north. A roundabout would help this problem. Traffic also seems to speed up coming downhill off the bridge.	No comments	No comments
A good option. Keeping the existing bridge is historically sensible for foot and cycle traffic. This existing bridge has stood up to all the heavy floods before the diversion construction, plus all the earthquakes throughout the years. It has to be a solid construction.	No comments	No comments	No comments
Excellent plan	No comments	No comments	The bridge plan is vital - but the traffic flow and practicality of the heavy duty volumes is not addressed. We definitely need a bypass to serve the trucks and passing through traffic. What we have now is dangerous, complex, inconvenient, and undesirable
The option is the obvious one - but it lacks any imagination for the future of Blenheim. Blenheim needs a bypass south to take the major trucks and thoroughfair out of Grove Road	If it has to be a bridge, concrete would be a good choice with hand rails and such	Bypass not bridge. Expanding the capacity to bring stock truck down Grove Road is the opposite to what Blenheim needs.	A good bypass - starting the northernside of Opawa ending somewhere near Riverlands would greatly increase the Blenheim township, as the majority of trucks coming off the ferry don't head straight through. In addition it would provide an additional route and bridge in case anything happened to the current crossings
No comments	No comments	No comments	We need a toll installed at (70km) entry into Blenheim to pay for a bypass
No comments	No comments	No comments	Lets put a bypass in it could start just this side of Grove Town, south side. It must save on costly property purchases and delays
Certainly makes sense to me! Best option	A modern version of the old bridge. The "then and now" bridges	Definitely do not want a bypass. Every town that has a bypass done that is on SH1 dies	Some lovely "Gateways" to Blenheim at the major entrances to Blenheim not just (50) speeds limits
We definitely need a new bridge into Blenheim	Future proof the bridge by making it wide enough to accommodate 4, or just 2 lanes for traffic	No comments	No comments
The new Opawa bridge is very short sighted. Its only putting a band aid over the problem. Be far more serviceable to be making a new highway from Riverlands up Vickerman Street	It will cost millions, but will have to be done in the future. If not, how is the Main Street roundabout and Grove Road going to cope in th future. Its bad enough now	Be a good idea to have a freighter carrying trucks from Wellington to Christchurce and vice versa as they do break up the roads so much	No comments
Without the other (top 3) options being made visible how can we tell?! Re cost of land, habitat destruction	Built in redundancy (for further traffic increases) no light or stopping bypass Blenheim completely	No - as they arent on the website!	Yes, put the top 3 including all costs (including any land purchase, environmental impaces etc) on the website/in council reception
No comments	Bridge should compliment existing bridge and not detract from it. A great chance to build a "Gateway' structure into Blenheim that should be used. New bridge will be visible from campground and from ped/cyclists on old bridge so please make it aestheticly pleasing	No comments	As above this is an opportunity to create a talking point structure. Doesn't have to cos the earth but please not a Super T or standard beam/column bridge with a bit of fancy precast barrier to pretty it up. Think of the social, humanistic side. Accent lighting on existing bridge to make it more appealing to users and traffic. Extend cycleway right through to Picton.

I agree that a new 2 lane bridge would be the best option because then you have a more reliable crossing over the Opawa in the event of an earthquake or flood compared to "repatching" the old one	I think it would be good to incorporate the design of the existing bridge with the old one	No comments	More focus on structural points of existing bridge to increase public knowledge and understanding of the project
RUBBISH	Put it over the river at Riverlands extension of Vickerman Street	Do the bypass now	Careful considerate drivers have no problem with the bridge. Remove the monster thanks - problem solved!!
No comments	No comments	No comments	I have relocated to Picton in December last year and travel thru to Blenheim regularly. In this short space of time, it has become obvious that the Opawa bridge is a real hazard on SH1 thru Blenheim. But, having crossed the bridge (heading south), there is still all the roundabouts to navigate, following a hugh truck and trailer thru the "maze" and it is just so obvious that the proposed new bridge is being built in the wrong place. Think BIG and reall long-term, starting from the northern side of the (new) Wairau bridge, head across thru Riverlands and rejoin existing SH1. Cost ?? what does it matter, given the amount of money spent on roading upgrades in other parts of the country, plus of 2.6 million can be wasted on a flag referendum, lets get things right the first time!
No comments	No comments	No comments	I wish to make a suggestion regarding improving the historical bridge, PLEASE leave as is, why not build a replica on the camp ground side of the bridge, this way we can have a north bound and a south bound lane. The look would fit into the existing landscape without extra intrusion on the camp grounds below
No comments	No comments	No comments	I feel it is a gross waste of taxpayer's money replacing this bridge. I was brought up "that if a job is worthwhile doing it is worthwhile doing properly or not at all". So in this case, I feel spend whatever is needed to make it earthquake compliant, but the balance of funds should be put towards a complete bypass of Blenheim. The existing bridge will meet the needs of the Marlborough residents. However, SH1 through Blenheim is a complete shambles for passengers, tourists, & freight companies seeking to head further south. As a gateway to the south island is it is very substantial route, and not a good image
No comments	No comments	No comments	I feel we need a Blenheim bypass and an upgrade of the existing bridge to make it earthquake compliant thus also keeping its historical value to the region. A bypass route will keep the ferry freight traffic out of Blenheim's industrial area, thus making it far safer for the locals and business operators alike. This is certainly more important with the predicted dramatic rise in visitor numbers arriving in NZ. Any tourists coming into Blenheim could use an off ramp fromthe new bypass, thus making the route a lot safer for them as well.
No comments	No comments	No comments	Hello, I would like to say that the bridge is not the problem. It is the amount of traffic that is the problem. I live in Parker Street and at times when Grove Road is jammed the traffic then gets jammed right up along Nelson Street, past Curry Street. This is only one street that is affected. A bypass is the answer. The report in the newspaper talked on a bypass starting at Tua Marina. Why there? Why not Grovetown? A new bridge is not going to help the flow of traffic. Is the price of 17.5 million dollars for the bridge included in the land purchase and road works? We have friends that are truck drivers and they all say the same thing. We need a bypass to keep away from Grove Road.
No comments	No comments	No comments	Hi lets put a bypass in it could start just this side of Grove Town, south side, it must save on costly property purchases and delays just my thoughts along with a lot of others
No comments	No comments	No comments	I am very pleased NZTA is seeking views on the replacement bridge over the Opawa River on the north side of Blenheim. Transport and traffic flows have dramatically changed over the past decade and with the long term establishment of the ferry service into Picton traffic will only grow to unmaneagable proportions on the present roading system especially through Grove Road/Main Street in Blenheim. NZTA "take off the blinkers" and establish an alternative bypass to the east of Blenheim alleviating the future congestion and improve the safety for all road users. There is a public ground swell for a bypass to be established and contrary to the business sector, some who oppose this option, you are well aware bypasses have been established which hae been established in towns and cities do attract the travelling public diverting into these towns and cities for shopping and recreation. Instead of quoting the reasons why a bypass cant be done NZTA should be advancing this option for the long-term benefit and future for the top of the south island and progress the bypass option along with an upgrade to the present bridge. I am sure you will receive many submissions supporting the above and due to the lack of interest shown by the local MP Stuart Smith, a copy of this has been forwarded to the leader of the opposition, Andrew Little.
No comments	No comments	No comments	To whom it may concern. It is a no brainer spending on a new Opawa bridge when on the otherside a bottle neck of crawling along Grove Road and Main Street. A bypass is needed, for traffic flow for large trucks, campers, cars, buses etc. We need a vision of traffic flow looking forward to the next 10, to 20 years when spending large amounts of money wisely, with firm quotes within our budget.

No comments	No comments	No comments	I wish to make it known that I oppose the replacement of the Opawa bridge for the following reasons: 1. The existing bridge is adequate for LOCAL traffic. 2. The expenditure of between $14 and $17.5 million on replacing this bridge is a gross waste of public funds when it could be put towards the more logical AND TOTALLY NECESSARY Blenheim bypass. Your information leaflet states: BENEFITS OF INVESTMENT: 1. make the journey times more reliable. This is hardly credible because, even though it would reduce the possibility of delays at the bridge, it does not eliminate the time spent negotiating through the town with its increasing traffic flows and numerous rounabout obstacles to contend with. 2. Make sure freight moves efficiently. If you were really serious about moving freight efficiently, you would be ensuring it went by RAIL. This would also have enormous benefits like less wear and tear on the roads if heavy trucks were reduced and would make the road network a lot safer for the motoring public. If however, you are determined to support truck transport, the way to make it move more efficiently throught this area is to build the bypass so that there are NO delays in Blenheim. 3. Make the area more resilient to natural disasters. To build another bridge adjacent to the existing one (even a vastly improved new bridge) puts it into exactly the same risk area in the event of a major natural distaster, whereas if the new bridge was to be built in a separate location (on the bypass) , it would be isolated from a localised event. 4. Support SH1 as a strategic freight route between Picton & Christchurch. To facilitate this, surely the object is to keep traffic flowing as efficiently as possible. This is NOT achieved by eliminating one possible delay location (the existing bridge) if traffic is then subject to immediate further delays. The 50k/h roundabouts and traffic holdups through the town. My preferred option would be: leave the existing bridge for local traffic thereby saving the wasteful expenditure of public funds and build the bypass. The elimination of so many heavy trucks crossing the existing bridge would remove the impact and stresses caused by them, which must be good for the structural integrity of the bridge. If, for some reason it were to fail at a later date, local people would still have other options of access available to then (including the new bypass bridge).
No comments	No comments	No comments	The opawa river bridge definitely needs a new bypass route to avoid Blenheim. Heavy trucks/vehicles going North/South who wish to avoid Blenheim's inadequate and potentially dangerous railway roundabouts on Main Street need to be able to do so. One of the dangers for me personally is that the large trucks trailers can swing out onto the adjoining land and clip the cars at the side of it. The roundabout is far too tight for these heavy trucks, it's madness to expect them to use it at all.
No comments	No comments	No comments	Indeed the bridge does not replacing. However, this will not decrease the congestion of Grove Road or Main Street. Periodically cars are built up from the Main Street roundabout right down Main Street and those attempting to exit the side streets have to wait for quite lengthy periods.....So please provide a bypass from Grovetown to Riverlands.
No comments	No comments	No comments	Attached please find Opawa Bridge feedback from the Marlborough Feedback Group. The Landscrape Group would like to be included in the NZTA planning for landscaping the approaches to the old and new bridge
No comments	No comments	No comments	You people need to remember who pays the bills. This is an OSH issues - failure to take all practical steps to protect us make you personally liable.
No comments	No comments	No comments	As residents of Marhborough we regularly use this bridge, the roads to the north and town road to the south of it. Yes there are problems with the present bridge - mainly caused by the heavy vehicle traffic using it. Improvement is necessary and a seond bridge is the obious solution to its narrowness. I see no need to demolish it (historic) and believe it should be retained. A second bridge could carry traffic one way and the old one the other. In the event of earthquake damage or flooding, the design could include the ability (by moving barriers) to use the new bridge for two way traffic. However, improving traffic flow here will only speed up south bound traffic meeting bottlenecks at the series of roundabouts along SH1 thruogh the north of Blenheim, especially the railway roundabout. What Blenheim really needs is a heavy vehicle bypass to the north of the township which will remove the heavy traffic from not only the bridge but the main road through town... Please put the money into the more important project.
No comments	No comments	No comments	Submission attached from Bike/Walk Marlborough
No comments	No comments	No comments	Attached please find a copy of the Automobile Association's submission regarding the Opawa Bridge
Personally I love this bridge. Never had a problem with it.	If it had to go ahead I would've prefered the money used to have another external entrance rather than having to go through town.	No comments	No comments
I think this is the cheapest option which does nothing to remove those enormous highway trucks from over the main road	NZ has a lack of attractive bridges though I seem to remember on on the Taupo Bypass. There are many lovely bridges all over the world, can we see some designs for this before we comment further	I's prefer a proper bypass along Vickerman St on the Eastern side to remove the aboce mentioned highway traffic. Through traffic would no longer have to dodge the trains!!	No comments

I believe the Opawa bridge needs replacing with a wider 2 ways however a bi-pass for heavy transport is essential in the near future	For the last 20 years I have driven on this bridge in trucks and realise is needs replacement. However the need for a bypass is inevitable in the near future!	Trucks coming of the ferry do not want to be held up going through Grove road nad main street. Puttin gthese truck on a by pass eill not effect business in Blenheim. Stopping in Blenheim is not possible for most trucks. As we see the rail failing there will be more road transport and need for the bypass. We live avoce the Waikawa marina in Picton and see all the traffic and rail going though.	No comments
I do not agree to a new bridge. Use the funds towards a by-pss from Grovetown to Riverlands	No elements reflected - just continued delay and danger for traffic negotiating Frove Road, Sinclair Stree, roundabouts, especially the Min St/Main Rail interction	As above - the ever so dangerous rail/roundabout to Main St and SH1	Just re-allocate funding towards a most necessary by-pass
I Find it a very good and very sensible decision	Just a plain and solid bridge. No frills	no	I hope the RMA for the bridge goes through with no hold ups.
I think a new two lane bridge is the best option and it's locaiton seems logical	I would like to see the new bridge reflect the design of the current bridge. Not necessarlity the exact same (materials etc) but something with a similar shape/profile	No comments	I think keeping the current bridge for cyclist and presetrians is a great idea, provided it will not be disporporionately expensive to maintain.
It is very shortsighted to spend up to $17 million on a brigd when a bypass shouldb e the first option. However if a new bridge is to be built anyway your option west of existing bridge will do in the meantime	Within the bew beidge planning something must be done abut the roundabouts trucks have to manoevre to get south / north. Very dangerous	SH1 between Blen and picton needs more passing lanes	the existing bridge must be kept for bikes and pedestrians. The type of bridge is iconic and we have lost too many historic structures in Marlborough.
The projects is a good idea but a unless bypass is not made first it may never happen once the bridge is built	no comments	Yes. A bypass first to get heavy traffic out of blenheim eg Grove rd	Also th ebypass wont many any difference to people stopping to shop or eat in Blenheim CBD as if they want to do they will take the existing bridge
That the bridge needs upgrading but if a bypass was done this would solve the problem	just make is safe with a bypass done. It is capable of serving for some more years.	If the big frustrated and in a hurry ferry and industrial traffic was able to get through blenheim quickly and safely the traffic wanting to shop or ear would be able to do just that. Get on with a bypuss now. Put a big clear sign at the beginning of the bypass 'Welcome to Marlborough City.'	No comments
Looks like a good option to service blenheim for general trafic the only problem heavy and agicultureal / vineyard machinery will still have to travel through Grove Rd / Main St		I believe hacy transport truck and agricultral / vineyard machinery needs to be dierted off SH1 at the intersection of lower wairau rd and SH1. The aproximated distance of 3/400m	With the T intersection would give truck drivers the vision and time to cross sh1 to avoid traffic travelling on SH1 relitibaly safely. From my experience going through Blenheim with vineyard / agricultral equipment is not a goin option for safety and incovenience to other traffic reasons. it is a relatively short distance to construct a new road and bridge SE of blenheim avoiding urban traffic.
Not. No. One priority. 'The bridge'. The Bypass essential. Now. With railway station moved to lower wairau Rd at the same time. Down vickerman st to riverlands. Now	no comments	No comments	Railway station with undercover for passengers and huge car park at Lower wairau rd. Also beginning of bypass out to riverlands. Huge persepts. Wine glass - 20ft high with lights showing wine - red and white also bunch of grapes down side of glass. Lighs in each grape. red & white. Thats marlborough - bypass - wine - railway station - out of town.
Put in the bypass			put in the bypass down vickermasn st starting out the roundabout at Spring creek and then across the Opawa bridge on to Wither.
Good option - make sense	modern, cost effective, nothing fancy	No comments	the bypass must remain a future option, absolutely. Traffic management of Grove raod may need improvement as a new bridge wil increase speed on this road
Replacement of the existing bridge does not cure the traffic flow problems through the town. A bypass is needed to improve traffic flows through to Christchurch and or south	no comments	the existing bridge is suitable for local traffic. Removing the large trucks by diverting them onto a bypass would releive stress on the existing bridge.	Save the money that would be spent on the bridge replacement to build the bypass which will be required at sime time - preferably now
No comments	no comments	a bypass. We need it. Two places to start bypass. Spring creek on east side of rail line as surplus land beside rail. Would also sort out spring creek main road troubles. Other place to start bypass is by the rail way. would stop of wairau road as a lot of spare land to shart to cross the rail line.	
I think it's the best possible answer at this stage. I lived in grovetown for years I have crossed the bridge daily the congestion has rapidly got worse, also believe a lot had been done in landscaping that entry to town to bridge detracts from that	Mainly that it is wide enough for the big trucks to pass (and the trucks smeem to be getting bigger every year!)	We all notice the push for a bypass which is a great concept but we also need this bridge asap. Bypass later if fear someone is going to lose their life, through frustration possibly within the next two years	Would like to see a digital or 3d ic of the proposed bridge to get an idea of what it would look like in the surroundings, great idea to use it as a cycleway etc for future use

A waste of time. Blenheim requires a bypass. It appears no new rail ferrys are in the pipeline. Heavy traffic will increase excerabating the problem experiences in grove rd	we need a bypass	yes the bypass which would solve the present problem. The cost of a byass, the 17.5 million spent on a bridge could co a long way to build a bypass. It's the putting righ that counts	with an increase of road traffic the bridge will not solve the present problem. Pundits say it will cost blenheim in people stopping in our town. If they are travelling off or onto the ferry they want to get to their destination firstly and not stop here
Waste of time. Put a bypass in to by pass blenheim all together. Anyone that would like to come to blen can, the rest by pass	waste of time and money	by pass to riverlands. Keeping trucks out of town	put the money in to something that is going to work and do not stuff things up like you do. A bypass is what is needed and will solve the problem.
It is overkill. A bypass will be built sooner or later like many other places. Should have been built when cillfor bay project was canned.	the current bridge is colourful. Reinforce and strengthen the pier in question. Double the earthquake protection. As per the original ides, build a single lane, northbound lane on to the bridge more or less like the bridge now. In a world of increasing sameness the 100yr old well design bridge is a point of difference that is a real asset to Marlborough and would make a remember able' entrance to here. Tourism is increasingly important. (a redundant bridge is a gloomy look.)		
The bridge is a bottle neck for heavy traffic		I believe a bypass is more important the roundabouts are a major problem for heavy trucks. It would give an optional routh during grape harvest, reducing spills. The ferry through traffic will increase over time. I have come into main st in the evenings many times with traffic stacked back to stuart st caused by trucks stuck at the main st roundabout.	
While I would support the nzta preferred option, if the opwaw bridge is to be replaces I would much prefer the time and money (to be spent on a new bridge) be spent on a bypass to the east of blenheim. So eleminating the passage of freight trucks etc into town.			
the present bridge has the effect of traffic calming on to this section of road. As far as I know there has never been a major accident on the bridge. I think putting faster traffic onto grove rd is likely to cause more problems.	only plan for a bypass	the only solution to the traffic problems on Grove rd and main st is to divert through traffic especially heavy goods vehicles around town by way of a bypass	The opawa bridge project should be delayed until the bypass can be built.
It sounds as if the Opawa bridge needs replacing for a variety of reasons. However it will not improve the traffic flow in town, apart from removing the congestion at that particular bottleneck	nill to add	the main problem concerting locals in the heavy through traffic (both HGV's cars and campervans) that travel through town, making Grove Rd/Main St an almost 'no go' area. Very few of the vehicles actually stop in Blenheim. The numerous roundabouts make it even worse.	Not only is there a lot of traffic in this area, but vehicles also use Alabama Rd/New Renwick Road/Batty's roas to 'by pass' through Blenheim from SH1 (from the South) through to Renwick/Nelson. This thould be take into consideration. What is required is a bypass. This is required now, not 10-20 years down the line.
The usual cheap expediant short term option. Far better to wait accumulate extra $$ and do the job correctly and just once!	Same as seddon Awatere River Bridge	It is convenient to say prefered option is best! It isn't! I does not fit genuany fit this criteris you are simply compownding a serious existing problem. Not solving it.	A complete bypass unhindered by rail or town traffic. Other towns achieve this. Whangari, taup, Wanganui, Waipu etc. Get real, no more half measures.
Not suitable. Keep the existing bridge and construct an additional bridge parallel to this using the new bridge as an exit lane and the old bridge as the entry lane. (I mean Parallel - side by side)	no	Most importantly and before we conside wasting time and money on a bridge... we the residents of Blenheim are demanding a bypass Spring creek to Reiverlands. We are really annyed and cannot understand why our district Council and transport agency are delaying. This is usrgent now, er are sick of the 9 axle trucks and Ni-Si freight and Ferry users constipating our residential roads and intersections and polluting our town. We pay or rates and traxes and we pay your sallaries. Pull finger now!	

Not in favour	N/A leave it as it is for now	a bypass is required now. Do the bridge later.	A bypas is going to be needed in the future and will cost a lot more at a later sate. Do it now and attend to the bridge later. It's structue is not that serious and it does work. Remove the buge through trucks direct to riverlands or something.
Every town should have a bypass. The road into Blenheim, is the main line from north to south on NZ therefore I think it would be more sense. IE build a bypass in the future rather than an expensie bridge. The bypass should come to 'the truck stop' riverlands	no comments	No comments	No comments
No to all options. A waste of money	no comments	We need a bypass that takes traffic south of blenheim so it does not have to use the roundabout on Main St	a road toll installed for all traffic using no.1 highway at 70km sign entering sth Blenheim and at Wairau River bridge on Highway 1 also for traffic travelling south.
Option is good but I don't support it so don't use that but is a start	something that doesn't look tatty with age.	It would be a wate of tax payer funds to not build a bypass NOW not later. Take the trucks off the bridge and it will suffice for years to come. Two bridges aren't necessary.	Don't know where you get your figure of 70% increased thruput! Trucks on HWY1 don't hold up Picton Ferry traffic as they drive too quickly now and is a red herring in your arument no traffic flow. Taking the trucks off the bridge will do that. It worked for richmond brightwater, stoke so why not here
Traffic is getting bigger and heavier so a bypass at blenheim town is necessary in the future so why not start to plan for it now. Building a new bridge will not lessen the traffic along grove road or the roundabouts and railway crossing heavy traffic is not going to stop in the town so why not let it pass on way to picton ferry or Christchurch	no comments	the bridge is an icon and should be kept and there has been big floods over later years.	There hasn't been any tragic or serious accident' over the recent past years. It slows the traffic doen and the hold ups occure in other places, where they are working on the roads anyway. Keep the bridge as is and start the plans for the bypass or bridge
That govt and mDC are releiving the bottleneck on the Opawa bridge but you are not releiveing the congetion through blenheim but are adding to it especially with Kiwi rail there as well	no comments	SH6 should be directed onto Rapaura road that is to and from Nelson area. Ideally SH63 should have been the same. Not enough forethought is put into roading matters.	Of course a new bridge is needed to replace the existing one over the Opawa at some stage. There have been a number of fatalities on rail crossings in Blenheim
Ludicrous. The 'preferred option' smacks of decisions being made without asking Marlborough before what heir preference is. Possibly a cheap option but certainly not the best option	n/a	Go for the diversion from Grovetown to Riverlands. Do it once do it correctly. It will have to be done one day of that there is no doubt. Do it now.	Further public consulation
Will launching increasing volumns of oversized rigs into a congested Grove Rd/Main st/ Three roundsabout region improve the efficiency of SH1? I think Not.	Simple and efficient with no expensice add ons or distracting extras.	A by-pass from aberhats road to Malthours road would facilitate speedy travel for travellers going south or north. And free the present rout for local traffic. Less pollution, less time wasting and safer for locals.	Bring a bit of intelligency to the table so we don't become congested like auckland
Consider a bypass through blenheim	to widen the shoulder to 1.8m for ride cycle and scotter a safer margin due to the trucks boat trailers and camper vans passing by	No comments	retain the old bridge for walking and biiking. An underpass to safely access the cycle trail
I find the prefered NZ transport option short sighted and leading to other problems.	if a new bridge has to be build now it should be plain and functional	the only option worth considering is removing heavy traffic from the bridge and bypassing Blenheim by way of lower Wairau rd, Vickerman st a culvert of roses overflow along swamp road to the confluence with Dillons Pt Rd a new road to the river then a bridge leading to the main road	it is irrational to speed up traffic with a new bridge that disgorges onto an over crowded gridlocked grove road then on the just as crowded main st. the only way to speed up south bound traffic is to bypass this area.
it does not effective address the safety issues on the section of SH1 passing through blenheim. This proposal is not my preferred option	I would like to see a 4 lane bridge build on a diversion east of the present route of SH1	I would like to know why public optionon the project was not sought until the transport agency had decided on their prered option wich is now unlikey to be changed no matter what the local residents pefer.	Save/stop anymore expenditure on the proposal. Install traffic lights (as was done on the Awatere road rail bridge make the present Opawa bridge one-way/ This will effectively halve the weight on the structure. Should the present bridge fail there is an alternative route already available. the traffic lights would cause no more delays to road traffic than those used at road works. DO the diversion and new bridge now (as soon as possible and eliminate the hazards on SH1 though Blenheim as well.
It is a temporary solution to a New Zealand Transport system. We are carrying freight from Auckland to Dunedin. Build the bypass nad let those who want to shop in Blenheim visit us.	Build the bypass and think about the futre now1 Take the congestion out of Blenheim	Go for Grovetown to riverlands Bypass	Large shopping malls out of town create urbanisation and therefore more infrastrucutre at the rate payers expense
Exsiting bridge is adequate for the present and replacement would not solve traffic delays through the town.	build a bypass to releive strass on the existing bridge and prove traffic flows for through traffic.	No comments	No comments

As a truck driver from the north island this option doesn't solve the existing issues for traffic floes. A bypass is by far the best option which will still be neede in the future	no comments	No comments	No comments
It is a short term solution that does not reduce the increasing heavy vehicle routh through grove rd. Heavy vehicle traffic will increase and create congestion on grove rd	no comments	Option II: construct a blenheim bypass for through traffic show detail of where the opwaw river splits into two downstream. Plrease provide a may of bypass route	a complete bypass on the eaterd edge of the blenhei urgan area providing a new link for the picton to christchurch route
Well researched - go for it	graceful - complimentary to river and future proofed	no	no
Save the funds and add them to the bypass project	survey just haw many vehicles from SH1 north want to travel directly south and how may on the1 south travelling north don't require to stop in Blenheim	in the eent of a new bridge why add north / south cyclie widths on 1.5m when the existing opwaw bridge is being targeted for cyclists and pedestrians.	te waiting time at each end of existing bridge in no more than waiting for traffic lights (whats the problem) the bridge is not th eproblem! It's a portion of the driving public that are the problem (be it only a small problem)
Ok but having cycles on the new bridge duplicates cycles on the old. If the old bridge is suited (structurally etc) for cycling, delete cyclist from the new bridge for safety. Incorperae off road truck load checking lanes N&S ends	Perhaps the use of natural stone beings on concrete pillars (schist eg) to reflect the natural local environment	a future town bypass is essential	The current bridge acts as a natural 'chicane'. The new bridge being faster will increase traffic / cars and longer traffic queues (refer queuing theory) will form at the railway station roundabout and cause congestion. You should consider the bigger picture (new) of traffic/cars from springcreek through to Main st affected by the current bridge proposal. I believe this is known in traffic lingo as 'induced demand' Safety issue of people jumping off the bridge
We agree with NZTAs prefered option as outlined at the information session	a deisgn sympatheic to the historic bridge (asthically)	No comments	easy and safe for cyclist and pedestrians particularly on the south approach
No comments	no comments	No comments	The existing bridge must be incorporated as a community asset. The awatere bridge has been largely sidelined and worse still the wooden s Shaped railway bridge over the grey ricer was demolished. One of only two in the world. Vandalism!
Good opinion - looks as though it will elimiate blind spost at the approaches	A simple structure that allows an unobstructed view (like the new awatere bridge) and unimpeded passage (ie does not prove a hazard to side mirrors)	no	no
yes something needs done with that bridge. Not sure a new 2 lane bridge is the best option	Could the old bridge not be strengthened and used as a single lane bridge (one way) and the new bridge as the other lane.	What other options are there except to bypass all heavy traffic out of the area.	This bridge is a small part of a bigger problem, traffic heading north and south getting slowed down in very congested Blenheim main streets. This traffic needs by passed out of town saving the national economy millions of dollars
Replacing the old bridge is a fantasic idea. Long over due. Traffic needs to be albe to flow better. Im very please that the old bridge will be kept but happy a new 2 lane bridge is going ahead	the think the new bridge should have low side rails to the view can be kept the same. Less damage to the environment the better	I stongly believe the bypass route east of blenheim is till needed as all the heavy trucks make our town roads horrible to drive on. As as we how have 3 roundabouts on grove road it just slows the flow of traffic	the roundabout where the train tracks are needs to be changed. I think its the worst roundabout in NZ. I'm surprised there hasn't been more accidents or death for that matter
Not a good ides	no comments	No comments	We need a bypass. Need cameras in Mayors office so he can see the amount of traffic and trucks on grove rd
No comments	no comments	No comments	Provision of a safe method for cyclists and pedestians to cross grove road to access cycle path
Not a good ioption. Put the bridge money into a bypass road. Now as it will never be cheaper. It should have been back in 1948 when the then Marlb County Engineer pushed for it. A bypass road is not a want it is a need	Leave the bridge alone! Consentrate on the bypass	a bypass is the only option to take all through traffic and heavy out of the obsitcale course called grove road with those 3 crazy roundabouts that don't work. A bridge will only compound these trouble spots	Keep thinking talking etc Bypass road. Every other thinking town and city in the South Island has a by pass road.
Putting the cart before the horse. Pleaqse aske the public what they pefer. Cheapest option not the correct option.	wat of time until decision to go ahead is made.	do it one and do it right. Dunedin grovetown to Riverlands is the only real option. Get the traffic off Frove road	Talk to the people who want. The locals.

No comments	no comments		Having read your reasons for replacing the old Opawa bridge in Blenheim in cant find the logic in it, there is no way that it is going to crease the flow rate thow Blenheim as once you are over the bridge you have to negotiate along Grove road, around three roundabouts through town before you are on the main road south. Grove road gets a tail back now when a stream of ferry traffic hits town putting in a new bridge is only going to increase the tail back as nobody will have to slow down or wait like they have to with the existing bridge if you do put in a new bridge then you are going to have to put another roundabout at the junction of Bridge St and Grove Road as at the moment it is nigh imposable to turn right on to Grove rd when ferry traffic comes through as budge st is the only access to town for all these streets, endeavour st, collett place , shirtliff st, Elizabeth st, Gascoigne st, Gardiner st, Henderson st Lucas st, holdaway st, turner place, bristol land and Creswell lane. Also budge st has Marlborough Polytechnic and a wine research centre in it so if you put in a new roundabout to let these people in our out of bridge st which I think you will have to do as the tail back will probably reach budge st with a faster flow over the brew bridge then you are going to slow the traffic flow through Blenheim even more. You also say that you get long tails of traffic from the ferries behind trucks making travelling time unreliable to me the obvious solution to this is divert the trucks by putting a bypass around Blenheim which I am sure that the truck drivers would like and also the people that didn't need to driver through Blenheim would like also, then you could say that you have make traveling times and journeys a lot more reliable which you could not say if you put in a new bridge, which to me would be a waste of money with no benefit what so ever. And by putting in a bypass you would take a lot of pressure off the old bridge which could then maybe last another hundred years.
Not good enough. The alternation needs to include the deletion of the roundabout on SH1 as it is a lober obstival to slowing traffic than the narrowness of the bridge	Similar construction to the bridge now over the Awatere	Hopefully the pricing will be more accurate than that presented for the theatre	See attached drawing
Wrong!! First identify the proble, ie large vehicles (trucks) using roads built for horse traffic the bridge is only a small part of the proble.	wrong place. Built it at the end of malthouse road as part of the bypass which would remove 80% of the proble.	Bypass first - bridge later	ERRORS. 1 The Opawa river does not collect runoff from heavy rain on the hills. Any flood water is reduced by the effect of Roses Overflow. There has not been a flood going under the bridge for say, 40 years. This can be confirmed by records at the Camping ground. How many times have they evacuated campers from the banks of the river and moved them over the stopbank? Climate change makes a flood very unlikely in future. 2. Earthquakes. The bridge has stood up to the Inangahua, Murchison and several Seddon quakes. If it damaged by a monster quake it will be the last of the worries of those few people left. Truck drivers working the Nelson/Christchurch and return route have devised their own (Southern) bypass to avoid the delay and confusion of Blenheim streets. From Rapaura road shift over to New Renwick Rd and use Alabama Rd to join Highway 1 at Butter Factory corner. Road alteration at this corner makes it easy to do so. If the Eastern bypass was operating these trucks could continue down Rapaura Rd to join Highway 1 at Spring Creek and keep more trucks of the southern Blenheim streets. SOLUTION . Use mostly already formed roads, from north to south. Leave highway 1 at either Aberharts Rd or Lower Wairau Rd to join Vickerman Street. Bridge Roses Overflow, (which is a floodway) at Swamp Rd create a new road which would roughly follow the pillons of the electric power supply. Use the money allocated for the Grove Rd bridge to build new bridge over the Opawa River to join Malthouse Road, which leads back to Highway 1. A delay on possible work on Welds Pass is acceptable. DO IT RIGHT THE FIRST TIME.
A bypass east starting at the nth end of the opawa bridge would be better as a new bridge would not help the congestion on Grove Rd - main st area at peak traffic time as at present this would get heavy vehicle off the bridge and extend it's life	no comments	No comments	a bypass east starting at the nth end of Opawa river and following the briver band around to roases overflow (culvert here) and onto sh1 just norh of riverlands (a short bridge over opawa here)

This is not NZTA policy. It is not in blenheim or the national interests priority to build the opawa bridge replacement before the grovetown riverlands bypass is intalled	too soon for this. Leave it to another agency to do the final touches after the fast tracked grovetown/riverlands bypass has been settled into place	NO! your other comments avout flyovers in Kaikoura and amberley and new hotels and scholls in blenheim are outside your frief. Including th railway / taylor flyovers	just get priorities back to order being on the bypass. To give the Opawa bridge priority in the NZ transit policy for the NZ infrastructure is another 'STEP TOO FAR" in the development of Blenheim. The local Blenheim Transit agents have a hidden agenda. It has always been transits policy to use bypasses, shorten routs between destinations rather than enter towns, they have had a history to avoid as many flyovers as possible. All construction by remain in the National Interest. The Spring Creek or Grovetown bypass to Riverlands must come first in the National Interest. The Wairau river bridge neds four lanes addressed in the not too distant future. Priorities! The National interest in Blenheim's interest. Not many homes or vineyards need be affected. The pressure of heavy, through traffic, requiring direct access fro Picton/Christchurch in the tourist industry alone, needs fast tracking instead of giving Opawa bridge, plus the Railway Station Flyover and another Taylor River Bridge priority with a lead time of two years to commence. Fast track the grove town / Riverlands bypass now! Please! Marlborough City needs more room to expand! A new Opawa bridge now and flyovers at this stage will cramp the unique style Blenheim is renowned for. What is best for NZ is best for Blenheim NO more red herring ides to stall or change well planned roading. Fast track it!
The Opawa bridge at present time in inadwuate for the volume of traffic and the size of larger trucks and trailers and tour busses using SH1. This causes traffic james along grove road to the roundabout on Main St and Redwood St	The new bridge needs to be adequate to take the heavy traffic and have clear approached	to improve the situation there needs to be a bypass from riverlands to Spring Creek/Grovetown this needs to be fast tracked so that the current state of the Groveroad area would be helped and improved. DELAY THE BRIDGE OPTION and reassess the need after the bypass has gone through. This wil lnot stop the traveler who wants to come into Blenhei. The Bypass will alow for the larger vehicle to have a straight path through.	Blenheim is a lovely place I have lived here all my life and have seen the town change and grow for the better. Marlborough is a destination for many visitors who want to relax and enjoy the unique town, scenery and places of interest. Be it enjoying wine dining out shopping sporting events etc. There is a need to expand and extend our wonderful facilities the new theatre clubs of Marlborough, the Marlborough Lines Stadium etc are wonderful facilities. Town planners please when you are considering and planning new facilities please think outside the square and any new buildings please put in a place where there is room to park, have garden setting. The town will expand and in the future allow us to have a lovely spacious garden city of Marlborough where there is space to breath the pure air enjoy the views and the clear blue skies and relax in a beaufity bountifuyl Marlborough. Please don't squeexe evry new building into the entre of town. Expand and breath.
No comments	No comments	No comments	The marlborough landscape group advises the Marlborough District Council on how to enhance and protect Marlborough's Landspace. We include representative from the wine induatry, forstry , farming and envirionmental groups. The landspace group was set up in 202 after community concern about the rapid increase in vineyards and loss of wetlands, shelterbests and historic trees. in the pas decase our focus hass been broadeded to also unclude hillside houseing development, foresty harvesting and urban planting projects. Initial throughs on the Opawa Bridge proposal: - This is a grand entrance into Blenheim and wee seek a leady and vegetative welcome rather than hard strutcures. - On the norther approach, put powerlines undergroudn to improve amenity and enable more scope for trees - Tie in with the Landscape groups planting enhancement project along Grove Rd. Continue the theme of natives featureing Marlborough rock daises (NZTA planting around Awatere Bridge approaches provide a good template) - It is regrettable that a number of handome estabisted trees will be lost with the realigned state highway. Please retain as many as possible and repland where appropriate. - Plant along the edge river channel with low riparian natives (taking into account floodway requirements). Co-ordiunate with MDC Rivers department - Continue planting north of the bridge to beautify the strip between SH1 and the railway line - consider qa theme such as lavender or Marlborough road daisies - We suppport retaining and using the historic bridge for cycliss and pedestians. Marlborough Landscpae group members offer a wealth of local experience and we would like to be included in NZTA planning for landscaping the approached to the old and new bridge

No comments	No comments	No comments	This letter outlines Bike Walk Marlborough (BWM) feedback on the Opawa Bridge replacement for the consultation process. Bike Walk Marlborough (BWM) was formed in 2005 by Marlborough Roads and Marlborough District Council. BWM is responsible for promoting cycling and walking and locating and facilitating various walking, running, and bikine routes around Marlborough. As such Bike Walk Marlborough Trust haf been involved in the development of off-road cycle tracks that include: Rtveriands and Ben Morven trail, the extension of Taylor River trail, and the Blenheim to Grovetown shared pathway. Crossing SH1 Our first concern is that cyclists and pedestrians (heading northbound) wishing to use the Grovetown Shared Pathway must cross Grove Road/SH1 prior to crossing the Opawa Bridge. The NZTA options outlined do not address this issue, including the preferred option. With the Grovetown to Spring Creek ($1 million dollar project) currently underway, it is paramount that these Opawa Bridge issues are addressed. Failure to solve these issues will undermine the project and the aim of providing a more efficient and integrated transport network. Generally, competitive cyclists prefer to use the Opawa Bridge rather than the shared pathway as it provides a direct route for travel. Therefore we recommend that cycle lanes are included on the new Opawa Bridge (heading northbound). Heading across the bridge (southbound), these competitive cyclists would prefer a cycle lane on the bridge, however if this is not possible a connection to the old Opawa bridge shared pathway would suffice. The width of the Awatere Bridge is sufficient for cyclists (1.8m shoulder on both sides) and we would suggest replicating this design in the future. In comparison, the majority of commuter/recreational riders and pedestrians generally use the Grovetown Shared Pathway beginning from the Opawa Bridge. While some cyclists choose to navigate through heavy traffic or use the pedestrian refuge (near Budge Street), this requires them to cycle illegally on the footpath to access the shared pathway which puts both cyclist and pedestrian safety at risk due to high motor vehicle volumes. Cyclists need to be provided with a seamless, safe and direct alternative. Grove Road Safety Crossing Grove Road has been a huge concern for Riversdale residents and Mayfield, Bohally and Marlborough Girls College School students. This has been a reoccurring issue that has been discussed in the "Issues around Schools meeting' with Steve James (Marlborough Roads), Jennifer Buck (NZ Police Safety Officer), Robyn Blackburn (Marlborough District Council Road Safety Coordinator), and Braden Prideaux (Bike Walk Marlborough Coordinator). It can be expected this safety issue on Grove Road will be exacerbated by the development of Lansdowne Park. Therefore an alternative transport route needs to be provided that will help rectify this issue. Possible Solutions
No comments	No comments	No comments	In regard to your ratepayer mailing concerning the Opawa Bridge, I submit:- 1. The bridge should not be replaced at present. 2. As a matter of urgency, a permanent Blenheim bypass built to motorway standard, should be developed at some point south of the Wairau River, cross the existing rail and road routes in a south-easterly direction and rejoin State Highway 1 in the vicinity of Riverlands 3. While this motorway is being built, southbound buses, heavy trucks, plant and equipment should continue to use a one-way existing bridge. However northbound, these categories of vehicles should be routed over a temporary Bailey-type bridge, to rejoin State Highway 1 at some point north of the existing bridge 4. I accept that the northbound detour will probably need to begin in the Alabama : and use the existing roading network to access the temporary bridge. A portion of road user and other charges incurred by these vehicles should be rebated as compensation for delays/inconvenience occasioned by the failure of Marlborough Roads and/or the Government to recognise the developing Opawa Bridge problem over the last 20 years. The Kapiti Coast motorway presently under high speed construction north of Wellington is a classic example of the failure of central and local government respond to the inexorable growth of road transport in New Zealand. 5. Planning of the Blenheim bypass should reflect the inevitable reversion of the southern terminal of the interisland ferry service to Christchurch (the destination and origin of much of the freight presently destroying the Marlborough component of State Highway 1). The Marlborough District Council should promote this reversion. 6. While the tragedy of the Christchurch earthquakes cannot be over-emphasied, it sobering to reflect on the dynamic changes they have wrought in local and central government decision-making. Hopefully, it will not require a mid-bridge, multi-fatal collision and fire of a coachload of foreign tourists to lend the Blenheim bypass project the sense of urgency it deserves.

No comments	No comments	No comments	SUBMISSION OF HERITAGE NEW ZEALAND POUHERE TAONGA ON THE OPAWA BRIDGE REPLACEMENT 1. Heritage New Zealand Pouhere Taonga (Heritage New Zealand) is an autonomous Crown Entity with statutory responsibility under the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA) for the identification, protection, preservation and conservation of New Zealand's historical and cultural heritage. Heritage New Zealand is New Zealand's lead historic heritage agency. 2. Heritage New Zealand supports the preferred option to create a new two-lane bridge to the west of the existing bridge for vehicular traffic, with pedestrians and cyclists using the existing bridge. However, Heritage New Zealand considers that there is a significant risk that the existing bridge will be allowed to decay, and so we would prefer to see more commitment in the proposals to ensuring that this does not occur. Significance of Opawa Bridge 3. The Opawa River Bridge is listed as a Category 1 Historic Place on the New Zealand Heritage List / Rarangi Korero. Construction began in 1915, but due to the War, it was not completed until 1917. The Bridge was one of the first bowstring arch bridges in reinforced concrete to be built in New Zealand. It's bold arches give it an overall rhythmic architecural elegence, different from the later, more refined, bowstring arch bridges. The Bridge remains an important part of State Highway 1 in the South Island. 4. The Bridge is also important for its rarity as a Category 1 item, being one of only three in Blenheim. The HNZPTA, section 65(4)(i), defines Category 1 historic places as having "special or outstanding historic or cultural heritage significance or value". As the highest level of recognition of heritage value in New Zealand, it is a category used to denote places that are key contributors to New Zealand's national story. In demonstrating the translation of engineering and design techniques from abroad into the New Zealand environment, the bridge also has a statement to make in the global cultural heritage narrative. Its long-term conservation therefore warrants the most serious consideration. Assessment of Potential Proposal Impacts 5. The Opawa Bridge is a significant local landmark and acts as a gateway to Blenheim when approaching from the north. Using the Bridge for pedestrian and bicycle traffic does retain this gateway effect, although it is diminished. Having the new bridge to the west is also preferable for maintaining the gateway effect. Vehicles approaching form the north will be given a less obstructed view of the Opawa Bridge, and cyclists approaching from the north on the road will not have to cross traffic. 6. The main concern Heritage New Zealand has with the proposal is that there does not appear to be a commitment to the ongoing maintenance of the existing Opawa Bridge. The obvious issue is that the Bridge may be allowed to decay until it is dilapidated or severely damaged due to liquefaction or scouring. The Bridge could then be removed or closed and all traffic
No comments	No comments	No comments	Scrap it and build a bypass

No comments	No comments	No comments	Do not accept your early investigation Opawa Bridge Replacement - May 2016 Problem 2 The bridge has poor structural resilience, Bridge susceptible to floods, (most bridges are built over rivers) In my lifetime and 35 years supervision of this bridge for the National Road Board (TNZ) I have never known the bridge to have debris build-up or scouring around the piers. The river is short in length, and is a spring fed stream, and at times after heavy rain, the runoffs being channelled into the river. The river flooded Dillons Point area in 1966, caused by the river backup, not allowing it to discharge into the flooded Taylor River. Bridge Structure Earthquakes The bridge was built approx. 1915 in the days of when concrete was mixed on a board with shovels. Some of the modern bridges built recently would have more cracks in them than this bridge, also this bridge has stood up to many earthquakes in its 100 years history. I inspected all the structures of all bridges in Marlborough, Kaikoura and State Highways. In 1967 a large earthquake occurred and following that I completed a thorough inspection of all bridges and found none to have suffered any damage. Whilst I was foreman for Wilkins & Davies Co.Ltd I built 2 bridges in Blenheim Central. The foundation was piles, driven to bearing and the liquefaction was plentiful. If this could cause the bridge to collapse then nothing would stop the recent Taylor Bridge in Grove Road (SH1) also to collapse as they would be on the same or similar foundation strata. Question 1 Construct the TRUCK BY-PASS and make the journey times more reliable. Question 2 Consider TRUCK BY-PASS with bridge constructed as the existing Tayior River Bridge vn Grove Road (SH1) (28- 1 - 1984) Question 3 Refer to statement provided on proposal - 1 - Mooted BY-Pass 1985 2 - Make sure freight moves efficiently, and delays in congestive traffic in Grove Road. (SH1) also the Rail-Crossing in the town centre. 3 - Make the Highway region more resilient to natural disasters. A BY-Pass would eliminate Christchurch's experience of water pipes, sewer mains, concrete structures etc. failing. This would be avoided in a BY-Pass is constructed and the repairs to the pavement would be much more simple.
No comments	No comments	No comments	Opawa Bridge Replacement: Submission: On behalf of the Reserves team at Marlborough District Council. There is currently Public access along the Eastern side of the Opawa River as outlined in the map below; the map also shows a pink hatched area which indicated (Reserves Esplande Future land Management) This would provide the opportunity to extend the Opawa Walkway under the existing and proposed Opawa Bridge. This extended walkwsy would provide a safer conveyance for the public and school childred of Mayfair Primary from the wastern side of the State Highway
Write up in the Marlborough Express May 5, 1992 if it had been done then imagine how much cost it would have saved. I would now prefer a bypass from Aberhards Road to Riverlands	2 Lane with the western side like the existing bridge design	Leave the existing bridge as inwards traffic to Blenheim asnd the new 2 land bridge for traffic leaving Blenheim. Then if the existing bridge becomes undafe you will still have a 2 lane bridge	Many thanks for a good display and listening to the public I hope the construction can start before 2018
Construct the TRUCK BY-PASS and make the journey times more reliable	Consider TRUCK BY-PASS with bridge constructed as the existing Taylor River Bridge in Grove Road (SH1) (28-2-1984)	Mooted BY-Pass 1985	To address the BY-PASS options would outweigh problems that Blenheim currently experiences in traffic congestion

APPENDIX E – KEY STAKEHOLDERS FEEDBACK

The Manager
Marlborough Roads
PO Box 1031
Blenheim 7240

Dear Frank

SH1 Opawa River Bridge Replacement

The Council of the Marlborough District of the NZ Automobile Association has pleasure in advising full support for the construction of a new bridge across the Opawa River as set out in your various consultative media.

Key factors considered are location, deck width, structural design (particularly in respect of seismic and flood risk) geometrics (in this sensitive speed environment), passage of vulnerable users.

At the strategic level, we are particularly conscious of the need to have a robust and resilient link to the north for vehicular access, freight and particularly as a lifeline to Picton and the eastern Sounds. In the event of a major seismic incident, the Marlborough community will be obliged to 'look after ourselves' for some time as there will be significant commitment of resources to the Wellington region. We must have robust access.

Other Matters

SH1 Eastern Bypass
While the Association is supportive of an eastern bypass in principle we note

- It is a completely separate issue to the replacement of the Opawa Bridge which, as noted, stands on its own investment merits.
- We endorse an overview of the business case for the Eastern Bypass as a prudent measure in the context of the current debate. However we suspect a BCR > 1 is unlikely.

Network Priorities
We take this opportunity to restate our priority road projects as we have previously shared with your Journey Manager. In particular, we believe the following projects have much greater priority than the SH1 Eastern Bypass;

- SH1 Pukapuka Bridge to Dazzle Corner reconstruction
- SH1 Wairau Bridge replacement (seismic and scour resilience; this is a key lifeline link)
- SH1 Spring Creek Intersection: Improvements based on conventional design practices as warranted by recent crash characteristics
- SH6 Pelorus Bridge Replacement, (susceptible to vehicular impact and seismic risk. Key lifeline to western Sounds in a major event; Whangamoas/Rai likely to close)

Consultation
Whilst most appreciative of the opportunity for this consultation we note:

- There appears to be considerable investment of time and cost in this Opawa project which has been in the public arena since the 1960's and has never been an issue of public contention
- In contrast, the decision to not proceed with the Wairau Bridge has been provided relatively negligible consultation / information. It appears that the decision was made on maintenance grounds; strategic and resilience matters not considered. We understood that the Minister instructed a package of work under this regional programme. We can understand a full evaluation to ensure we are provided with the best value bridge replacement but not as a basis to not follow a policy directive
- The current Spring Creek intersection re-design, as recently notified, retains some issues of significant concern to our Council and our colleagues in the trucking industry. Again, we would appreciate a level of consultation consistent with the intricacies and challenges presented by this project. Irrespective of our well researched views, it will be the response of the ordinary motorist which will determine the safety, efficiency and credibility of our combined effort.

Marlborough Landscape Group

Feedback to NZTA: Opawa Bridge Proposal
June 2016

The Marlborough Landscape Group advises the Marlborough District Council on how to enhance and protect Marlborough's landscape. We include representatives from the wine industry, forestry, farming and environmental groups.

The Landscape Group was set up in 2002 after community concern about the rapid increase in vineyards and loss of wetlands, shelterbelts and historic trees. In the past decade our focus has broadened to also include hillside housing development, forestry harvesting and urban planting projects.

Initial thoughts on the Opawa Bridge proposal:

- This is a grand entrance into Blenheim and we seek a leafy and vegetative welcome rather than hard structures
- On northern approach, put powerlines underground to improve amenity and enable more scope for trees
- Tie in with the Landscape Group's planting enhancement project along Grove Road. Continue the theme of natives featuring Marlborough rock daisies. (NZTA plantings around the Awatere Bridge approaches provide a good template)
- It is regrettable that a number of handsome established trees will be lost with the realigned state highway. Please retain as many as possible and replant where appropriate.
- Plant along the edge river channel with low riparian natives (taking into account floodway requirements). Co-ordinate with MDC Rivers department
- Continue planting north of the bridge to beautify the strip between SH1 and the railway line – consider a theme such as lavender or Marlborough rock daisies
- We support retaining and using the historic bridge for cyclists and pedestrians

Marlborough Landscape Group members offer a wealth of local experience and we would like to be included in NZTA planning for landscaping the approaches to the old and new bridge.

Contact: Bev Doole
Marlborough Landscape Group co-ordinator
bev.doole@icloud.com T 03 570 5233

HERITAGE NEW ZEALAND
POUHERE TAONGA

1 June 2016

File ref: 33002-249

Marlborough Roads
PO Box 1031
Blenheim
7240

SUBMISSION OF HERITAGE NEW ZEALAND POUHERE TAONGA ON THE OPAWA BRIDGE REPLACEMENT

1. Heritage New Zealand Pouhere Taonga (Heritage New Zealand) is an autonomous Crown Entity with statutory responsibility under the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA) for the identification, protection, preservation and conservation of New Zealand's historical and cultural heritage. Heritage New Zealand is New Zealand's lead historic heritage agency.

2. Heritage New Zealand supports the preferred option to create a new two-lane bridge to the west of the existing bridge for vehicular traffic, with pedestrians and cyclists using the existing bridge. However, Heritage New Zealand considers that there is a significant risk that the existing bridge will be allowed to decay, and so we would prefer to see more commitment in the proposals to ensuring that this does not occur.

Significance of Opawa Bridge

3. The Opawa River Bridge is listed as a Category 1 Historic Place on the New Zealand Heritage List / Rārangi Kōrero. Construction began in 1915, but due to the War, it was not completed until 1917. The Bridge was one of the first bowstring arch bridges in reinforced concrete to be built in New Zealand. Its low bold arches give it an overall rhythmic architectural elegance, different from the later, more refined, bowstring arch bridges. The Bridge remains an important part of State Highway 1 in the South Island.

4. The Bridge is also important for its rarity as a Category 1 item, being one of only three in Blenheim. The HNZPTA, section 65(4)(i), defines Category 1 historic places as having "special or outstanding historic or cultural heritage significance or value". As the highest level of recognition of heritage value in New Zealand, it is a category used to denote places that are key contributors to New Zealand's national story. In demonstrating the translation of engineering and design techniques from abroad into the New Zealand environment, the bridge also has a statement to make in the global cultural heritage narrative. Its long-term conservation therefore warrants the most serious consideration.

Assessment of Potential Proposal Impacts

5. The Opawa Bridge is a significant local landmark and acts as a gateway to Blenheim when approaching from the north. Using the Bridge for pedestrian and bicycle traffic does retain this gateway effect, although it is diminished. Having the new bridge to the west is also preferable for maintaining the gateway effect. Vehicles approaching form the north will be given a less obstructed view of the Opawa Bridge, and cyclists approaching from the north on the road will not have to cross traffic.

6. The main concern Heritage New Zealand has with the proposal is that there does not appear to be a commitment to the ongoing maintenance of the existing Opawa Bridge. The obvious issue is

that the Bridge may be allowed to decay until it is dilapidated or severely damaged due to liquefaction or scouring. The Bridge could then be removed or closed and all traffic routed through the new bridge.

7. Heritage New Zealand notes that the preferred option would have shoulders wide enough for bicycle traffic, catering towards an eventuality where the Opawa Bridge is closed. The following language on page 3 of the summary document is also non-committal regarding keeping the existing bridge: "We *expect* to keep the existing bridge and will *continue to investigate* its future use as a pedestrian and cycle only facility" (emphasis added). Heritage New Zealand submits that a Category 1 Historic Place warrants a greater level of commitment to its retention and care. We recommend that a commitment is made to the on-going maintenance of the Bridge and to potential works to protect it from liquefaction and scouring.

8. Heritage New Zealand also considers that the design of any new bridge needs to be done in a way that preserves sight lines to the existing bridge, especially for those approaching from the north.

Conclusion

9. As discussed above, Opawa Bridge is one of just three places of special or outstanding national significance in Blenheim, and is one of the most significant of these. Heritage New Zealand is therefore of the view that the Bridge's active conservation will be a key contributor to the sustainability of Blenheim's and New Zealand's connection with the past.

10. Heritage New Zealand appreciates the opportunity to comment on this proposal, and we look forward to being involved in the Opawa Bridge Replacement process as it progresses.

Yours sincerely

Claire Craig
General Manager
Central Region
Heritage New Zealand Pouhere Taonga

Opawa Bridge Replacement:

Submission: On behalf of the Reserves team at Marlborough District Council.

There is currently Public access along the Eastern side of the Opawa River as outlined in the map below; the map also shows a pink hatched area which Indicates (Reserves Esplanade Future Land Management intention).

This would provide the opportunity to extend the Opawa Walkway under the existing and proposed Opawa Bridge. This extended walkway would provide a safer conveyance for the public and school children of Mayfair Primary from the eastern side of the State highway.

KEY:

- Esplanade
  - Future Land Management Intention
  - MDC Lease
  - Land Management Status
    - Esplanade Reserve
    - Esplanade Strip
    - MDC

MAP:

Mark Witehira

Reserves and Amenities, Planning Officer

MARLBOROUGH DISTRICT COUNCIL

Only Marlborough

Grovetown Shared Pathway beginning from the Opawa Bridge. While some cyclists choose to navigate through heavy traffic or use the pedestrian refuge (near Budge Street), this requires them to cycle illegally on the footpath to access the shared pathway which puts both cyclist and pedestrian safety at risk due to high motor vehicle volumes. Cyclists need to be provided with a seamless, safe and direct alternative.

Grove Road Safety

Crossing Grove Road has been a huge concern for Riversdale residents and Mayfield, Bohally, and Marlborough Girls' College School students. This has been a reoccurring issue that has been discussed in the 'Issues around Schools meeting' with Steve James (Marlborough Roads), Jennifer Buck (NZ Police Safety Officer), Robyn Blackburn (Marlborough District Council Road Safety Coordinator), and Braden Prideaux (Bike Walk Marlborough Coordinator). It can be expected this safety issue on Grove Road will be exacerbated by the development of Lansdowne Park. Therefore an alternative transport route needs to be provided that will help rectify this issue.

Possible Solutions

Bridge Underpass for cyclists and pedestrians (please see a diagram in appendix A)

An underpass used as a shared pathway would provide a safe alternative for both pedestrians and cyclists heading northbound and wishing to use the Grovetown Shared Pathway. Similarly cyclists and pedestrians wishing to cross Grove Road will take advantage of this off-road alternative. Bike Walk Marlborough suggests that NZTA engage OPUS to have cycling/pedestrian design input into this bridge and underpass to ensure we have specific engineering expertise and input.

Cycle Lanes

Bike Walk Marlborough also suggests that this bridge underpass (or similar solution) is supported by cycle lanes on both sides on Grove Road. Figures from the New Zealand Transport Agency, which uses incidents reported to police, show 91 crashes between car and cyclist in Marlborough over the past five years. Studies have shown that cycle lanes lead to a significant reduction injuries for all street users. Furthermore cycle lanes help define road space, promoting a more orderly flow of traffic, and act as a visual reminder for drivers when drivers open car doors or turn at intersections.

We look forward to your response and trust you can see the considerable benefit of incorporating an underpass into the proposed project.

The Bike Walk Marlborough Trust members would be keen to meet with Marlborough Roads to discuss the project further and hear possible solutions of design.

For any further information, please give me a call on 577 8855 ext 5.

Bike Walk Marlborough Trust
Date: 30.05.2016

To Andrew Adams
Project Manager – Opawa Bridge
Marlborough Roads
15 Seymour Street
Blenheim

To submissions
Opawa Bridge

Hello Andrew

Opawa Bridge Consultation

This letter outlines Bike Walk Marlborough's (BWM) feedback on the Opawa Bridge replacement for the consultation process.

Bike Walk Marlborough (BWM) was formed in 2005 by Marlborough Roads and Marlborough District Council. BWM is responsible for promoting cycling and walking and locating and facilitating various walking, running, and biking routes around Marlborough. As such Bike Walk Marlborough Trust has been involved in the development of off-road cycle tracks that include: Riverlands and Ben Morven trail, the extension of Taylor River trail, and the Blenheim to Grovetown shared pathway.

Crossing SH1

Our first concern is that cyclists and pedestrians (heading northbound) wishing to use the Grovetown Shared Pathway must cross Grove Road/SH1 prior to crossing the Opawa Bridge.

The NZTA options outlined do not address this issue, including the preferred option. With the Grovetown to Spring Creek ($1 million dollar project) currently underway, it is paramount that these Opawa Bridge issues are addressed. Failure to solve these issues will undermine the project and the aim of providing a more efficient and integrated transport network.

Generally, competitive cyclists prefer to use the Opawa Bridge rather than the shared pathway as it provides a direct route for travel. Therefore we recommend that cycle lanes are included on the new Opawa Bridge (heading northbound). Heading across the bridge (southbound), these competitive cyclists would prefer a cycle lane on the bridge, however if this is not possible a connection to the old Opawa bridge shared pathway would suffice. The width of the Awatere Bridge is sufficient for cyclists (1.8m shoulder on both sides) and we would suggest replicating this design in the future.

In comparison, the majority of commuter/recreational riders and pedestrians generally use the

Kind Regards,

Braden Prideaux on behalf of the Trust

Bike Walk Marlborough Coordinator
Sport Tasman Community Sport Advisor
Sport Tasman
Stadium 2000, Kinross Street
PO Box 953, Blenheim 7240
ddi: 03 577 8855 ext 5
email: braden.p@sporttasman.org.nz

Appendix A: Diadram of proposed underpass for both pedestrians and cyclists

APPENDIX F – IWI FEEDBACK

OPUS

Communication Record

To:	File	Date:	31st May 2016
Copy to:	Brent Morgan, Frank Westergard	Time:	11 am
Recorded by:	Donna Hills	File No:	5-MB982.03
Subject:	Meeting with Hemi Toia CEO of Ngati Rarua – Pou	Proj No:	5-MB982.03
Type:	Record of Meeting	Page 1 of 2	

Brent Morgan and Donna Hills met with Hemi Toia to update Ngati Rarua on where the project is up to.

- Hemi accepts that a new bridge is needed
- Outlined that Ngati Rarua are keen to tap into cruise ships docking at Picton – promotion of wine tours and other tourist attractions in and around Blenheim
- Was interested in traffic data across Opawa bridge, Brent pointed out that this data is in the Options Booklet – 9,800 vmpd average – 2,700 going through Blenheim, and the remainder locals going into Blenheim so ¾ of traffic is not bypassing Blenheim
- Discussed Bypass option and that it would need to go though business case process and could be 10 to 30 years away
- Regardless a new bridge is needed and to upgrade existing bridge seismically would cost almost as much as a new bridge and would alter a historic structure
- Hemi keen on being involved in official opening ceremony
- Hemi queried if the bridge will go ahead and Brent advised that it has government funding and therefore will be built – start in 2018 and is expected to take approx. 16 months
- Hemi mentioned proposed new Marae at Spring Creek
- Keen on Pou and landscaping around bridge, and provision for cyclists/pedestrians to be able to cross safely from new bridge to old to get onto cycleway – underpass
- Improvements to river access and exposure for community was mentioned – Lansdowne Park Upgrade
- Iwi groups, MDC and Opus should all meet after engagement and discuss the design of the bridge – there is no design agreed yet or if the bridge will be concrete or steel construction – Heritage NZ want low impact design so as not to detract from historic bridge – some want something really WOW

Opus International Consultants Ltd
Nelson Office
Level 1 Morrison Square, 77 Selwyn Place
Private Bag 36, Nelson Mail Centre, Nelson 7042
New Zealand
t. +64 3 548 1099
f. +64 3 548 9528
w. www.opus.co.nz

Donna
1/6/16

OPUS

Communication Record

To:	File	Date:	31st May 2016
Copy to:	Brent Morgan, Frank Westergard	Time:	11 am
Recorded by:	Donna Hills	File No:	5-MB982.03
Subject:	Meeting with Liz McElhinney and Sandra Evers of Rangitane	Proj No:	5-MB982.03
Type:	Record of Meeting	Page 1 of 1	

Brent Morgan and Donna Hills met with Liz McElhinney and Sandra Evers of Rangitane on where the project is up to.

- Rangitane fully support a new bridge
- Not concerned about a bypass as acknowledge that traffic needs to go through Blenheim to keep town alive
- Keen on a serious of message boards along old bridge telling the history of the bridge
- Would like to be part of the official opening ceremony
- Keen on meeting with other Iwi, MDC and Opus to discuss design etc

Donna
1/6/16

Opus International Consultants Ltd
Nelson Office
Level 1 Morrison Square, 77 Selwyn Place
Private Bag 36, Nelson Mail Centre, Nelson 7042
New Zealand
t. +64 3 548 1099
f. +64 3 548 9528
w. www.opus.co.nz

Communication Record

To:	File	Date:	8th June 2016
Copy to:	Brent Morgan, Frank Westergard	Time:	11 am
Recorded by:	Donna Hills	File No:	5-MB982.03
Subject:	Meeting with Natalie Smith	Proj No:	5-MB982.03
Type:	Record of Meeting	Page 1 of 1	

Donna Hills met with Natalie Smith on where the project is up to.

- No concerns agree new bridge is needed
- Interested in opening ceremony
- Interested in Pou/artwork
- Interested in Joint meeting with other Iwi, MDC and Opus in future to discuss the way forward
- Natalie will take her notes to the board (9 persons)

Donna
8/6/16

Opus International Consultants Ltd
Nelson Office
Level 1 Morrison Square, 77 Selwyn Place
Private Bag 36, Nelson Mail Centre, Nelson 7042
New Zealand
t. +64 3 548 1099
f. +64 3 548 9528
w. www.opus.co.nz

APPENDIX M – ENGAGEMENT PLAN

ARRP SH1 Opawa Bridge Public Engagement Plan

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

Prepared By	Donna Hills	------------------------	Opus International Consultants Ltd Nelson Office Level 1 Morrison Square, 77 Selwyn Place Private Bag 36, Nelson Mail Centre, Nelson 7042 New Zealand	
Reviewed By	Brent Morgan	------------------------	Telephone: Facsimile:	+64 3 548 1099 +64 3 548 9528
			Date: Reference: Status:	
Approved for Release By	Matthew Taylor	------------------------		

Contents

1.INTRODUCTION

As part of the Government's Accelerated Regional Roads Package (ARRP), the New Zealand Transport Agency (the Transport Agency) is tasked with the upgrade of the Opawa Bridge in Marlborough on State Highway 1 in order to improve safety and reliability in the Marlborough region and provide better access for heavy vehicles on SH1.

The project investment objectives are to:

- increase throughput of freight and light vehicles
- provide greater structural resilience to natural hazard events, resulting in increased availability and access.

An initial scoping exercise has been completed which included consideration of the upgrading of the existing structure or the duplication of the Opawa Bridge as well as an associated work including realigning the highway and providing pedestrian and cycling facilities.

During the initial scoping phase, a long list of options for replacement was compiled, including:

- upgrade of the existing heritage bridge
- intelligent transport solutions (traffic signals, oversize vehicle detection etc.)
- new single lane bridge, operating in tandem with existing bridge
- new two-lane bridge adjacent to the existing bridge
- a Blenheim by-pass.

The costs and benefits of each option were assessed for feasibility and a do-minimum option and a possible replacement option nominated to focus further development as follows:

- the do-minimum option to retain the existing bridge with its current lane width until it reaches the end of its remaining life of 25-45 years
- a possible option of a new two-lane bridge upstream of the existing bridge, retaining the existing heritage bridge as a pedestrian and cycle bridge to be taken over and maintained by Marlborough District Council (MDC).

The other options considered to date are currently considered unfavourable for a number of reasons ranging from high cost, seismic limitations of the existing bridge, excessive land acquisition, marginal constructability, excessive noise or other environmental impacts and consenting issues, removal of traffic calming gateway/slowing traffic into Blenheim, and undesirable removal of the important heritage bridge.

The DBC phase will conclude consultation inputs from the key stakeholders and the wider community that will enable final selection of the preferred option to be progressed through to detailed design and construction.


N
TO PICTON
TO NELSON
WAIRAU BRIDGE
SPRING CREEK
BRIDGE
OPAWA BRIDGE
BLENHEIM
TO CHRISTCHURCH
1
6
62
63
MAP LEGEND
WORK AREA
STATE HIGHWAY

2.ENGAGEMENT STRATEGY

The strategy of engagement is to achieve an outcome for the project that, as far as practicable, has the support of stakeholders and the community and more specifically:

- to proactively engage with key stakeholders, potentially affected parties, and Iwi on the project
- to communicate details of the project to the community,
- to receive public feedback on the project
- to maintain good relations with stakeholders and directly affected parties
- to achieve a high level of public engagement
- to meet statutory (incl. planning) requirements.

2.1. RESPONSIBILITIES FOR THIS ENGAGEMENT

The following persons have key responsibilities under this engagement strategy. Key roles and responsibilities are detailed in Section 5.

Transport Agency Project Manager: DBC Phase	Andrew James Andrew.James@nzta.govt.nz
Transport Agency Project Manager: Detailed Design and Construction	Andrew Adams Andrew.Adams@nzta.govt.nz
Transport Agency Communications Advisor:	Andree Kai-Fong Andree.KaiFong@nzta.govt.nz
Transport Agency Media spokesperson: DBC Phase	Felicity Connell Felicity.Connell@nzta.govt.nz
Transport Agency Media spokesperson: Design/Construction Phase	Felicity Connell Felicity.Connell@nzta.govt.nz
Signoff protocol for media statements:	Frank Porter, Frank.Porter@nzta.govt.nz Raewyn Bleakley, Transport Agency Regional Director, Raewyn.Bleakley@nzta.govt.nz
Advice to Minister and local MP:	Raewyn Bleakley, Raewyn.Bleakley@nzta.govt.nz

Consultant Team Leader:	Brent Morgan, Opus Blenheim Brent.Morgan@opus.co.nz
Consultant Communications:	Donna Hills, Opus Nelson Donna.Hills@opus.co.nz

2.2. AUDIENCE

Key stakeholders, Iwi, and other affected parties including landowners are listed in Appendix A. Other audience are the wider public, engaged both directly and through local media.

2.3. KEY MESSAGES

The following key messages are taken from the IBC document dated 15th June 2015:

- the bridge is too narrow and is not suitable for current traffic requirements, particularly heavy commercial vehicles and
- the bridge has poor structural resilience in terms of seismic resistance.

Initial feedback from the affected parties, key stakeholders and Iwi identified the key issues to be considered, and influenced the potential options assessment.

Key issues identified were:

- heritage NZ would like the heritage bridge retained which is extremely important to the community and Heritage NZ
- top 10 holiday park would like consideration of noise issues
- Forest & Bird would like consideration of Whitebait in Opawa River
- Marlborough Lines would like to underground existing overhead lines
- key stakeholders, Iwi and affected property owners agreed that the best alignment for a new bridge is upstream (on the western side)
- key stakeholders wanted consideration of cycle safety
- Iwi would like traditional Pou carvings on gateway to Blenheim
- MDC raised a desire to seek a higher hydraulic design standard of 1 in 400 flood and 1m sea level rise.

The current Engagement Register is attached in Appendix B.

A summary to date of consultation feedback is included in Appendix C.

IMPORTANT NOTE:

The engagement going forward needs to recognise that the Transport Agency has not engaged with the key stakeholders or the general public in nearly a year when the project was initiated.

All engagement needs to tell the story of how we got to this point. The Transport Agency has taken their ideas and made a long list of options and then through a process ended up with a short list of options to support the financial case. The key stakeholders do not understand why some options are not preferred, such as the bypass option. So all engagement documentation needs to go back and cover this off and bring everyone up to this point in time.

3.COMMUNICATION STAGES

The degree of communication and consultation on this project will be kept to a level commensurate with the nature and scale of the project which, while medium in terms of a national project, has national exposure being on State Highway 1, government funded, and high local exposure in the Marlborough community being a key strategic and signature piece of infrastructure on the roading network.

3.1. DETAILED BUSINESS CASE

During the detailed business case phase the following communications are planned to occur;

3.1.1. Key Stakeholders, Landowners, and Iwi

Refresh the memories of affected parties, key stakeholders, and Iwi about the project background, and the need for the replacement bridge;

- key issues raised at meetings in 2015
- update on project
- explain how their feedback at first meeting helped inform evaluation of options for the financial case
- present the possible options considered to date
- tell the story of how we got to the possible options, including why other options are not preferred; i.e. widening and/or strengthening existing bridge – excessive cost and disruption; Blenheim bypass – excessive cost and timeliness; tunnelling – inappropriate solution and unrealistic
- gain feedback on the possible options, level of comfort with options selection, issues and information that would help refine the final option design and provide opportunity to receive any other options people may have
- obtain feedback on the possible options, if there are previously unidentified issues needing further consideration both in selection and design
- determine whether another stakeholder meeting is needed or whether written communication would be sufficient (based on level of comfort with the possible options)
- include Iwi in design, particularly with Pou as expressed in Hui last year
- present a number of ideas/themes/concepts of architectural design for feedback
- inform what happens next.

Individual meetings will take place for landowners where the project will affect their properties. These meetings will be led by the Transport Agency's property consultant and assisted by Opus where requested.

MDC will be consulted with regard to the bridge appearance and handover of ownership and maintenance of the existing bridge. A letter will be sent to the CEO of Council inviting them to discuss the future of the existing bridge.

The Marlborough Roads Manager is to provide on-going updates to the MDC Regional Land Transport Committee, supported by the Project Manager.

3.1.2. Wider Public

Engage with the wider general public and the Marlborough community in particular to;

- provide an update on the project

- tell the story of how we got to the possible options, including why some options assessed to date may not be preferred
- present the possible options
- obtain feedback on the possible options, if there are previously unidentified issues needing further consideration both in selection and design
- present a number of ideas/themes/concepts of architectural design for feedback
- inform what happens next.

3.1.3. Key Dates for Engagement

Event	Date	Responsibility - Preparation	Responsibility – Approval To Proceed
Warm-up media release	Start 11th April 2016 Close 8th May 2016	NZTA	NZTA Regional Director
Media release	Start 11th May 2016 Close 9th June 2016	NZTA	NZTA Regional Director
Drop-in sessions	19th May 2016 21st May 2016	Opus/NZTA	A James
Displays at Blenheim & Picton Libraries, MDC and MR	Start 11th May 2016 Close 9th June 2016	Opus	A James
One on one meeting with Iwi	31st May 2016	Opus	A James
Property Acquisition	11th May 2016	Opus	A Adams

3.1.4. Specific Matters to Engage on

There are specific matters that are to be engaged on with each of the parties in this phase;

- alignment options
- land requirement issues and impacts
- cyclist options
- pedestrian options
- the bypass option
- urban design elements (in particular architectural qualities of the bridge).

3.2 Detailed Design

During the detailed design phase the following communications are to occur:

- to advise key stakeholders and Iwi that the design is being carried out, and to seek comment on the draft proposal at quarterly intervals
- individual meetings for property owners where the project will affect their properties as required
- update to general community through media releases at quarterly intervals
- the Marlborough Roads Manager is to provide on-going updates to the MDC Regional Land Transport Committee.

The accelerated detailed design phase is expected to be six months long.

Event	Dates (to be confirmed)	Responsibility - Preparation	Responsibility – Approval To Proceed
Updates to key stakeholders	Quarterly	Opus	A Adams
Individual meeting with Property Owners	As required	Opus	A Adams
Media Releases	Quarterly	Opus	A Kai-Fong
Updates to MDC RLTC	On-going	FP	F Porter

3.2. PRE-CONSTRUCTION

Prior to construction the following communications are proposed:

- to provide the key stakeholders and Iwi with an outline of the finalised project design and an explanation on how potential environmental impacts will be addressed and
- to advise the other stakeholders and the general public that the design has been completed, the purpose of this project and the benefits anticipated to be achieved, the successful contractor engaged, and the expected programme for construction.

3.3. CONSTRUCTION

During construction the following communications are proposed:

- to provide an update to key stakeholders and the media at quarterly intervals about construction progress and mitigation measures to be put in place associated with the project
- on completion of construction a formal opening ceremony to celebrate the construction of a strategic piece of infrastructure and recognise the funding source.

Event	Dates (to be confirmed)	Responsibility - Preparation	Responsibility – Approval To Proceed
Updates to key stakeholders	As Required	Opus	A Adams
Media Release	Quarterly	Opus	A Kai-Fong

Event	Dates (to be confirmed)	Responsibility - Preparation	Responsibility – Approval To Proceed
Individual meeting with Property Owners	As required by construction project management team	Opus	A Adams
Project Board on site approaches	On award of contract remaining to 1 year following completion	PW Contractor	A Adams
Regional Director to Advise Minister of Transport and Local member of Parliament that construction due to be completed for formal opening	3 months prior to planned completion	A Adams	Regional Director
Official Bridge Opening Ceremony	Bridge Opening	A Adams	Regional Director
Final update to Transport Agency website with new bridge images	Completion of construction	Opus	A Kai-Fong

4.METHODS OF COMMUNICATION

4.1. GENERAL

Consultation meetings and Drop-in sessions will be led by the Transport Agency, with support from Opus as per their professional services Scope of Work.

Opus will keep the Transport Agency informed at all times of its consultation activities, and of any matters arising. NZTA will provide Opus with all feedback received by them for input into the Engagement Summary Report.

4.2. MEDIA RELEASES

Opus will recommend to the Transport Agency when to release information to the public, and via what means. Content will be drafted by Opus, for approval by the Transport Agency Regional Director or approved delegate and publication by the Transport Agency.

4.3. NEWSLETTERS

Brochure content will be drafted by Opus, for approval and publication by the Transport Agency.

Opus will distribute the brochure (by email where possible), as well as copies at the Libraries in Blenheim and Picton. The brochure with a feedback form, will be available as a hand-out at the libraries and at the Drop-in sessions. An outline of the brochure is included in Appendix E.

The brochure will also be published on the Transport Agency's website page.

4.4. MEETINGS

Iwi meetings will be arranged by Opus' consultation personnel (if required).

Opus will arrange venue hire, refreshments (water), comments forms, projector (if required), and materials to support the verbal presentation. Display materials will include large aerial plans, wall mounted photographs, as well as brochures and for distribution to attendees.

4.5. DROP-IN SESSIONS

Opus will work with the Transport Agency's Project Manager but is responsible for a large portion of the work required (e.g. invites, general coordination and visual materials) including record keeping of feedback and findings. Visual materials will be as per the stakeholder meetings.

The current Scope of Service proposes two drop-in sessions which will be attended by the Opus team leader, deputy, consultation personnel, a noise/vibration specialist, and several NZTA staff.

4.6. PUBLIC DISPLAYS

Public displays at the Blenheim and Picton Public Libraries, MDC and MR will include wall mounted photographs and aerials, copies of the brochure and feedback form and a submission box.

4.7. WEB PAGE

A web page has been set up on the Transport Agency's website; http://nzta.govt.nz/opawa-bridge-replacement by the Transport Agency with online comments/feedback form.

All documentation (e.g. brochure, public displays) will encourage the use of the website to submit comments.

4.8. RESPONSES TO SPECIFIC INDIVIDUALS AND ENQUIRES

All questions will be directed to the Transport Agency phone 03 520 8330.

A sample of potential questions from the public and appropriate answers is included in Appendix F.

4.9. MINISTERIAL COMMUNICATIONS

The Transport Minister and local Member of Parliament will be advised at key milestones in the project by the Transport Agency's Regional Director. It is expected that the minister and/or local MP will publically announce the approval for construction phase to commence, and will be given the opportunity to formally open the new bridge upon completion.

5.TACTICS FOR PROJECT PHASES

5.1. TACTICS FOR DBC PHASE

5.1.1. Iwi

Separate meetings will be held with Iwi representatives.

5.1.2. Wider Public

Media releases will be provided for the Marlborough Express, Blenheim Sun, and Marlborough Midweek, and for the MDC website. A warm up media release will be released early April and/or pre-open day media release in early April.

Opus is to draft media releases for Transport Agency approval and release (draft warm-up release included in Appendix D).

The content to be covered is detailed in section 3.1.2, with key messages in section 2 and specific matters to engage on in section 3.1.4 of this engagement plan.

A brochure will be released in May with a media release explaining status of the project, and timeline and how there will be an opportunity for further public involvement. A third newsletter #3 will be released in July to inform outcomes of the DBC phase.

Opus is to draft newsletters for Transport Agency approval and publication.

A suitable location in Blenheim will be booked for the two drop-in sessions by Opus' consultation personnel. Maps, drawings, other display materials will be prepared by Opus and put up at venue prior to meetings by Opus' consultation personnel.

Materials to be available at the public open day are;

- wall mounted aerial of preferred option
- photographs of the site from various angles to facilitate discussion on tables
- brochure and feedback form to hand out displayed on tables
- wall mounted A1 copy of brochure and feedback form.

The Blenheim, Picton Public Library, MED and MR displays will be organised by Opus' consultation personnel.

A brochure is to be available for the public open day with a simple feedback form provided.

The Transport Agency is to publish a page on the Transport Agency website with a feedback form with input from Opus.

5.2. TACTICS FOR DESIGN PHASE

5.2.1. Key Stakeholder, Landowners, and Iwi

Affected parties, key stakeholders, and Iwi will be contacted with a newsletter at quarterly intervals to advise them of the current status of the project and programme for works, and to seek comment on the draft proposal.

Additional meetings and phone calls will be undertaken with stakeholders, affected property owners and Iwi as necessary.

The Marlborough Roads Manager is to provide on-going updates to the MDC Regional Land Transport Committee.

5.2.2. Wider Public

Media releases will be provided for the Marlborough Express, Blenheim Sun, and Marlborough Midweek, and for the MDC website at quarterly intervals.

The Transport Agency is to update the page on the Transport Agency website with input from Opus.

5.3. TACTICS FOR PRE-CONSTRUCTION PHASE

5.3.1. Key Stakeholder, Landowners, and Iwi

Affected parties, key stakeholders, and Iwi will be contacted to advise them of the current status of the project and programme for works.

Additional meetings and phone calls will be undertaken with stakeholders, affected property owners and Iwi as necessary.

The Marlborough Roads Manager is to provide on-going updates to the MDC Regional Land Transport Committee.

5.3.2. Wider Public

A media release will be provided for the Marlborough Express, Blenheim Sun, and Marlborough Midweek, and for the MDC website.

The Transport Agency is to update the page on the Transport Agency website with input from Opus.

A project site media board depicting an architectural image of proposed bridge and promoting the NZTA Brand is to be erected adjoining the project site.

5.4. TACTICS FOR CONSTRUCTION PHASE

5.4.1. Key Stakeholder, Landowners, and Iwi

Directly affected parties will be contacted as required through the physical works construction period to advise them of any issues, the current status of the project and programme for works, and to seek feedback if required.

Additional meetings and phone calls will be undertaken with stakeholders, affected property owners and Iwi as necessary.

5.4.2. Wider Public

Media releases will be provided for the Marlborough Express, Blenheim Sun, and Marlborough Midweek, and for the MDC website at quarterly intervals.

The Transport Agency is to update the page on the Transport Agency website with input from Opus.

A project board is to be erected on the site on both approaches for the duration of the project and for one year after opening.

An official opening ceremony to be arranged for opening of the new bridge involving the appropriate representatives and elected officials from central government , NZTA, local Government, Iwi, Key Stakeholders, and the public. An Iwi blessing to be included in this ceremony.

6.DELIVERABLES

6.1. FEEDBACK

Notes will be taken at all stakeholder meetings/open days and will be appended to the Engagement Summary. Feedback gathered via the feedback form/website will be collated and included in the Engagement Summary. NZTA will provide all feedback received by them to Opus for inclusion in the Engagement Summary Report.

The Engagement Register will record any other written correspondence/ telephone calls received. All feedback will be provided to the project team to help inform the investigation, and feed into the risk register if appropriate.

6.2. OUTPUTS

The following Outputs are to be provided by the Consultant;

- an Engagement Summary Report will be provided to the project team with issues and information for consideration of the options, and inclusion in the Risk Register as appropriate
- drop-in session report and analysis of comments with identification of issues and preferences to inform final selection of option. Information for Risk Register and Engagement Register
- draft newsletters/brochure as required for approval for release by the Transport Agency
- draft media releases as required for approval for release by the Transport Agency
- graphic displays for drop-in sessions
- graphic display board content for site.

APPENDIX A –TARGET AUDIENCES

Affected Parties:

Marlborough District Council	(future administrator of historic bridge)
Peter and Pauline Pickering	(landowner)
Top 10 Holiday Park	(landowner)
Grovepark Motor Lodge	(neighbour)
Marlborough Tour Company	(neighbour)
Hill Laboratories	(neighbour)
Marlborough Research Centre	(neighbour)

Key Stakeholders:

Marlborough District Council (Council, Management, Compliance, Rivers)

Spring Creek Community Group

Grovetown Community Group

Tuamarina Community Group

KiwiRail

National Road Carriers (NRC)

Road Transport Association

Automobile Association Blenheim

NZ Police

Marlborough Lines

Chorus

Transpower

Vodafone

Department of Conservation

Fish and Game

Forest and Bird

Birding New Zealand

Heritage New Zealand

Bike Walk Marlborough

Mana whenua/Iwi:

Ngati Apa

Rangitane (Te Runanga o Rangitane)

Ngati Rārua

The above three Iwi groups are those with statutory interests in the Marlborough region. The other groups identified in the IBC confirmed they are not affected, but would like to be kept up to date with any newsletters, throughout the project.

Media:

Marlborough Express

Blenheim Sun

Marlborough Midweek

NZTA website

MDC website

APPENDIX B – ENGAGEMENT REGISTER (KEY STAKEHOLDERS)

Organisation	Name	Job Title	Add1	Email	Phone
Key Stakeholders					
Marlborough District Council	Mark Wheeler	Asset & Services Manager		mark.wheeler@marlborough.govt.nz	03 520 7400
Spring Creek Community Group	Tim Newsham			timnewsham@xtra.co.nz	03 570 5745
Tuamarina Community Group	Sue Gill	Secretary		suziegill@hotmail.com	03 570 5646
KiwiRail	Graham Boorman	National Structures Maintenance Engineer		graham.boorman@kiwirail.co.nz	
National Road Carriers (NRC)				enquiries@natroad.co.nz	0800 686 777
Renwick Transport	Jackie	Deputy Chair		admin@renwicktransport.co.nz	027 436 5148
Road Transport Association	John Bond			jbond@rtanz.co.nz	0800 367 782
Automobile Association Blenheim	Sally Wright	Manager		swright@aa.co.nz	03 578 3399
NZ Police	Simon Feltham/Peter Payne			blenheim@police.govt.nz	03 578 5279 021 192 0277
Significantly affected utilities...					
Chorus	Pamela Earby			pamela.earby@chorus.co.nz	0800 822 003
Marlborough Lines	Wayne Stronach/Scott Wilkinson			waynestronach@linesmarl.co.nz	03 577 7007
Transpower				transpower.plans@digsafe.co.nz	04 590 6286
MDC rivers staff	Geoff Dick	Rivers & Drainage Engineer		Geoff.dick@marlborough.govt.nz	03 520 7400
DoC	Joy Crump/Julie Buunk			jcrump@doc.govt.nz	03 572 9100
Fish and Game	Vaughn Lynn			vlynn@fishandgame.org.nz	03 578 8421
Forest and Bird Top of South	Andrew John			celtsh@clear.net.nz	03 573 5509
Birding New Zealand	Diane John			draganz2001@gmail.com	
Save the Wairau River Inc	Phyllis Collins				
Heritage NZ	Alison Dangerfield			adangerfield@historic.org.nz	04 494 8320/DD 04 494 83
Bike/Walk Marlborough	Rob Dunn	Reserves/Amenities Officer & Bike Walk Marl		bwm@marlborough.govt.nz	03 520 7400 / 021721 443
Maritime NZ	Steve Hainstock			Steve.Hainstock@maritimenz.govt.nz	03 748 1760 / 0278 361 10
Property Owners					
Top 10 Holiday Park	Leon & Min She			stay@blenheimtop10.co.nz	0800 521 045
Grovepark Motor Lodge	Noel & Jill Thompson			reservations@grovepark.co.nz	03 578 4389
Marlborough Tour Company	Scott McKenzie	Gen Manager		scott@marlboroughtourcompany.co.nz	03 577 9997
Hill Laboratories	Hugh Richards	Lab Manager		hugh.richards@hill-labs.co.nz	03 579 2270
Marlborough Research Centre	Gerald Hope	CEO		gerald@mrc.org.nz	03 577 2377
Orchard/Lifestyle Block	Peter & Pauline Pickering		Main Rd, Grove Town, Ble	peandpe@xtra.co.nz	03 579 5747
IWI					
Te Atiawa (o Te Waka a Maui)	Catherine and Ian Shapcott				
Ngati Koata Trust	Matthew Hippolite		137 Vickerman Street, PC	projects@koata.iwi.nz	03 548 1639
Ngati Toa Rangitira (Manawhenua Kit T	Tracey Williams & Jennie Smeaton		PO Box 5061, Blenheim 7	toa.kitetauihi@xtra.co.nz	04 237 7922
Ngati Apa ki te Ra To	Butch Bradley		78 Seymour Street, Blenh	ceo@ngatiapakiterato.iwi.nz	03 578 9695 / 0212225064
Rangitane (Te Runanga o Rangitane O	Paia Riwaka-Herbert		PO Box 883, Blenheim 72	admin@rangitane.org.nz	03 578 6180
Ngati Rarua Iwi Trust	Hemi Toa		PO Box 1026, Blenheim 7	hemi@ngatirarua.co.nz	03 577 8468
Ngati Kuia	Raymond Smith		PO Box 1046, Blenheim, 7	raymond@ngatikuia.iwi.nz	03 579 4328
Ngati Tama te tau ihu (some parts e.g. F	Jo Westrupp		21 Buxton Square, PO Bo	tari@ngati-tama.iwi.nz	03 548 1740 / 021548471

KEY

Key Stakeholders
Affected Land Owners/Businesses
IWI

As at 16th February 2016

APPENDIX C – INITIAL CONSULTATION FEEDBACK

Stakeholders involved in the option workshops included representatives from:

- Transport Agency Project Manager and Marlborough Roads Regional Manager
- all identified key Stake-holders: Marlborough District Council, Spring Creek residents Association, KiwiRail, National Road Carriers, Road Transport Association, Automobile Association, NZ Police, Utility Operators, Department of Conservation, Forest and Bird, Heritage NZ and Walk Bike Marlborough
- local Iwi: Te Atiawa, Ngati Koata, Ngati Toa Rangatira, Ngati Apa, Rangitane, Ngati Rarua, Ngati Kuia and Ngati Tama
- Marlborough District Council: Mark Wheeler Infrastructure Manager, Hans Versteegh Planning Manager and Geoff Dick Rivers Engineer
- consultation was also undertaken with directly affected property owners to understand their specific concerns and requirements. The identified property owners were: Blenheim Research Centre, Pickerings, Top 10 Holiday Park and the Grove Motel. (KiwiRail land holdings are also affected but it is not considered necessary to consult KiwiRail directly as identified land is well outside their current operational area).

A long list of possible options were developed with the key stakeholders to address the key problems and to achieve the KPIs established in the strategic case and the subsequent strategic case review. These were developed and presented through five separate stakeholder workshops and meetings.

The key issues that were identified by stake holders, iwi and affected property owner during consultation are summarised below.

Opawa Consultation Key Issues

Key Issues	Organisation	Action Required
Heritage values of the existing bridge is extremely important to the community and Heritage NZ.	Heritage NZ	Ongoing dialogue with Heritage NZ
Iwi expressed they would like a traditional gateway to Blenheim with Pou carvings.	Ngati Rarua	Consider as part of landscaping
Holiday Park expressed interest in being involved in option design and asked for consideration of noise mitigation.	Top 10 Holiday Park	Careful consideration of noise impacts and ongoing dialogue
Whitebait use the Opawa River to be considered.	Forest and Bird	Consider construction period
Marlborough Lines would like to underground existing overhead lines.	Marlborough Lines	Consider relocation of overhead lines

Key stake holder group, along with Iwi and affected property owners agreed the best alignment is upstream on the western side.	All	Preferred alignment
Cycle safety is important. The existing bridge access creates concern and discourages cycling.	Key Stake holders	Consider improved cycle facilities
MDC raised a desire to seek a higher hydraulic design standard of 1 in 400 year flood and 1m sea level rise.	MDC	Consider cost and design implications

APPENDIX D – DRAFT MEDIA RELEASE

What's happening – Opawa Bridge

Media release: 11th April 2016

In June 2014 the government announced funding to accelerate a package of regionally important State Highway projects including the replacement or duplication of the Opawa Bridge on State Highway 1 between Blenheim and Picton. Funding has been confirmed and the NZ Transport Agency is now seeking to determine the final option for this key project.

This Opawa Bridge is over 100 years old and an important heritage structure and signature gateway to Blenheim. However, its practicality for traffic use is limited by its narrow width and seismic vulnerability.

The Transport Agency is investigating options to either upgrade or duplicate the bridge, and is seeking feedback from stakeholders, Iwi and the public.

The Blenheim and Picton libraries will be hosting displays for a limited period with brochures available explaining the project. An open day will be held at the Chateau Marlborough on Saturday the 23rd April 2016 from 10am. Here we will present the options investigated to date and provide an opportunity for public feedback. Feedback via email and phone are welcome with the consultation period closing on the 8th May 2016.

Ends

Contact: NZ Transport Agency project team

APPENDIX E – FACTSHEET #1

ACCELERATED REGIONAL ROADING PROGRAMME
TRANCHE 2

Opawa Bridge replacement

BENEFITS

Replacing the Opawa Bridge will improve safety and reliability in the Marlborough region and provide better access for heavy vehicles on SH1 in Blenheim.

The project objectives are to:

- increase throughput of freight and light vehicles
- provide more consistent travel times
- provide greater structural resilience to natural hazard events, resulting in increased availability and access.

PROJECT DESCRIPTION

Two bridges (Wairau and Opawa) have been investigated for potential replacement to provide better heavy vehicle access on SH1 in Blenheim. Following investigation, the Wairau Bridge will not be replaced as it has been certified to carry heavier vehicles and can be cost-effectively maintained. The Opawa Bridge, however, has been identified for replacement.

The project involves replacing the existing bridge with a new two-lane bridge upstream of the existing structure. Due to the existing bridge's heritage status, it will be constructed in harmony with the existing bridge with careful architectural design. The existing bridge will be retained and used for improved cycle and pedestrian facilities.

BACKGROUND

The Opawa River Bridge was designed in 1912 and opened in 1917. The bridge is a Heritage NZ Category 1 heritage place, indicating a place of outstanding significance. This bridge is a legacy structure, being the first of its kind (concrete bowstring) constructed in New Zealand.

The Opawa Bridge is 170m long and carries 9,800 vehicles per day, 9% of these being heavy vehicles. The bridge is located north of Blenheim across the Opawa River, which forms a natural geographic boundary between the urban and the rural agricultural activities on the lower Wairau River Plain. As the bridge is on the northern urban fringe of Blenheim, it is an important gateway to Blenheim.

The recent investigations determined that the 5.5m-wide bridge is not suitable for current and future traffic requirements, particularly heavy vehicles and campervans. The bridge also offers low seismic resistance.

The narrowness of the bridge results in short travel time delays, but also creates significant difficulties for larger vehicles and campervans as opposing large vehicles are unable to pass on the bridge or its immediate approaches.

COST

$14-17.5 million.

FUNDING SOURCE

The replacement of the Opawa Bridge will be funded by the Crown as part of the Government's Accelerated Regional Roading Programme. The continued maintenance of the Wairau Bridge will be funded from the National Land Transport Programme 2015–18.

DATES

It is anticipated construction will start early in 2018, taking 12 months to complete.

NZ TRANSPORT AGENCY WAKA KOTAHI

New Zealand Government

15-325

APPENDIX F – DRAFT NEWSLETTER #2

NZ TRANSPORT AGENCY
WAKA KOTAHI

Opawa Bridge Replacement

May **2016**

Tell us what you think about plans to replace the Opawa Bridge on State Highway 1

Building a new bridge for State Highway 1 over the Opawa River

Where we are today on the investigation

Last year the NZ Transport Agency launched an investigation of the Wairau and Opawa Bridges to improve travel on State Highway 1 north of Blenheim. The investigation of these bridges was identified as part of the Government's Accelerated Regional Roading Package, which provided funding to progress a selection of regionally important state highway projects to address economic efficiency, safety, and resilience issues on our regional transport networks.

We considered strengthening, replacing or duplicating both bridges. Following an earlier investigation, the Wairau Bridge was found to be in serviceable condition. It has been certified to carry heavier vehicles and can be effectively maintained. Replacement of this bridge may be considered in the future. The Opawa Bridge, however, was identified for replacement. Upgrading it is a high priority for the Marlborough District Council and residents.

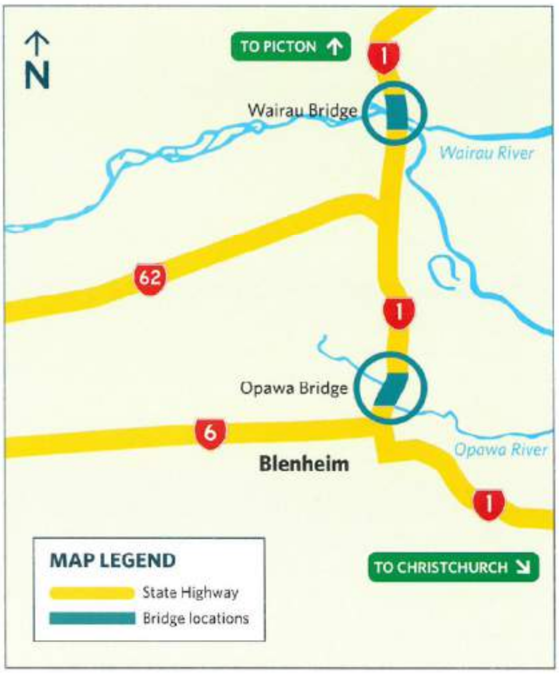
Early investigation of the Opawa Bridge confirmed it is too narrow for some vehicles, large freight vehicles in particular. We have also learned the bridge is vulnerable in an earthquake and is susceptible to damage from heavy floods.

In January 2016 the Government announced a preferred option: build a new two-lane bridge on the western side of the existing bridge. The existing bridge will be kept for pedestrians and cyclists. This proposal is estimated to cost between $14 and $17.5 million.

What we are asking of you

Now is your chance to review the investigation findings and give feedback on the preferred option. Read more information on **www.nzta.govt.nz/opawa-bridge-replacement** and fill out the survey in this brochure or online.

FEEDBACK DEADLINE:
Thursday 9 June 2016



Page 1 | **Update 2** May 2016

New Zealand Government

The state of the existing bridge

As part of our earlier investigation, we have identified two problems with the State Highway 1 Opawa Bridge and the traffic flow over it:

Problem one: The bridge is too narrow

At 5.49m wide between kerbs, the bridge does not meet today's requirements, particularly for heavy commercial vehicles.

When large vehicles cross the bridge, they become a hazard, particularly if they cross the centre line. Many opposing vehicles must slow down or stop because they cannot pass, causing frequent delays and uncertain travel times.

Also, long traffic flows trail behind large freight trucks that travel along State Highway 1 heading to or departing from the interisland ferries. This adds to congestion on the bridge, making journey times unreliable.

Problem two: The bridge has poor structural resilience

The bridge's structure would not be adequately able to withstand a significant earthquake. Its structure could be affected as a result of shaking or liquefaction that could cause the bridge piers, or the entire structure, to collapse. Also, the bridge is vulnerable to significant flooding events as floodwater could undermine the bridge's central pier and cause partial bridge collapse.

Given the importance of the bridge to the transport network, we need to ensure we can keep this route open.

Why the road and bridge are strategically important

The Opawa Bridge is located on State Highway 1 between Picton and Blenheim. It is integral to the state highway network and the interisland ferries. It is also a vital freight link between the North and South Island via the Port of Picton, which is why the Government included investigating its replacement in the Accelerated Regional Roading Programme.

The Opawa Bridge, on the northern edge of Blenheim, spans 170m and carries 9,800 vehicles/day. It serves many functions in the region today, though it has changed little over its 100-year life. It:

- is a protected heritage item under the Wairau / Awatere Resource Management Plan
- is listed as a category 1 historic place by Heritage New Zealand
- is an important local gateway to Blenheim
- carries a considerable amount of inter-regional traffic. This is because Marlborough is an export-focussed producer of primary products
- is a key cycle route with plans underway to extend an off-road cycle path that serves as a transport corridor for local access between Spring Creek and Blenheim. This is something the Marlborough District Council, the Transport Agency, and Government (through its urban cycleway fund) are investing in.

We appreciate that the road and bridge are integral to the larger Picton to Christchurch state highway network. Some people have expressed an interest in building a bypass route to the east. This is a separate issue. We need to replace the Opawa Bridge now in order to address its identified problems, particularly as the majority of its current users will continue to use it to access central Blenheim from the north.

A bypass remains a future option, and will be considered as part of a separate investigation of State Highway 1 between Picton and Blenheim.

Preferred option

The preferred option is to create a new two-lane bridge to the west of the existing bridge for vehicular traffic with pedestrians and cyclists using the existing bridge.

As part of our investigations, we developed a long list of all possible options to address the two problems. Thirteen separate options were investigated and assessed, including a do-nothing option, using a variety of criteria. You can read more about all of the options and the detailed analysis on our website, **www.nzta.govt.nz/opawa-bridge-replacement**.

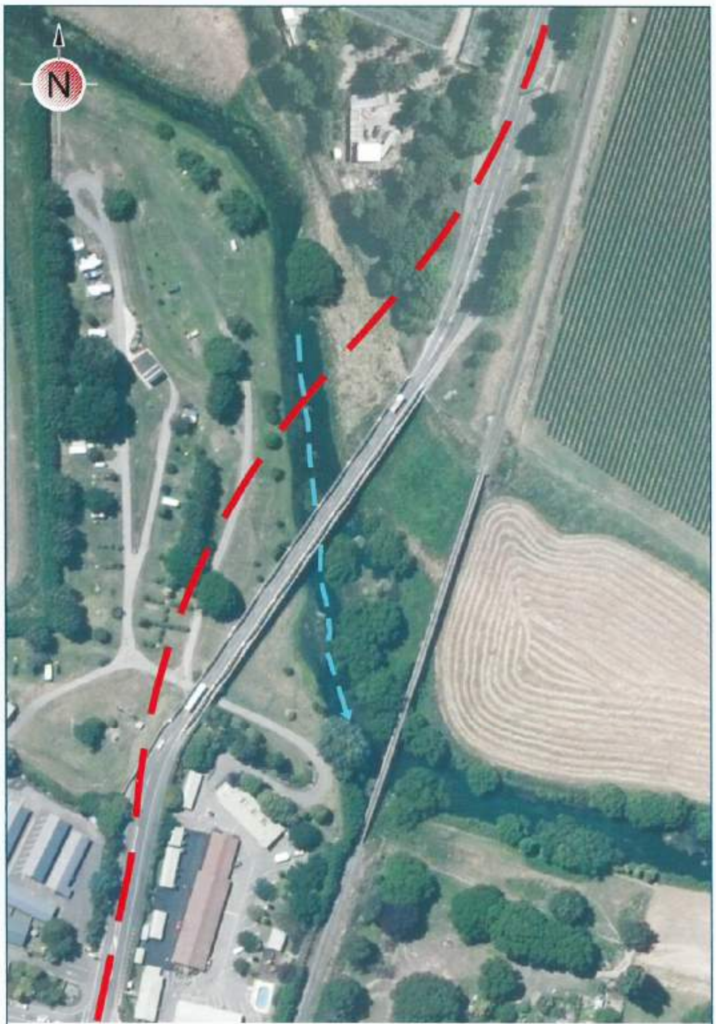
Taking into account all of the information investigated to date, including stakeholder, iwi, and affected landowner feedback, the preferred option is to build a new 10.8m wide bridge. This will operate as a full two-lane highway and cater for on-road cyclists with a 1.5m wide shoulder on each side.

We expect to keep the existing bridge and will continue to investigate its future use as a pedestrian and cycle only facility.

A western alignment (upstream) has the least impact on surrounding properties, provides better pedestrian and cyclist access, and requires less property acquisition.

This option resolves the identified problems and meets all criteria for vehicular traffic.

It is estimated to cost between $14 and $17.5 million.



Route of the proposed highway realignment to the west of the existing bridge.

Benefits of investment

At the heart of our investigation work is our key objective to keep people and goods moving along State Highway 1 between Blenheim and Picton. We want to:

- make journey times more reliable
- make sure freight moves efficiently
- make the region more resilient to natural disasters and
- support State Highway 1 as a strategic freight route between Picton and Christchurch.

The specific benefits of investing to address the Opawa Bridge's identified problems (including weightings) are:

- Benefit 1 (70%): Increased throughput of freight and light vehicles and greater certainty of state highway journey
- Benefit 2 (30%): Greater structural resilience to natural hazard events, resulting in increased availability and access.

How to give feedback

There are a number of ways you can give us your feedback about our preferred proposal.

You can:

1. Attend one of our public information sessions to understand the proposal further (see dates listed below)
2. Read the information on our website and fill out our online feedback form
3. Fill in the hard copy feedback form and mail it to us by using the Freepost address on the reverse or post to: Marlborough Roads, PO Box 1031, Blenheim 7240
4. Fill in the hard copy feedback form and place it in the submission boxes at these locations, including Marlborough District Council (MDC) customer service centres and libraries:
   - MDC Customer Service Centre, Blenheim: 15 Seymour Street
   - Marlborough District Library, Blenheim: 33 Arthur Street
   - Marlborough Roads office, Blenheim: Level 1, The Forum, Unit 2.4, Market Street
   - MDC Customer Service Centre / Picton Library: 67 High Street

FEEDBACK DEADLINE: Thursday 9 June 2016

Public information sessions

Please come along to one of our information sessions to speak to the project team about questions you may have on this investigation.

- **Thursday 19 May.** Scenic Hotel Marlborough, Marlborough Room, 4pm - 7pm
- **Saturday 21 May.** Scenic Hotel Marlborough, Chart Room, 10am - 2pm

Next steps

After the engagement period has ended, we will refine the preferred bridge replacement proposal taking on board the feedback received. We aim to seek Resource Management Act consents early in 2017.

In the meantime, we will continue to work with key stakeholders, potentially affected landowners, and the local community and seek input on the potential design of the replacement bridge. Should consents be granted, we expect construction would start in 2018.

Early 2017	Lodge the consent applications
Early 2018	Construction estimated to begin

Contact us

Website: www.nzta.govt.nz/opawa-bridge-replacement

Email: opawa-bridge@nzta.govt.nz

Phone: 03 520 8330

Post: Marlborough Roads office, Level 1, The Forum, Unit 2.4, Market Street, Blenheim

NZ TRANSPORT AGENCY WAKA KOTAHI

New Zealand Government

APPENDIX G - ANTICIPATED Q&A

Q1. When is the bridge construction expected to commence?

Construction on site is expected to start in mid-2017 subject to the necessary regulatory approvals and any necessary property purchase agreements being completed in time.

Q2. How long is it expected to take to construct?

Construction of any new bridge or upgrading of the existing bridge and approaches is expected to take 12 to 18 months to construct with an estimated completion date at the end of 2018.

Q3. Who is paying for this work?

The New Zealand Government has appropriated special funding for the regions known as the Accelerated Regional Roads Programme (ARRP). The Opawa Bridge project is just one of 13 currently approved for further investigation or construction.

Q4. What is being planned as part of this project?

The ARRP SH 1 Opawa Bridge project proposes to either upgrade or duplicate the existing narrow bridge on the entry into Blenheim. The existing 100 year old bridge has heritage listing and we need to carefully preserve that heritage while providing a structure that meets the needs of today and tomorrow.

It is intended to provide adequate lanes for today's heavy vehicles and increasing traffic volumes which are well beyond what anyone could have envisaged in 1917 when the existing bridge was constructed. Facilities for pedestrians and cyclists will also be provided.

Q5. Do I have any opportunity to comment on the proposal?

Yes, there is currently a consultation phase underway which is planned to be completed and all comments and feedback incorporated into the design where practicable by the middle of 2016. Key stakeholders that represent various interest groups have been identified and are being consulted directly with including Marlborough District Council, the Road Transport Association, the Automobile Association, Iwi, and directly affected property owners amongst others.

Q6. How will my feedback be incorporated into the work?

All feedback is welcomed and is collated and assessed by the Transport Agency and the design team to ensure the design reflects the community's aspirations as much as possible.

Q7. Why is this project being done before other projects?

The Transport Agency identified a series of projects nationally that had high local interest but were proving difficult to obtain prioritised funding for against a constrained national roading fund. The government has provided special funding through the Accelerated Regional Roads Programme to stimulate the local economy in regional New Zealand.

The Opawa Bridge business case demonstrated real savings to the New Zealand and local economy through improved freight moving efficiencies and safety improvements.

Q8. Why not build the Blenheim Bypass instead?

One of the initial options considered when developing the business case for the Opawa Bridge improvements was to construct the Blenheim Bypass in lieu of upgrading the Opawa Bridge. Economically the bridge improvement option gives a better return on investment over the next 40 years. There is insufficient traffic that would use the bypass as a proportion of the total traffic that uses the current bridge and that is expected to use it over the foreseeable future. A large proportion of the traffic using the Opawa Bridge is stopping in Blenheim as a destination being predominately local traffic. Further consideration of a Blenheim Bypass will be addressed as part of the SH1 Picton to Christchurch investigation currently underway.

Q9. Will the new bridge cater for cyclists and pedestrians?

Yes, all options being considered include facilities for both cyclists and pedestrians and will meet the current building code for disabled access.

Q10. What impacts will the construction work have on the travelling public?

Traffic impacts during construction should be minimal if a duplicate structure is constructed. If another option is finally chosen to proceed to construction such as improvements to the existing structure, then the impacts will be more significant. Constructability is something that is closely considered in the optioneering and design phases and may require the use of temporary bypasses around the construction to minimise impacts on the travelling public.

Q11. What impacts are there on adjoining property?

Depending on the final option chosen there are some impacts on adjoining properties. The Transport Agency and the design team will work closely with adjoining and impacted property owners to minimise those impacts where possible.

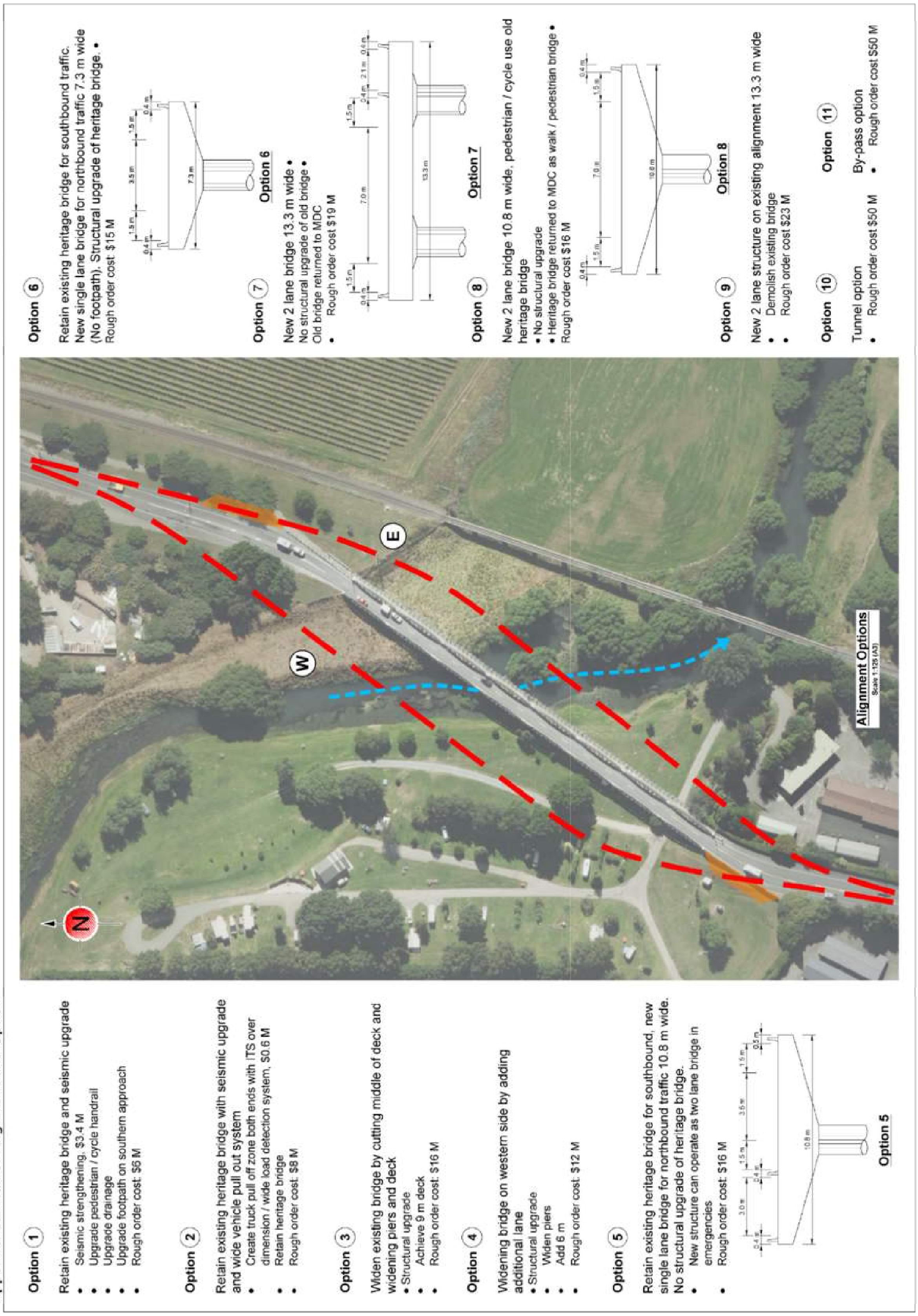
Q12. What happens to the old existing bridge?

The existing Opawa Bridge is 100 years old and has NZ heritage listing so it will remain even if replaced with a new bridge. Options include using the existing bridge for walking and cycling linking with communities to the north.

Q13. Will any new bridge be sympathetic to the existing structure?

Urban design is an important element and will be incorporated into the design. The existing Opawa Bridge is a signature bridge well known by everyone who travels on State Highway One. It is important that any new structure is sympathetic to the existing bridge.

APPENDIX H - OPTIONS PLAN



APPENDIX I – FEEDBACK FORM

NZ TRANSPORT AGENCY
WAKA KOTAHI

Opawa Bridge Replacement

Feedback form

We would encourage you to read the information in the brochure and the supporting information on our website before completing the form: **www.nzta.govt.nz/opawa-bridge-replacement**. If you would like to submit responses with additional sheets, please be sure to attach them and post everything in an envelope or drop it into a submission box.

Q1. What is your opinion about the NZ Transport Agency's preferred option?

Q2: Tell us what elements you would like to see reflected in the new bridge structure or its design that we could include in our planning.

Q3. Do you have any comments on other options considered by the Transport Agency and if so why?

Q4. Is there anything else you want us to consider to further develop the project?

Thank you for your feedback.

Your feedback is public information

...se note that the NZ Transport Agency may publish any information that you give to us on this form, or provide it to a third party, and you may be individually identified as the submitter. Therefore, please indicate clearly:

- Whether your comments are commercially sensitive or, for any other reason, should not be disclosed.
- Any reason(s) why you should not be identified as the submitter of the feedback.

How to give feedback

There are a number of ways you can give us your feedback about our preferred proposal.

You can:

1. Attend one of our public information sessions to understand the proposal further (see dates listed overleaf)
2. Read the information on our website and fill out our online feedback form.
3. Fill in this feedback form and mail it to us by using the Freepost address on the reverse or post to: Marlborough Roads, PO Box 1031, Blenheim 7240
4. Fill in this feedback form and place it in the submission boxes at these locations, including Marlborough District Council (MDC) customer service centres and libraries:
   - MDC Customer Service Centre, Blenheim: 15 Seymour Street
   - Marlborough District Library, Blenheim: 33 Arthur Street
   - Marlborough Roads office, Level 1, Blenheim: The Forum, Unit 2.4, Market Street
   - MDC Customer Service Centre / Picton Library: 67 High Street

DEADLINE: Thursday 9 June 2016

Public information sessions

Please come along to one of our information sessions to speak to the project team about questions you may have on this investigation.

- Thursday 19 May. Scenic Hotel Marlborough, Marlborough Room, 4pm – 7pm
- Saturday 21 May. Scenic Hotel Marlborough, Chart Room, 10am – 2pm

For more information on the project and to read answers to frequently asked questions, visit the project website at **www.nzta.govt.nz/opawa-bridge-replacement** or email **opawa-bridge@nzta.govt.nz**

FOLD HERE

FreePost Authority Number 251610

Free

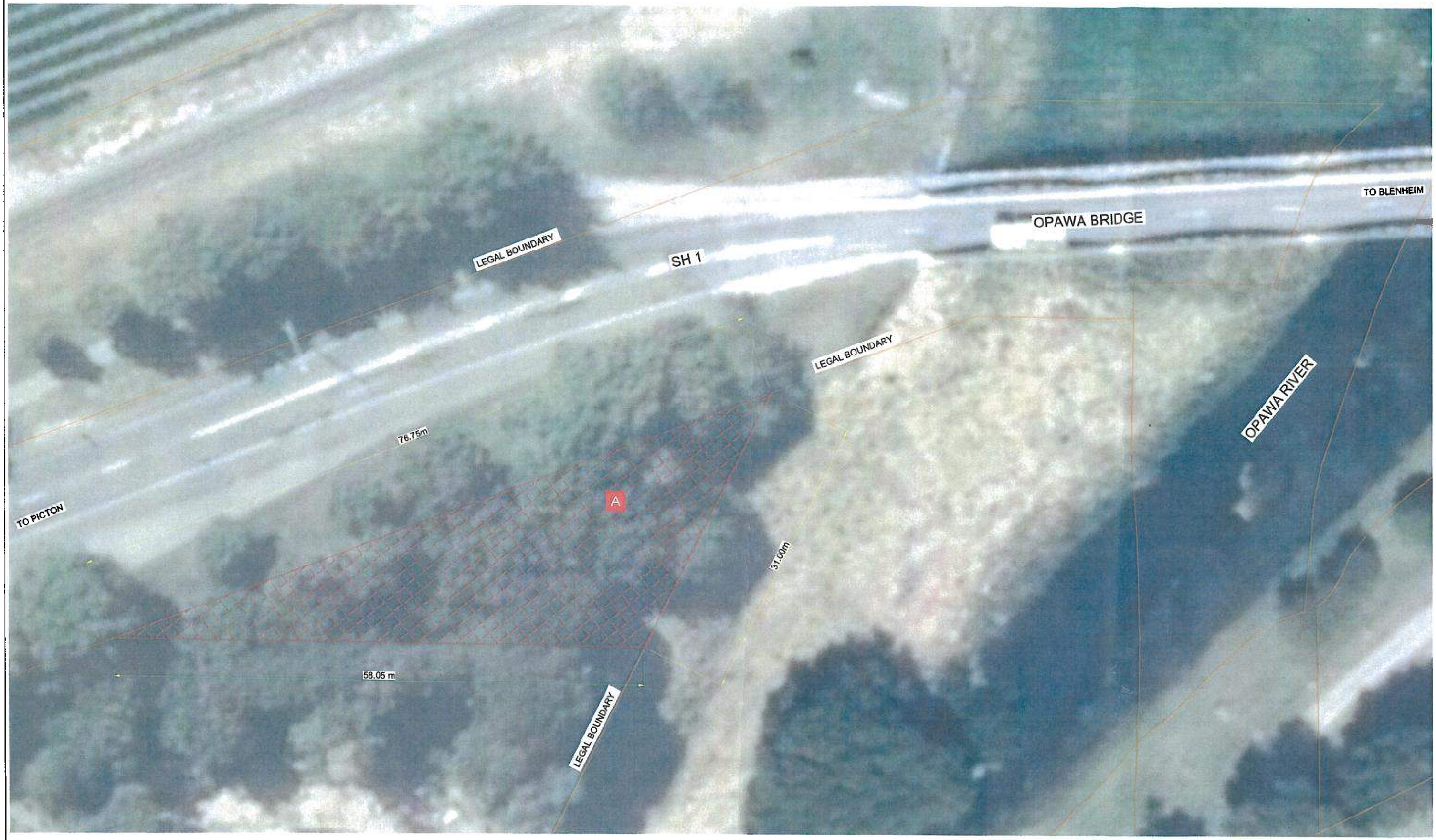
Marlborough Roads
PO Box 1031
Blenheim 7240

FOLD HERE

FOLD AND TAPE OPEN SIDES LEAVING SPACE FOR A LETTER OPENER / NO GLUE OR STAPLES PLEASE

APPENDIX N1 – PROPERTY STRATEGY

APPENDIX N2 – LAND REQUIREMENT PLANS



LAND REQUIREMENT PLAN

LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
A	815	PT SEC 146 - SO 6524 - CFR 5B/208	P.E. PICKERING & P.E PICKERING	FOR NEW ROAD

1:200 @ A1 / 1:400 @ A3 — 0 2 4 6 8 10 12 14 16 18 20 m

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY WAKA KOTAHI

APPROVED 12.5.16

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	19.04.2016

Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project: NEW ZEALAND TRANSPORT AGENCY OPAWA BRIDGE REPLACEMENT

Sheet: LAND REQUIREMENT PLAN P.E AND P.E PICKERING

Project No	Sheet No	Revision
5-MB982.03	20	1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:04 p.m. Path G:\project\data\other_office\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_fr\OpawaDesignBase.dwg PickeringLandPlan

LAND REQUIREMENTS/LEGAL DESCRIPTIONS

AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
B	1537	SEC 147 BLK XVI – CLOUDY BAY SD	LOCAL PURPOSE RESERVE	FOR NEW ROAD

1:200@ A1 / 1:400@ A3 — 0 2 4 6 8 10 12 14 16 18 20 m

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED 17.5.16

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	19.04.2016

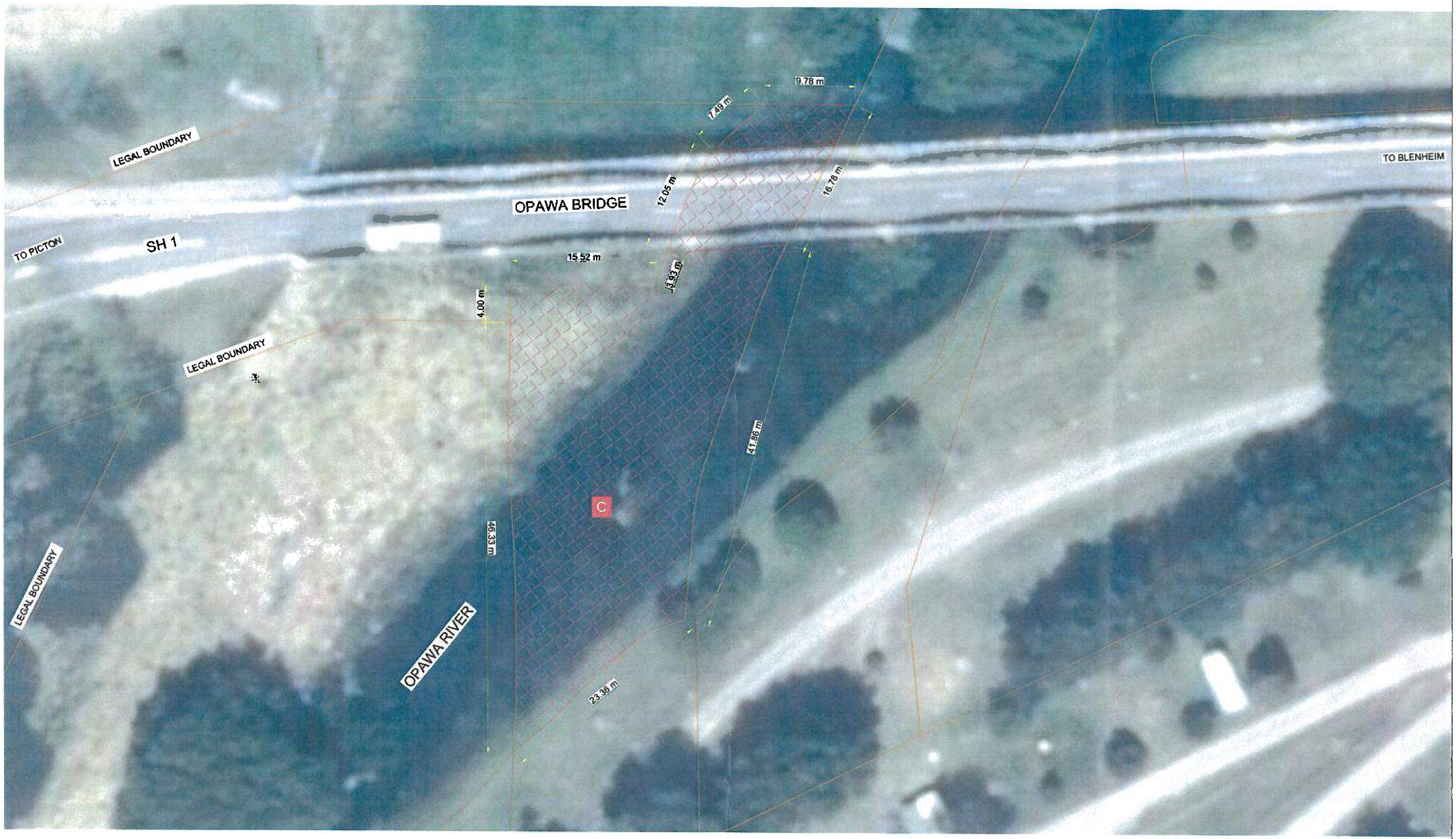
Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project: NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet: LAND REQUIREMENT PLAN
LOCAL PURPOSE RESERVE

Project No.	Sheet No	Revision
5-MB982.03	21	1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:10 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_h\OpawaDesignBase.dwg LPRLandPlan



LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
C	1144	MAIN NORTH RAILWAY LINE	KIWI RAIL	FOR NEW ROAD

1:200 @ A1 / 1:400 @ A3 — 0 2 4 6 8 10 12 14 16 18 20 m

Original Sheet Size A1 [841x594]   Plot Date 2016-05-11 at 4:34:16 p.m.

LAND REQUIREMENT PLAN

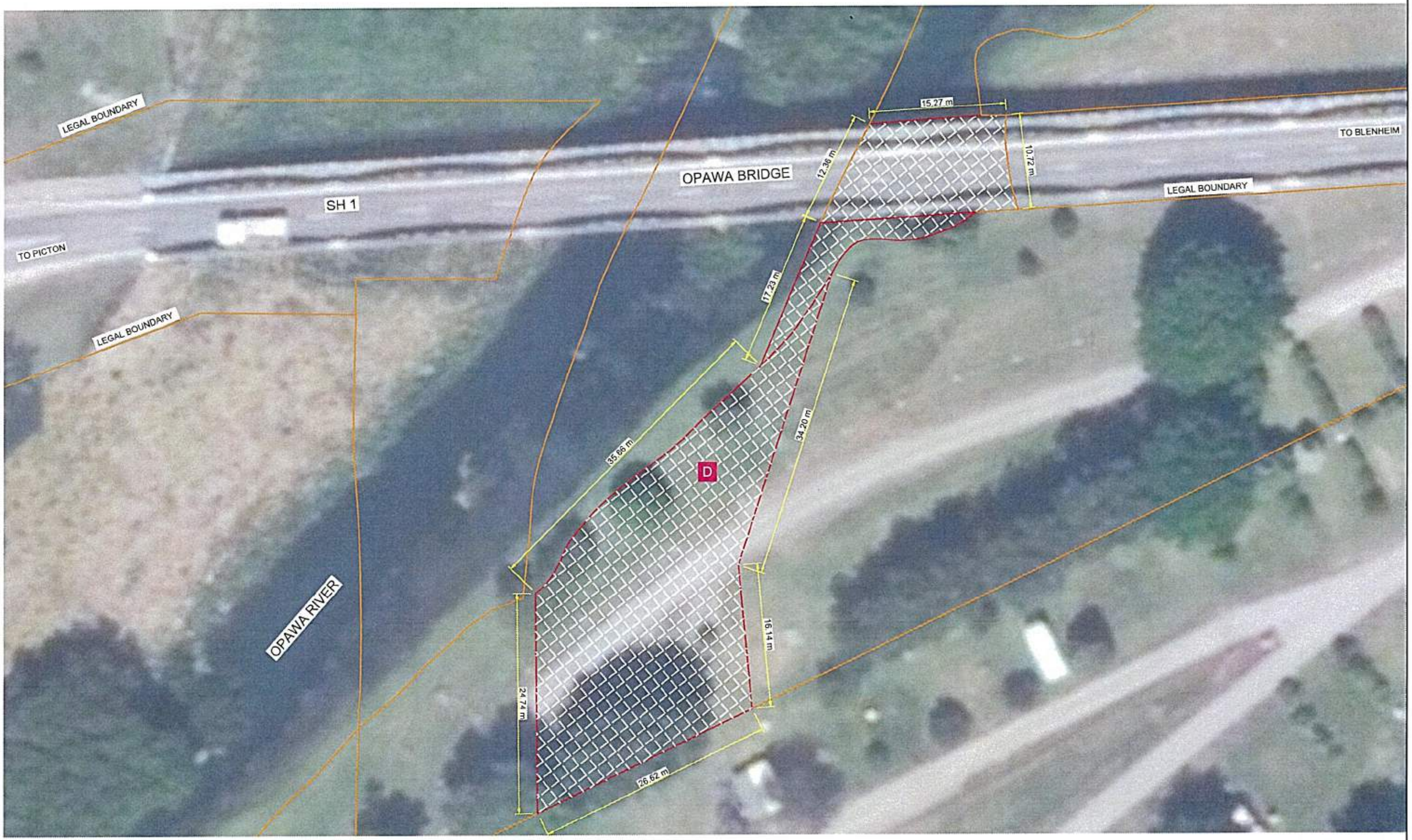
Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY WAKA KOTAHI

APPROVED 12.5.16

OPUS Nelson Office +64 3 548 1099 Private Bag 36 Nelson 7042 New Zealand

Project	NEW ZEALAND TRANSPORT AGENCY OPAWA BRIDGE REPLACEMENT
Sheet	LAND REQUIREMENT PLAN KIWI RAIL
Designed	B. McD
Approved	M.CRUNDWELL
Approved Date	19.04.2016
Drawn	B. McD
Scales	1:200 (A1) 1:400 (A3)
Project No	5-MB982.03
Sheet No	22
Revision	1



LAND REQUIREMENTS/LEGAL DESCRIPTIONS

AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
D	1100	PT OLD BED OPAWA ROAD	LINZ	FOR NEW ROAD

1:200 @ A1 / 1:400 @ A3 — 0 2 4 6 8 10 12 14 16 18 20 m

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED [signature] 27.6.16

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	24.06.2016

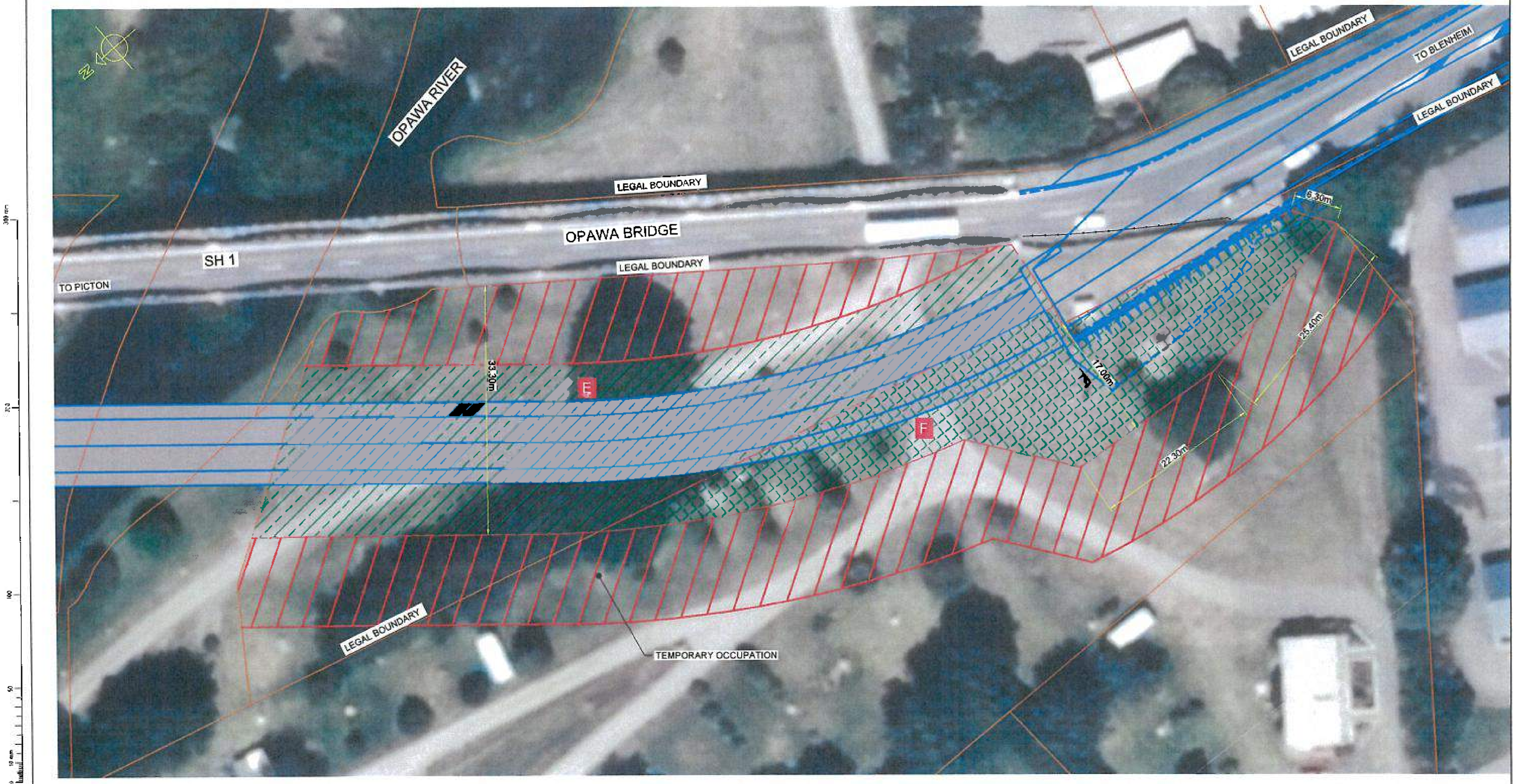
Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project: NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet: LAND REQUIREMENT PLAN
LINZ

Project No.	Sheet No.	Revision
5-MB982.03	23	1

Original Sheet Size A1 [841x594] Plot Date 2016-06-24 at 8:51:34 a.m. Path G:\project\data\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_h\OpawaDesignBase.dwg LinzLandPlan



LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
E	1816	LOT 1 DP 4714 CFR 153630 CFR MB3A/114	L&M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENTS No 1 LTD	FOR NEW ROAD
F	1115	LOT 2 DP 2971 CFR 153630 CFR MB3B/328	L&M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENTS No 1 LTD	FOR NEW ROAD
	2832	TEMPORARY OCCUPATION DURING CONSTRUCTION		

1:1 @ A1 / 1:2 @ A3 0 10 20 30 40 50 60 70 80 90 100 mm

LAND REQUIREMENT PLAN

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED 10.8.16

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

LAND REQUIREMENT PLAN
L & M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENT No 1 LTD.

Drawn: B McD | Scale: 1:250 (A1) 1:500 (A3) | Approved: 10/8/16

Project No: 5-MB982.03 | Sheet No: 24 | Rev: A

Original Sheet Size A1 [841x594] Plot Date 2016-08-10 at 9.41.12 a.m. Path G:\projects\data\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\Blue Option - 50kph Concept Design dwg 24

LAND REQUIREMENTS/LEGAL DESCRIPTIONS

AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
G	261	LOT 2 DP 6215 CFR 171714 CFR MB3E/1296	GROVE MOTOR LODGE LTD. COLIJON LIMITED	FOR NEW ROAD

1:1 @ A1 1:2 @ A3 0 10 20 30 40 50 60 70 80 90 100 mm

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY WAKA KOTAHI

APPROVED 12-5-16

OPUS Nelson Office +64 3 548 1099 Private Bag 36 Nelson 7042 New Zealand

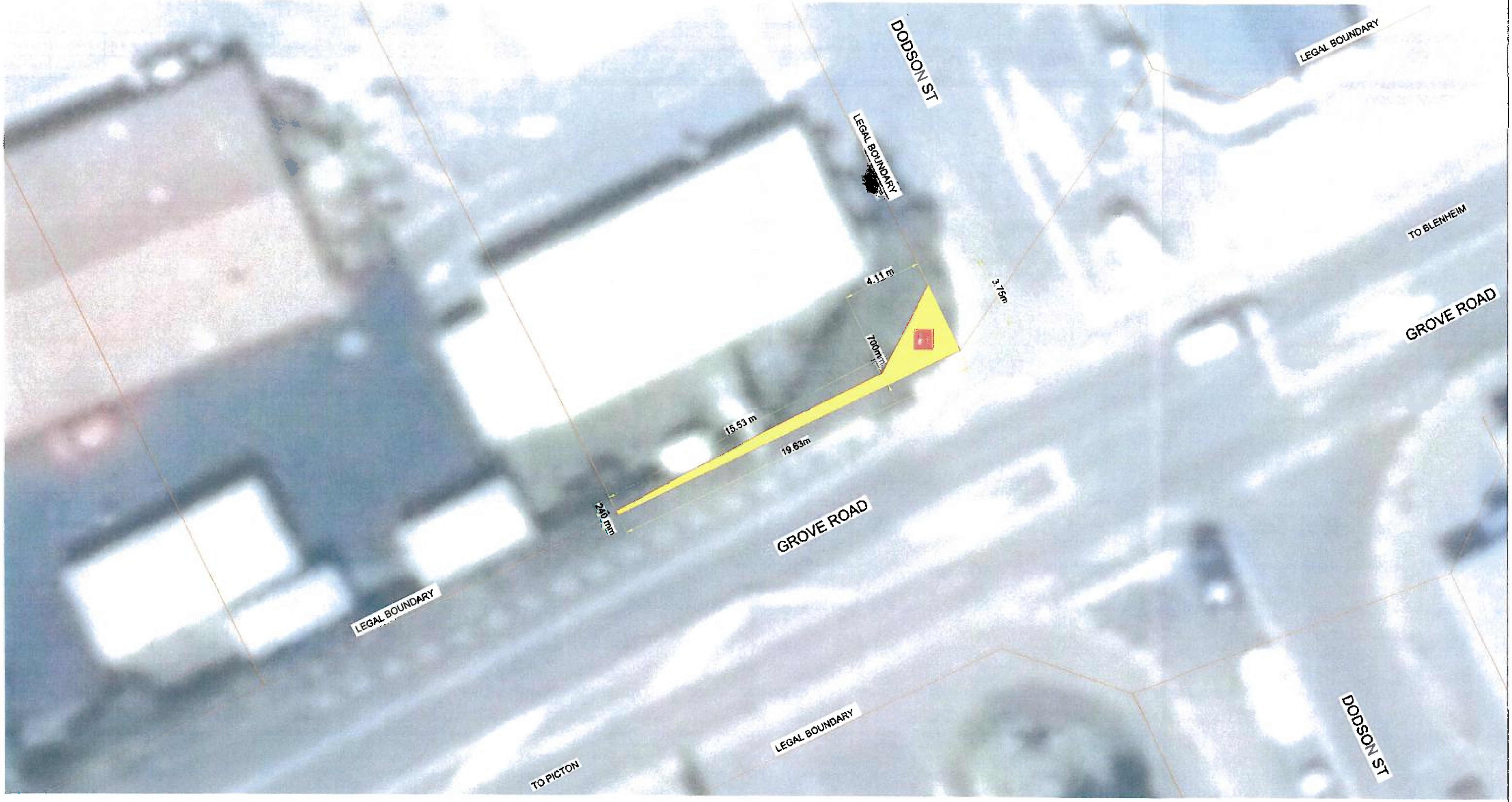
Designed: B. McD
Approved: M.CRUNDWELL
Approved Date: 19.04.2016
Drawn: B. McD
Scale: 1:200 (A1) 1:400 (A3)

Project: NEW ZEALAND TRANSPORT AGENCY OPAWA BRIDGE REPLACEMENT

Sheet: LAND REQUIREMENT PLAN GROVE MOTOR LODGE LTD, COLIJON LTD

Project No: 5-MB982.03 | Sheet No: 25 | Revision: 1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:33 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_h\OpawaDesignBase.dwg GroveLandPlan



LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
H	18	LOT 22 DEED 8 MB 32/48, 153630	L&M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENTS No 1 LTD	FOR NEW ROAD

1:100@ A1 1:200@ A3 0 1 2 3 4 5 6 7 8 9 10 m

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED 12.5.16

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed: B. McD
Approved: M.CRUNDWELL
Approved Date: 19.04.2016
Drawn: B. McD
Scales: 1:100 (A1) 1:200 (A3)

LAND REQUIREMENT PLAN

Project: NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet: LAND REQUIREMENT PLAN
L & M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENT No 1 LTD.

Project No: 5-MB982.03
Sheet No: 26
Revision: 1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:36 p.m. Path G:\project\data\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_h\OpawaDesignBase.dwg SantarosaLandPlan2

LAND REQUIREMENT PLAN

LAND REQUIREMENTS/LEGAL DESCRIPTIONS

AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
A	815	PT SEC 146 – SO 6524 – CFR 5B/208	P.E. PICKERING & P.E PICKERING	FOR NEW ROAD

1:200 @ A1 / 1:400 @ A3 — 0 2 4 6 8 10 12 14 16 18 20 m

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	19.04.2016

Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet
LAND REQUIREMENT PLAN
P.E AND P.E PICKERING

Project No.	Sheet No.	Revision
5-MB982.03	20	1

Original Sheet Size A1 [841x594]   Plot Date 2016-05-11 at 4:34:04 p.m.   Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_hOpawaDesignBase.dwg PickeringLandPlan

LAND REQUIREMENT PLAN

LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
B	1537	SEC 147 BLK XVI – CLOUDY BAY SD	LOCAL PURPOSE RESERVE	FOR NEW ROAD

1:200 @ A1 1:400 @ A3 0 2 4 6 8 10 12 14 16 18 20 m

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	19.04.2016

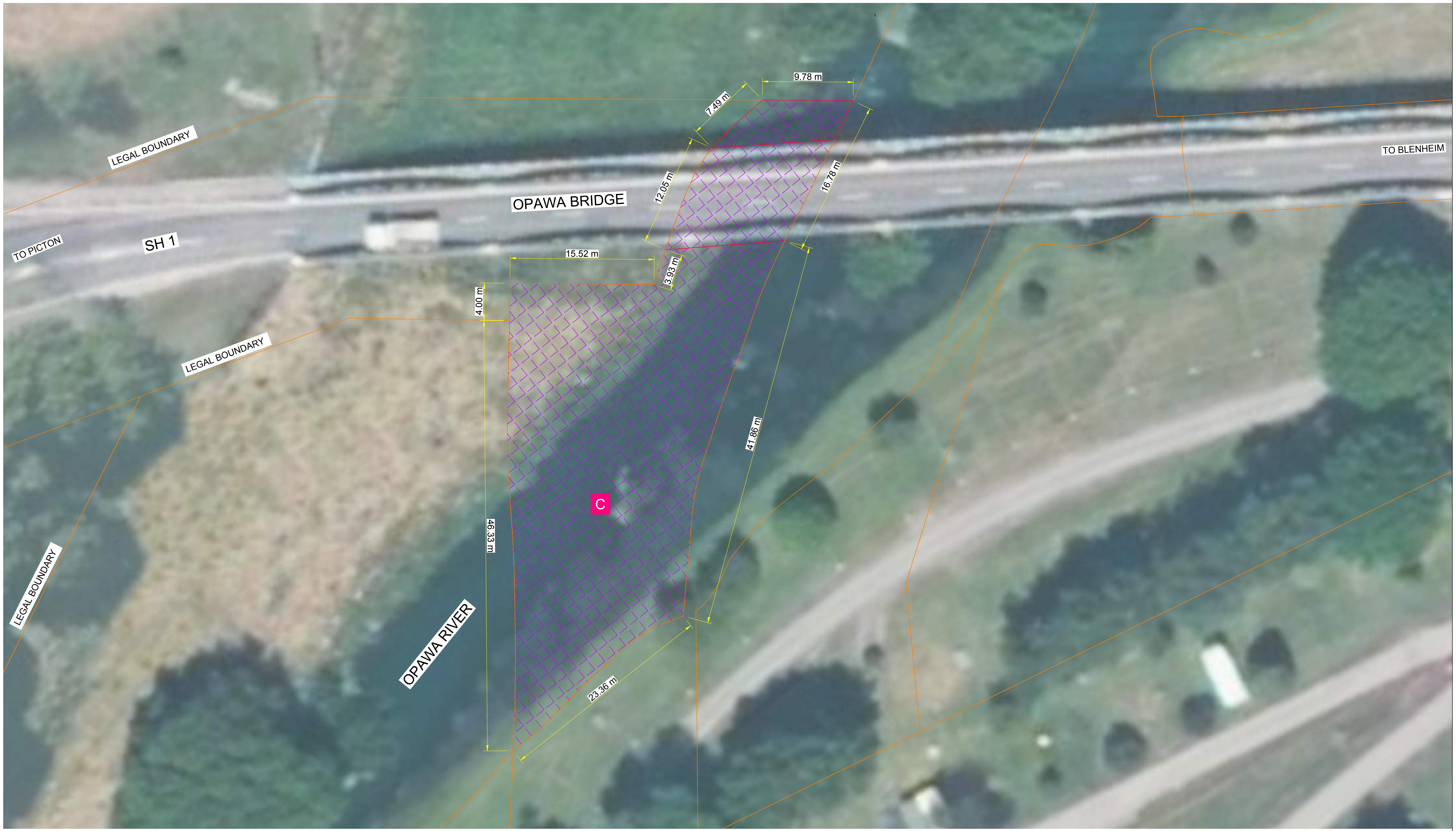
Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet
LAND REQUIREMENT PLAN
LOCAL PURPOSE RESERVE

Project No.	Sheet No.	Revision
5-MB982.03	21	1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:10 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_hOpawaDesignBase.dwg LPRLandPlan



300 mm
200
100
50
10 mm
0

LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
C	1144	MAIN NORTH RAILWAY LINE	KIWI RAIL	FOR NEW ROAD

1:200@ A1 / 1:400@ A3 — 0 2 4 6 8 10 12 14 16 18 20 m

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	19.04.2016

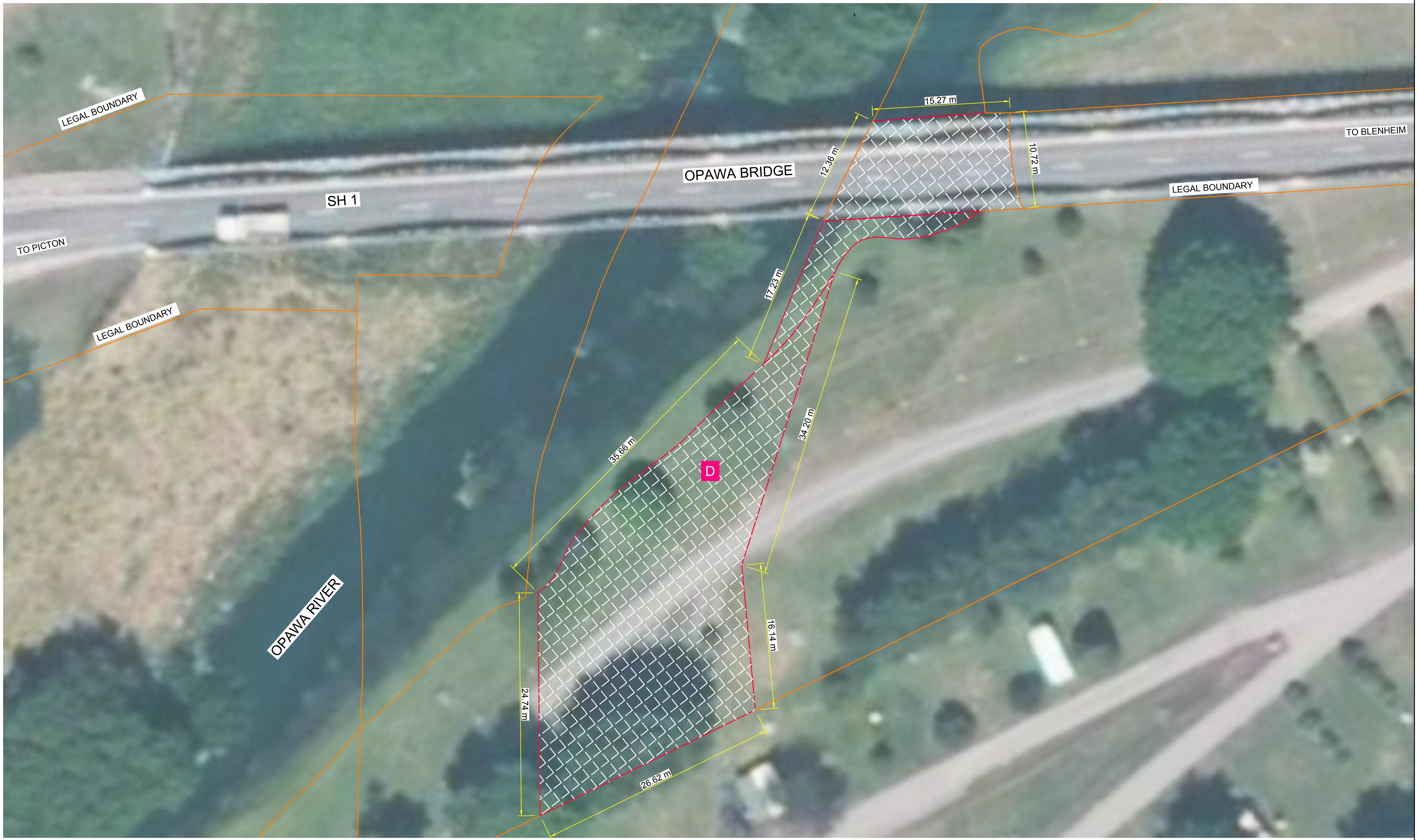
Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet
LAND REQUIREMENT PLAN
KIWI RAIL

Project No.	Sheet No.	Revision
5-MB982.03	22	1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:16 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_hOpawaDesignBase.dwg KiwiRailLandPlan



LAND REQUIREMENTS/LEGAL DESCRIPTIONS

AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
D	1100	PT OLD BED OPAWA ROAD	LINZ	FOR NEW ROAD

1:200 @ A1
1:400 @ A3
0 2 4 6 8 10 12 14 16 18 20 m

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	24.06.2016

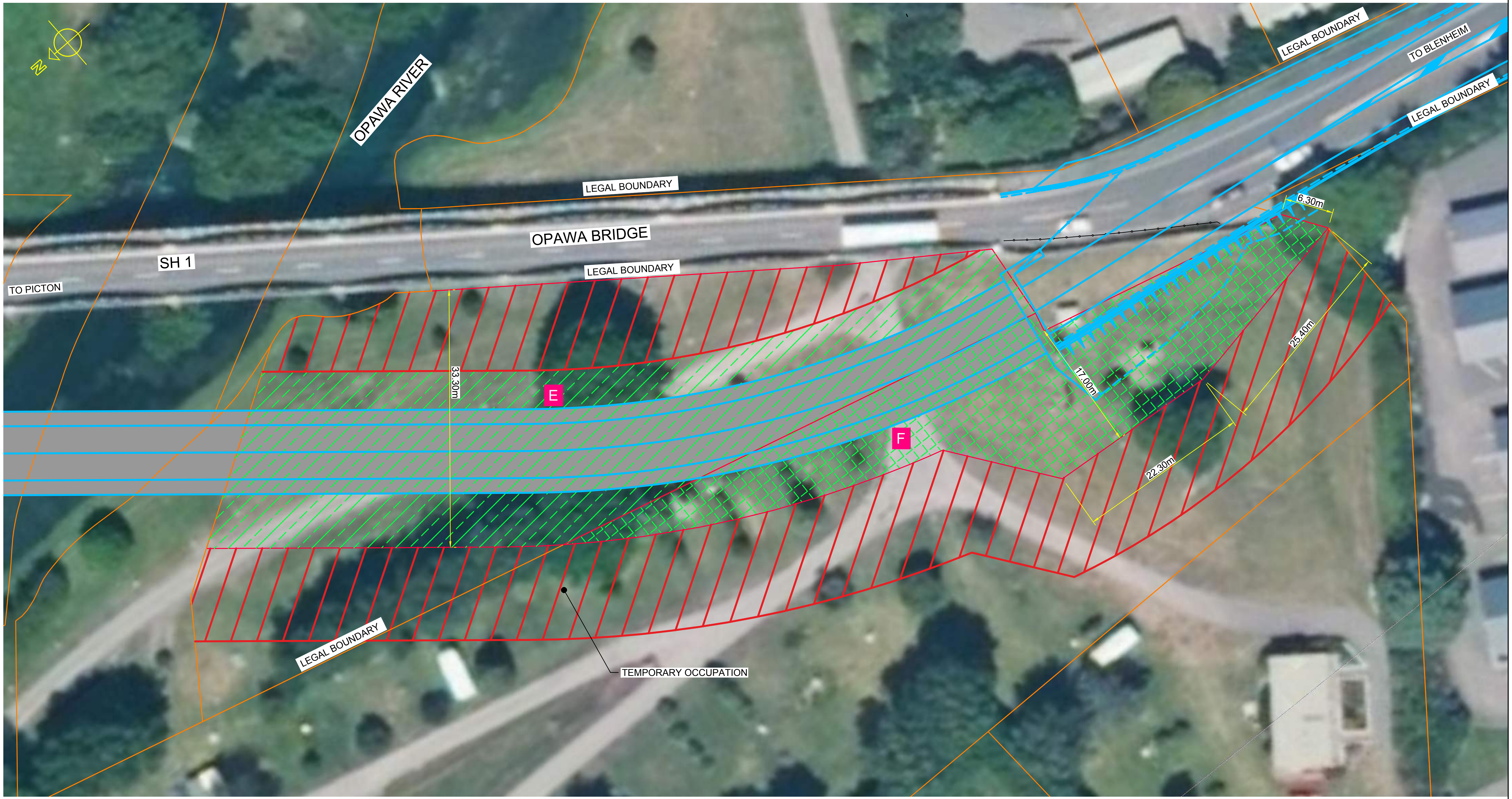
Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet
LAND REQUIREMENT PLAN
LINZ

Project No.	Sheet. No.	Revision
5-MB982.03	23	1

Original Sheet Size A1 [841x594] Plot Date 2016-06-24 at 8:51:34 a.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_hOpawaDesignBase.dwg LinzLandPlan



LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
E	1816	LOT 1 DP 4714 CFR 153630 CFR MB3A/114	L&M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENTS No 1 LTD	FOR NEW ROAD
F	1115	LOT 2 DP 2971 CFR 153630 CFR MB3B/328	L&M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENTS No 1 LTD	FOR NEW ROAD
	2832	TEMPORARY OCCUPATION DURING CONSTRUCTION		

1:1@ A1
1:2@ A3 0 10 20 30 40 50 60 70 80 90 100 mm

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date

APPROVED

Nelson Office
+64 3 548 1099

Private Bag 36
Nelson 7042
New Zealand

Designed | Approved | Approved Date

Drawn: B. McD
Scales: 1:250 (A1) 1:500 (A3)

Project: NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet: LAND REQUIREMENT PLAN
L & M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENT No 1 LTD.

Project No.: 5-MB982.03
Sheet. No.: 24
Revision: A

Original Sheet Size A1 [841x594] Plot Date 2016-08-10 at 9:41:12 a.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\Blue Option - 50kph Concept Design.dwg 24

LAND REQUIREMENTS/LEGAL DESCRIPTIONS

AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
G	261	LOT 2 DP 6215 CFR 171714 CFR MB3E/1296	GROVE MOTOR LODGE LTD, COLIJON LIMITED	FOR NEW ROAD

1:1@ A1 1:2@ A3 0 10 20 30 40 50 60 70 80 90 100 mm

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	19.04.2016

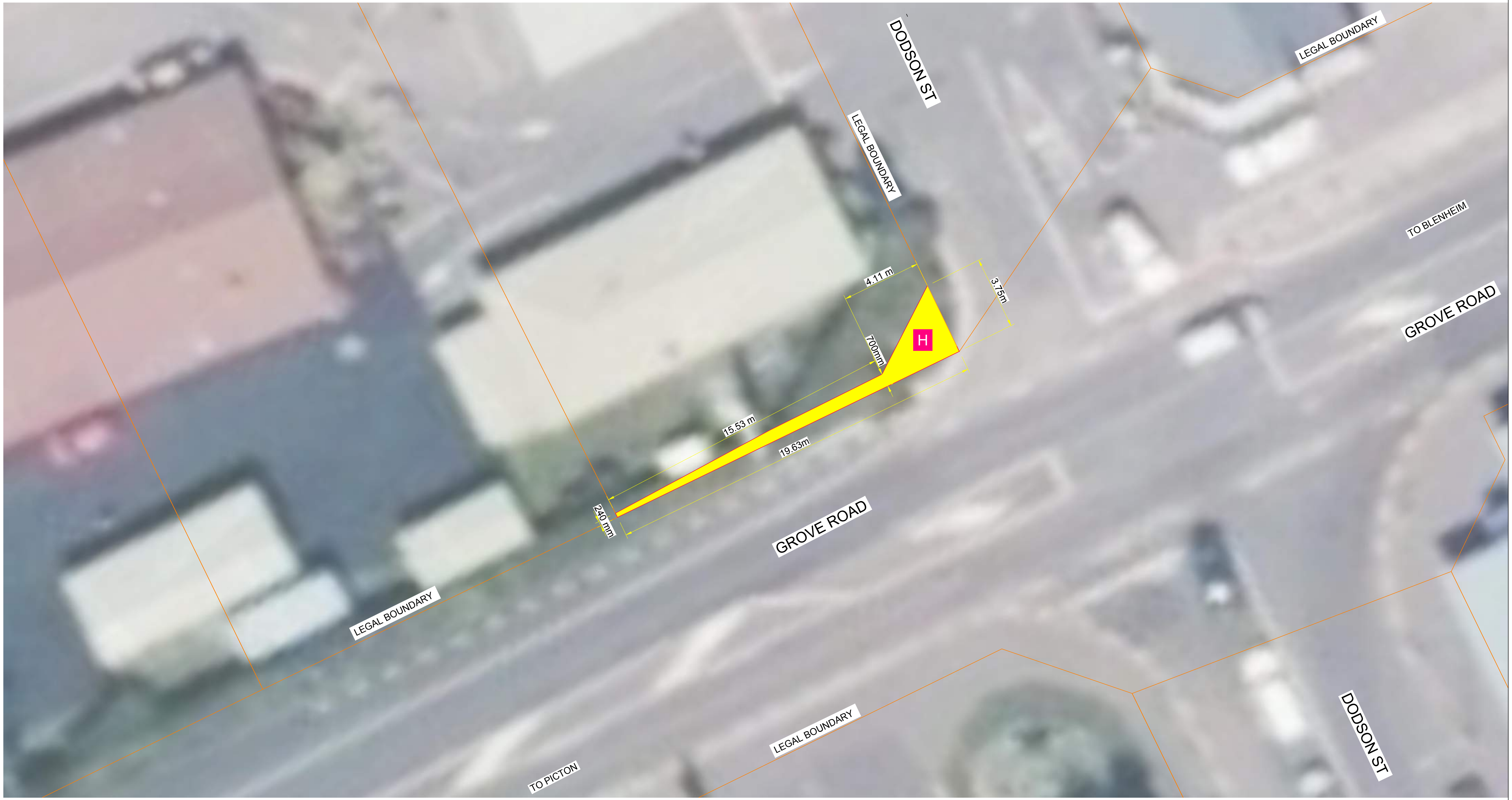
Drawn	Scales
B. McD	1:200 (A1) 1:400 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet
LAND REQUIREMENT PLAN
GROVE MOTOR LODGE LTD, COLIJON LTD

Project No.	Sheet. No.	Revision
5-MB982.03	25	1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:33 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_hOpawaDesignBase.dwg GroveLandPlan



LAND REQUIREMENTS/LEGAL DESCRIPTIONS				
AREA LABEL	AREA (m2)	LEGAL DESCRIPTION	OWNER	REQUIREMENT
H	18	LOT 22 DEED 8 MB 32/48, 153630	L&M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENTS No 1 LTD	FOR NEW ROAD

1:100@ A1
1:200@ A3
0 1 2 3 4 5 6 7 8 9 10 m

300 mm 200 100 50 10 mm 0

LAND REQUIREMENT PLAN

Revision	Amendment	Approved	Revision Date
1	ISSUED FOR REVIEW	M.L.C	19.04.16

NZ TRANSPORT AGENCY
WAKA KOTAHI

APPROVED

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed	Approved	Approved Date
B. McD	M.CRUNDWELL	19.04.2016

Drawn	Scales
B. McD	1:100 (A1) 1:200 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
OPAWA BRIDGE REPLACEMENT

Sheet
LAND REQUIREMENT PLAN
L & M SANTAROSA INVESTMENT LTD, SPINNAKER INVESTMENT No 1 LTD.

Project No.	Sheet. No.	Revision
5-MB982.03	26	1

Original Sheet Size A1 [841x594] Plot Date 2016-05-11 at 4:34:38 p.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_hOpawaDesignBase.dwg SantarosaLandPlan2

APPENDIX O – PROCUREMENT STRATEGY

APPENDIX P – ROAD SAFETY AUDIT AND REVIEWS

Road Safety Audit

Refer following report.

Design Speed Review

Refer following memo dated 23 March 2016 and email response from Steve James (NZTA) dated 6 April 2016.

Safety in Design Workshop

Refer following Register from Safety in Design workshop.

Opus International Consultants Ltd
Blenheim Office
19 Henry Street
PO Box 563, Blenheim 7240
New Zealand

t: +64 3 520 9500
f: +64 3 520 9501
w: www.opus.co.nz

23 March 2016

Andrew James
New Zealand Transport Agency
PO Box 1031
Blenheim 7240

MR 223/3

Dear Andrew,

MR 223 - SH 1 Opawa Bridge
Approval for Design Speed of Possible New Bridge Alignment

To ensure we meet the accelerated design programme for this project, we need to confirm the design speed to be utilised in the design of any replacement bridge as an outcome of the Detailed Business Case. The bridge form and design is sensitive to the geometric alignment.

Speed Environment

The northern 100/50 km/h threshold to Blenheim is only 145m to the north of the abutment of the existing bridge. It is considered that a 50 km/h geometric design speed for any new bridge and approaches will be out of context with the preceding highway and that a higher design speed will be required for safety reasons.

The preceding two km of highway prior to the threshold is flat, relatively straight, with good visibility. The last speed limit review in 2012 has a southbound mean speed of 96 km/h and an 85$^{\%ile}$ speed of 106 km/h at Rowley Crescent some 850 metres to the north. Between the threshold and the current bridge, operating speeds vary with a large standard deviation in speed distribution predominately as a result of the existing tight and obstructed turn onto the existing Opawa Bridge resulting in significant slowing including some vehicles stopping completely.

Any new replacement bridge should not have this obstruction and sight distances will need to conform to the Austroads Design Standards. On this basis higher operating speeds can be expected with a more linear flow.

Geometric Design

Good geometric design practice calls for no more than 10-15 km/h change in design speed between successive geometric elements. Allowing an 85$^{\%ile}$ operating speed at the threshold of 90 km/h, the first curve beyond the threshold, which indicatively coincides with the possible northern bridge approach, should ideally have curvature and camber suitable for no less than 75 km/h design speed. The subsequent curve, indicatively within the bridge structure and ending at the southern abutment, should ideally have a design speed of around 65 km/h. To illustrate the alignment an example 70 km/h design has been produced (attached), which averages the two idealised design speeds to create consistent radius reverse curves.

Higher operating speeds need to be discouraged on any new bridge to ensure compliance with the regulatory speed limit. SLNZ notes that the $85^{\%ile}$ speed for a 50 km/h speed zone should only be 60 km/h. Relocation of the current threshold or amendment of speed limits on the northern approach are an option, however appropriate treatment of the current threshold, along with a new curvilinear alignment in both the horizontal and vertical elements combined with reduced visibility resulting from the bridge side protection, should allow us to increase the side friction sufficiently to reduce operating speeds down closer to the regulatory speed limit.

Considering these issues we need to create an environment that indicates 50-60 km/h to the driver but accommodates 70-80 km/h for safety reasons particularly on the northern approach to the bridge.

Constraints

Property at the southern urban end is constrained with the existing motel buildings quite close to any new alignment with the community desire for the existing, historically listed bridge, to remain. The available corridor between the motel and existing bridge abutment effectively pin any new bridge alignment at this end. The resulting geometric alignment then 'pivots' around this point. The northern property will incur additional impacts from a higher design speed alignment as a result. The form of the bridge is heavily influenced by design speed, with 75% of the bridge length needing to be curved to accommodate the example 70 km/h alignment.

A higher design speed increases operating speeds and the consequences of any crashes. It contributes less to achieving the correct operating speed in relation to the regulatory speed limit. In addition the environmental effects will increase with additional land required and impacts on adjoining properties needing to be mitigated.

A lower design speed will decrease operating speeds but the standard deviation in speed distribution will increase as laminar flow is disrupted. The consequences of any crashes should be less as operating speeds decrease. Environmental effects are less as the geometry is more constrained.

Recommendation

A minimum design speed of 70 km/h is recommended to be adopted for all potential bridge replacement options as a reasonable compromise. Higher design speeds, which while increasing safety for errant vehicles approaching from the north, will exacerbate land purchase and bridge curvature issues, and negatively impact the speed environment heading into the urban area. Lower design speeds are out-of-context with the speed environment to the north and create issues with visibility and safe stopping sight distances.

It is considered that a 70 km/h design speed can accommodate the errant driver travelling at 80-90 km/h, and that the location and form of the threshold and other shoulder treatments can be used to create an environment that encourages drivers to travel nearer to the 50 km/h regulatory speed limit.

It will be difficult to complete the Preliminary Structure Options Report without this decision as it directly affects the possible bridge forms that can be considered. The geometrical design is actually quite complicated due to the site constraints and will potentially challenge certain bridge construction forms, e.g. double hollow core beams, as viable options due to the curvature and possible dead loads to be applied to achieve the required cross falls.

The accelerated design and construction programme cannot afford challenging of design aspects at a later date with associated time impacts.

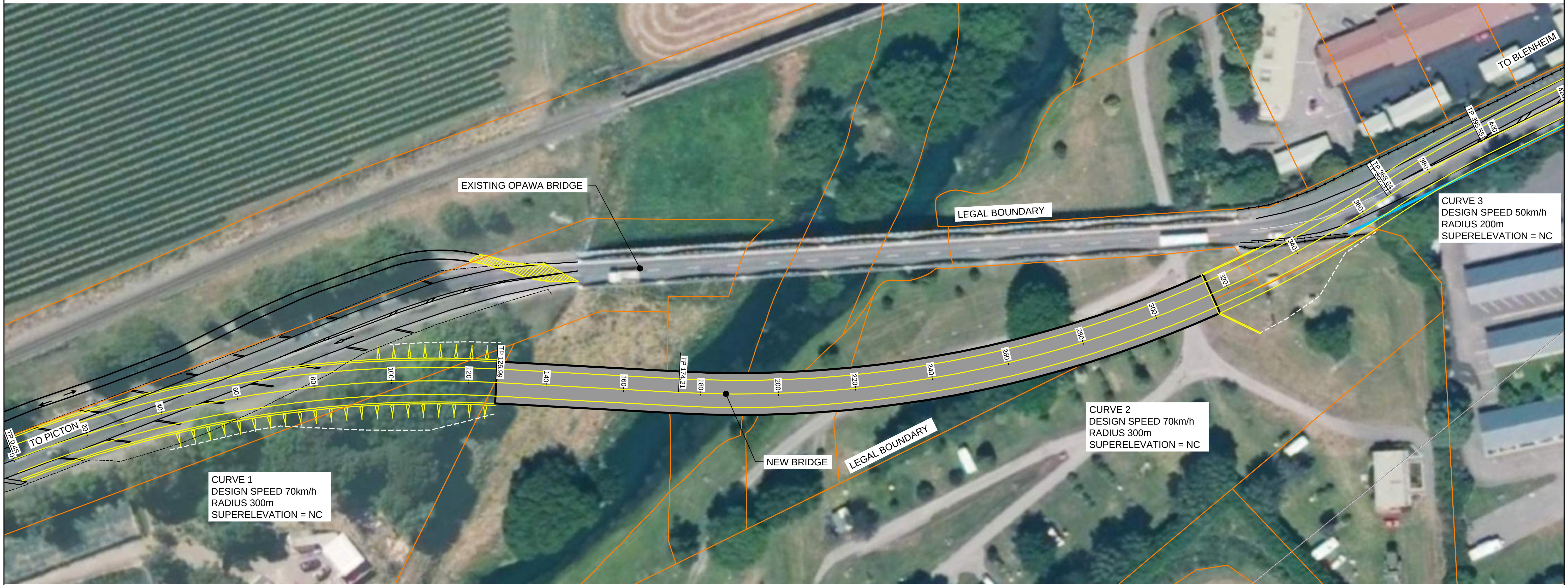
An early consensus is required to allow work to proceed to programme.

Yours faithfully,

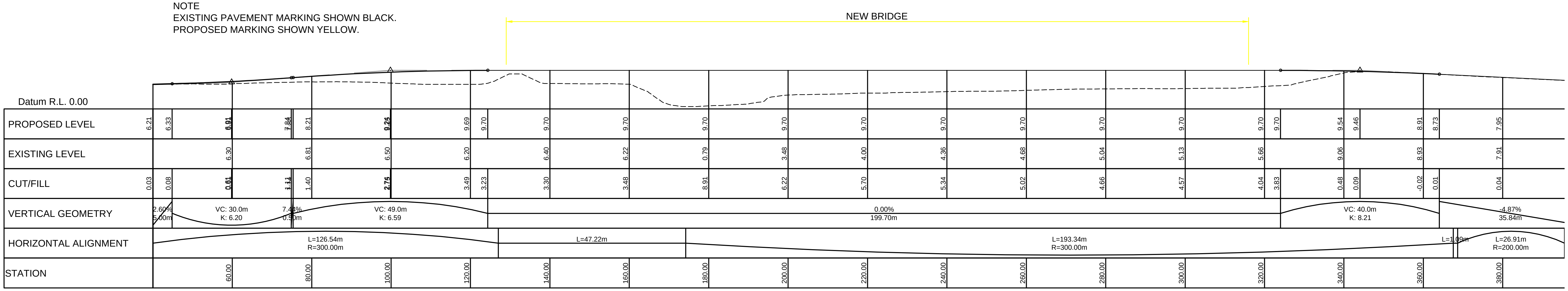
B J Morgan

Brent Morgan
Team Leader

cc Andrew Adams, NZTA



NOTE
EXISTING PAVEMENT MARKING SHOWN BLACK.
PROPOSED MARKING SHOWN YELLOW.



Option1Centreline
SECTION BETWEEN CH: 40.00 AND 440.00

CONCEPT

Revision	Amendment	Approved	Revision Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Nelson Office
+64 3 548 1099
Private Bag 36
Nelson 7042
New Zealand

Designed: B. McD
Approved:
Approved Date:
Drawn: B. McD
Scales: 1:500 (A1) 1:1000 (A3)

Project
NEW ZEALAND TRANSPORT AGENCY
MR 223. SH1 OPAWA BRIDGE

Sheet
SH1 OPAWA RIVER BRIDGE REPLACEMENT
70 km/h DESIGN SPEED - PLAN AND LONGSECTION

Project No.: 5-MB982.03
Sheet. No.: 1-A
Revision: A

1:1 @ A1
1:2 @ A3
0 10 20 30 40 50 60 70 80 90 100 mm

Original Sheet Size A1 [841x594] Plot Date 2016-03-21 at 9:46:50 a.m. Path G:\projectdata\other_offices\5-MB982.XX Wairau and Opawa Bridges\Opawa Bridge\Opawa Design\70km_hOpawaDesignBase.dwg Overall(Sht1)

Safety in Design Record – Simplified Procedure

This document records the H&S hazards that could give rise to reasonably foreseeable risks to the health & safety of those interacting with the design option, or any part of it, as a work place during its lifecycle.

Limitation on Safety in Design Information provided: Only H&S hazards and risks which will or may result from the design have been identified and recorded. The hazards recorded are those that were identified at the date and associated with stage of the design.

Project information					
Project Name	SH 1 Opawa Bridge Replacement	Project Number	MR 223	Date	27 July 2016
Client	New Zealand Transport Agency	Project Stage	Conceptual – DBC Phase		
Brief description of design option, including its intended use	New two lane bridge alongside existing historical bridge to be retained for walking and cycling.	Prepared by	Brent Morgan, Andrew James, Andrew Adams, Matthew Taylor, Michael Cowan, Martin Crundwell, Frank Westergard		

For information on the process refer to our Safety in Design policy and guidelines PO-HS 504. CHAIR tool utilised for this review.

Generic Keywords & Questions (1)	**Identified hazards** (2)	**How is hazard managed in design** (3)	**Residual risk** (4) and **Additional requirements** (5)	
Size – Construction	Bridge deck unit size and weight	Substituted – manage size and weight in design	High	Certified crane and rigger
Size – Construction	Cranage platforms / staging	Substituted – manage size and weight in design	High	Certified crane and rigger
Size – Construction	Working over water	Eliminate – temporary staging	High	Manage in construction H&S Plan
Size – Demolition	Explosive release of post tensioning	Mitigate – manage post tensioning process, esp. transverse	High	Asset Management manual to note
Size – Maintenance	Confines spaces – avoid small street box sections	Eliminate – manage in design	Low	
Size – Maintenance	Confined spaces – avoid small access points	Eliminate – manage in design	Low	
Size – Maintenance	Access platforms – access to bearings	Eliminate – manage spill through batters for access to bearings	Low	
Size – Maintenance	Access for maintenance generally	Eliminate – provide sufficient land purchased to manage maintenance access	Low	
Size – Maintenance	Access for maintenance generally	Eliminate – provide handrails / steps to access bearings	Low	
Size – Operation	Access for maintenance generally	Eliminate – provide safety barriers located to avoid small gaps & falling from heights	Low	
Size – Operation	People hanging off services / flanges	Eliminate – manage in design to remove opportunity to climb / hang	Low	
Size – Operation	Vandalism / public nuisance around abutments and piers	Mitigate opportunities through CPTED reviews	low	
Size – Operation	Clearance for vehicle in camp under bridges	Eliminate – manage design to ensure standards met	Med	Additional clearance signage may be necessary

Safety in Design Record – Simplified Procedure

Generic Keywords & Questions (1)	**Identified hazards** (2)	**How is hazard managed in design** (3)	**Residual risk** (4) and **Additional requirements** (5)	
Size – Operation	Sight distances do not meet standards	Eliminate – manage design to ensure geometric standards met	Low	
Heights and Depths – Construction	Working at heights	Eliminate – manage design to ensure safety barriers in place	Med	Construction H&S plan to note any requirements
Heights and Depths – Maintenance	Working at heights	Eliminate – manage design to ensure safety barriers in place	Med	Asset management plan to note any specific requirements
Heights and Depths – Operation	Vandalism / thrown objects	Isolate – consider throw screens if deemed necessary	Med	Camp ground modifications to be considered as part of design
Heights and Depths – Maintenance	Access for maintenance from camp ground level	Eliminate – sufficient land purchased to allow access	Low	
Heights and Depths – Maintenance	Scaffolding around spill through abutment	Eliminate if possible through design	Med	Use certified riggers for scaffolding if required.
Heights and Depths – Maintenance	Scaffolding under deck	Mitigate – provide points to hang scaffold off for maintenance purposes	Low	
Heights and Depths – Maintenance	Maintenance of expansion joints in live lanes	Mitigate – reduce expansion joints with fully integrated deck design	Med	TMP required for working in live lane to maintain expansion joints
Heights and Depths – Maintenance	Confined spaces	Eliminate / mitigate – limit enclosed section	Med	Note in asset management plan confined space access / certified confined space personal and procedures
Heights and Depths – Operation	Crime under bridges	Mitigate – incorporate CPTED practices	Low	
Heights and Depths – Operation	Crime in walkways under bridges	Mitigate – incorporate CPTED practices	Low	
Heights And Depths – Maintenance	Access to street lighting	Eliminate – manage through design	Low	
Position / Location – Operation	Misaligned kerbs, safety barriers and manholes	Eliminate – manage through design	Low	
Position / Location – Maintenance	Access to stormwater systems	Eliminate – no underslung piping	Low	
Position / Location – Operation	Water ponding on live lanes	Eliminate – manage through design to stop water ponding at transition into super-elevation	Low	Normal camber assists drainage complexity and reduces northbound traffic speeds
Position / Location – Operation	Vehicles in pedestrian areas	Eliminate – manage through design with removable bollards	Low	
Position / Location – Operation	Vehicle parking inappropriate areas	Mitigate – look at option of providing parking for old bridge	Med	Additional signage and controls may be necessary

Safety in Design Record – Simplified Procedure

Generic Keywords & Questions (1)	**Identified hazards** (2)	**How is hazard managed in design** (3)	**Residual risk** (4) and **Additional requirements** (5)	
Position / Location – Operation	Pedestrians injuries on barriers	Eliminate – manage through design	Low	
Ergonomics – Operation	Access provisions inadequate	Eliminate – manage through design	Low	
Ergonomics – Maintenance	Access to bridge through safety barriers and acoustic fencing	Eliminate negotiate sufficient land for access through land purchase	Low	
Ergonomics – Operation	Pedestrian facilities	Eliminate – all pedestrians on old bridge, no pedestrians on new bridge	Low	
Movement / Direction – Operation	Speed management	Mitigate – manage through design to increase side friction	Med	Police speed management as necessary
Load / Force – Operation	Seismic / live load / hydraulic load on structure	Mitigate – manage through design	Low	
Load / Force – Construction	Cranage loads	Mitigate – manage size and weight through design	High	Certified crane and rigger
Load / Force – Construction	Cranage from deck	Mitigate – manage additional deck capacity through design / constructability reviews	High	Certified crane and rigger
Load / Force – Construction	Geotechnical ground improvements	Mitigate through design of alternative ground treatments	Low	
Energy – Construction	Explosive release of post-tensioning	mitigate manage post tensioning process esp. transverse	High	Asset management plan to note
Timing – Construction	Impact on construction programme	Mitigate through constructability review	Low	
Timing – Construction	Impact on construction programme	Mitigate through road safety audit	Low	
Size – Construction	Construction loads	Mitigate through constructability review	Med	Legal loads and transport management by approved carriers
Access – Construction	Construction access / egress	Mitigate with temporary access agreement with land purchase	Med	Construction H&S plan to manage.
Access – Operation	Other property accesses	Mitigate through design to standards	Low	
Access – Operation	Pedestrian and cyclist desire line not met causing people to cross live lanes	Mitigate through design and align where possible to prevent crossing live lanes	Med	Additional fencing may be required RSA audit should identify
Environmental – Construction	Temporary works increase flood risk	Mitigate – temporary works to manage flood risk	Med	Contractors management plans to manage flood risk

Safety in Design Record – Simplified Procedure

Generic Keywords & Questions (1)	**Identified hazards** (2)	**How is hazard managed in design** (3)	**Residual risk** (4) and **Additional requirements** (5)	
Environmental – Construction	Construction noise and vibration cause nuisance	Mitigate – design to minimise	Med	Contractors management plans to manage noise and vibration issues
External Safety Interfaces – Construction	Traffic management	Mitigate – constructability review	Med	Contractors management plans to manage TMPs
External Safety Interfaces – Construction	Public distraction causing harm	Mitigate / Isolate – provide hoardings	Med	Contractors management plans to manage
External Safety Interfaces – Construction	Damage to adjacent property / buildings	Mitigate – constructability review	Med	Contractor to undertake assessment reports before / after work
Toxicity – Maintenance	Toxic materials causing harm	Eliminate – eliminate toxic paints and surface coatings	Low	
Environmental – Construction	Harm to the environment	Mitigate through constructability reviews	Med	Contractors management plans to manage environment issues
Inspection And Testing – Construction	Access to confined spaces	Eliminate through design	Low	
Demolition	Demolition of structure at end of life	Mitigate through constructability and demolition review	Med	Note issues in asset management plan

Notes:

(1) The above categories are **not** an exhaustive list of issues that should be considered to ensure safety in design—but are a guide only. You must consider what H&S hazards may arise during the entire lifecycle of the design option from construction of the structure to its use/operation, alteration, maintenance, or demolition.

(2) When considering what hazards should be recorded, only record hazards and risks that arise from the design and that users need to be aware of to ensure there are no resulting risks to their H&S. A useful test is to ask yourself, "Can I influence this risk through my design?" if the answer is yes then it should be recorded.

(3) Record how each hazard has been managed (either eliminated, substituted, isolated, or mitigated) including reference to any additional supporting information (such as codes or design regulations) if required.

(4) Record the residual risk, i.e. the level of risk after the hazard has been managed, as Extreme (E), High (H), Medium (M) or Low (L) based on the table below (extracted from PO-CG-108g, enterprise risk management framework):

			Potential Consequence of Threats				
			Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Likelihood	V	Almost certain	Low	Medium	High	Extreme	Extreme
	IV	Likely	Low	Medium	High	Extreme	Extreme
	III	Possible	Low	Medium	Medium	High	Extreme
	II	Unlikely	Low	Low	Medium	High	High
	I	Rare	Low	Low	Low	Medium	High

Where the definition of the consequence of the threats are:

Insignificant	No harm incidents
Minor	First aid treatment for one or more people
Moderate	Medical treatment injury to one or more people
Major	Serious harm injury to one person
Catastrophic	Death or multiple serious harm injuries

(5) For any hazards that have a residual risk other than ‘Low’, record what additional conditions (if any) the users of the structure must be aware of to ensure that each hazard is reduced to ‘Low’, including who is responsible for completing that.

aurecon

Project: SH1 Opawa River Bridge Replacement

Detailed Business Case Road Safety Audit Report

Reference: 253391

Prepared for: NZ Transport Agency

Revision: 1

31 August 2016

Document Control Record

Document prepared by:
Aurecon New Zealand Limited
1st Floor, 62 Bridge Street
Nelson 7040
PO Box 1545
Nelson 7040
New Zealand

T **+64 3 539 0190**
F **+64 4 472 9922**
E nelson@aurecongroup.com
W aurecongroup.com

Document control							aurecon
Report Title		Detailed Business Case Road Safety Audit Report					
Document ID			**Project Number**		253391		
File Path							
Client		NZ Transport Agency	**Client Contact**		Andrew James		
Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**	
0	31 August 2016	Internal verification check	A Fon	A Fon	S Hamilton	M Muirson	
1	31 August 2016	Draft for Client	A Fon	A Fon	S Hamilton	M Muirson	
Current Revision		1					

Approval			
Author Signature		Approver Signature	
Name	Ari Fon	Name	Melanie Muirson
Title	Senior Engineer	Title	Technical Director

Contents

Appendices

1. Background

1.1 Safety Audit Procedure

A road safety audit is a term used internationally to describe an independent review of a future road project to identify any safety concerns that may affect the safety performance. The audit team considers the safety of all road users and qualitatively reports on road safety issues or opportunities for safety improvement.

A road safety audit is therefore a formal examination of a road project, or any type of project which affects road users (including cyclists, pedestrians, mobility impaired etc.), carried out by an independent competent team who identify and document road safety concerns.

A road safety audit is intended to help deliver a safe road system and is not a review of compliance with standards.

The primary objective of a road safety audit is to deliver a project that achieves an outcome consistent with Safer Journeys and the Safe System approach, that is, minimisation of death and serious injury. The road safety audit is a safety review used to identify all areas of a project that are inconsistent with a safe system and bring those concerns to the attention of the client in order that the client can make a value judgement as to appropriate action(s) based on the risk guidance provided by the safety audit team.

The key objective of a road safety audit is summarised as:

> *To deliver completed projects that contribute towards a safe road system that is increasingly free of death and serious injury by identifying and ranking potential safety concerns for all road users and others affected by a road project.*

A road safety audit should desirably be undertaken at project milestones such as:

- Concept Stage (part of Business Case);
- Scheme or Preliminary Design Stage (part of Pre-Implementation);
- Detailed Design Stage (Pre-implementation / Implementation); and
- Pre-Opening / Post-Construction Stage (Implementation / Post-Implementation).

A road safety audit is not intended as a technical or financial audit and does not substitute for a design check on standards or guidelines. Any recommended treatment of an identified safety concern is intended to be indicative only, and to focus the designer on the type of improvements that might be appropriate. It is not intended to be prescriptive and other ways of improving the road safety or operational problems identified should also be considered.

In accordance with the procedures set down in the "*NZTA Road Safety Audit Procedures for Projects Guideline*", (dated November 2004 for the current guideline and Interim release May 2013 of new guidelines)", the audit report should be submitted to the client who will instruct the designer to respond. The designer should consider the report and comment to the client on each of any concerns identified, including their cost implications where appropriate, and make a recommendation to either accept or reject the audit report recommendation.

For each audit team recommendation that is accepted, the client shall make the final decision and brief the designer to make the necessary changes and / or additions. As a result of this instruction the designer shall action the approved amendments. The client may involve a safety engineer to provide commentary to aid with the decision.

Decision tracking is an important part of the road safety audit process. A decision tracking table is embedded into the report format at the end of each set of recommendations to be completed by the designer, safety engineer and client for each issue documenting the designer response, client decision (and asset manager's comments in the case where the client and asset manager are not one and the same) and action taken.

A copy of the report including the designer's response to the client and the client's decision on each recommendation shall be given to the road safety audit team leader as part of the important feedback loop. The road safety audit team leader will disseminate this to team members.

1.2 The Safety Audit Team

The road safety audit was carried out in accordance with the "NZTA Road Safety Audit Procedure for Projects Guidelines - Interim release May 2013", by:

- Melanie Muirson, Technical Director, Aurecon Christchurch
- Ari Fon, Senior Engineer, Aurecon Nelson
- Stuart Hamilton, Senior Civil Designer, Aurecon Blenheim (observer)

The Safety Auditors reviewed the drawings as a desk-top exercise prior to a pre-audit meeting with Brent Morgan of Opus International Consultants on Wednesday 24th March 2016. The audit site inspection was carried out that afternoon, following this meeting.

1.3 Report Format

The potential road safety problems identified have been ranked as follows:

The expected crash frequency is qualitatively assessed on the basis of expected exposure (how many road users will be exposed to a safety issue) and the likelihood of a crash resulting from the presence of the issue. The severity of a crash outcome is qualitatively assessed on the basis of factors such as expected speeds, type of collision, and type of vehicle involved.

Reference to historic crash rates or other research for similar elements of projects, or projects as a whole, have been drawn on where appropriate to assist in understanding the likely crash types, frequency and likely severity that may result from a particular concern.

The frequency and severity ratings are used together to develop a combined qualitative risk ranking for each safety issue using the Risk Assessment Matrix in Table 1 below. The qualitative assessment requires professional judgement and a wide range of experience in projects of all sizes and locations.

Table 1: Risk Assessment Matrix

Severity (*Likelihood of Death or Serious Injury Consequence*)	Frequency (Probability of a Crash)			
	Frequent	Common	Occasional	Infrequent
Very Likely	Serious	Serious	Significant	Moderate
Likely	Serious	Significant	Moderate	Moderate
Unlikely	Significant	Moderate	Minor	Minor
Very Unlikely	Moderate	Minor	Minor	Minor

While all safety concerns should be considered for action, the client or nominated project manager will make the decision as to what course of action will be adopted based on the guidance given in this ranking process with consideration to factors other than safety alone. As a guide a suggested action for each risk category is given in Table 2 below.

Table 2: Risk Categories

RISK	Suggested Action
Serious	A major safety concern that should be addressed and requires changes to avoid serious safety consequence.
Significant	Significant risk that should be addressed and requires changes to avoid injury consequence
Moderate	Moderate risk that should be addressed to improve overall safety
Minor	Minor risk that should be addressed where practical to improve overall safety.

In addition to the ranked safety issues it is appropriate for the safety audit team to provide additional comments with respect to items that may have a safety implication but lie outside the scope of the safety audit. A comment may include items where the safety implications are not yet clear due to insufficient detail for the stage of project, items outside the scope of the audit such as existing issues not impacted by the project or an opportunity for improved safety but not necessarily linked to the project itself. While typically comments do not require a specific recommendation, in some instances suggestions may be given by the auditors.

1.4 Scope of Audit

This audit is a Scheme Design Safety Audit of the proposed replacement of the Opawa River Bridge located on State Highway (SH) 1 on the northern side of the Blenheim urban area. The audit is based on the detailed business case drawings provided by Opus International Consultants.

The Safety Audit Team (SAT) is not aware of any previous Road Safety Audits undertaken for earlier phase drawings for the project.

1.5 Documents Provided

The SAT has been provided with the following documents for this audit:

- NZ Transport Agency, MR223.SH1 Wairau and Opawa Bridges, Detailed Business Case, SH1 Opawa Bridge Replacement Blue Option, Road Intersection, Project No. 5-MB982.03, Sheets C01 – C03, Plan and Typical Cross Section drawings, Concept, Opus International Consultants, Issue Date 08/08/16

- NZ Transport Agency, SH1 Opawa Bridge, Indicative Business Case, Opus International Consultants, June 2015
- Opus letter to NZ Transport Agency, Approval for Design Speed of Possible New Bridge Alignment, 23 March 2016

1.6 Disclaimer

The findings and recommendations in this report are based on an examination of available relevant plans, the specified road and its environs, and the opinions of the SAT. However, it must be recognised that eliminating safety concerns cannot be guaranteed since no road can be regarded as absolutely safe and no warranty is implied that all safety issues have been identified in this report. Safety audits do not constitute a design review nor an assessment of standards with respect to engineering or planning documents.

Readers are urged to seek specific technical advice on matters raised and not rely solely on the report.

While every effort has been made to ensure the accuracy of the report, it is made available on the basis that anyone relying on it does so at their own risk without any liability to the safety audit team or their organisations.

1.7 Project Description

The project is the replacement of the existing Opawa River Bridge located on State Highway (SH) 1 on the northern side of Blenheim. The existing bridge is narrow and is not considered suitable for current traffic requirements, particularly carrying heavy commercial vehicles.

The preferred option comprises a new bridge located immediately upstream of the existing bridge, with associated approach realignments, particularly for the northern approach. The existing bridge which carries a heritage listing will be retained and will be used for access by recreational cyclists and pedestrians.

2. Safety Audit Findings

2.1.1 Speed Environment/ Design Speed - Significant

As described in detail in the Opus Indicative Business Case, the primary problem is the existing narrow nature of the existing Opawa Bridge. However, by its nature the current bridge creates an ideal traffic calming threshold treatment as vehicle speeds typically reduce on either approach, and heavy vehicles in particular are forced to either slow or stop completely to check that the bridge is clear of other heavy traffic before proceeding across.

There is no crash history discussed in the Indicative Business Case and the SAT believe that the crash severity is minor-only in nature, with vehicle damage and inconvenience the main consequence.

The new bridge as designed to current standards will have full-width lanes and shoulders and will therefore provide no significant cues to motorists approaching from the north to reduce their speeds. It is therefore highly likely that speeds on the new bridge, particularly for southbound vehicles, will be higher than those on the existing bridge.

The SAT has concern that this situation could result in an increase in the crash occurrence and severity of crashes.

The SAT has reviewed the Opus letter of 23 March 2016 to NZTA discussing the rationale for selection of the design speed for the new bridge. The SAT, while in general agreement with the selection of different design speeds at either approach to transition the southbound traffic into the urban area, also consider that the bridge itself should not be used as a geometric feature as control of the design speeds, as there will be minimal opportunity to encourage a lowering of vehicle speeds once vehicles are on the bridge.

Recommendation:
The design speed of the northern approach (for southbound traffic) be assessed as part of detailed design to check the desired vehicle speeds can be achieved rather than considering a step-down in vehicle speeds along the bridge.

Frequency Rating:	Common	Severity Rating:	Likely
Designer Response:			
Valid point. Detailed design to consider whether transition to 50 km/h can be achieved for southbound traffic prior to entering bridge.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.2 Northern Approach Threshold Treatment - Moderate

The highway environment north of the bridge is typically rural in nature, with wide shoulders, grassed verges and established trees. There are few visual cues to motorists of the need to reduce speeds, when approaching the existing bridge. While the existing bridge structure, as noted above, provides an effective speed control, this effect is removed as part of a new bridge approach alignment.

In addition, the existing 100 km/h to 50 km/h speed change limit is located approximately 180 metres from the northern abutment of the existing bridge.

The SAT view is that some form of threshold treatment is critical on the higher speed northern approach to control vehicle speeds to reduce the likelihood of crashes occurring. The preferred method of treatment is to "urbanise" this approach as much as possible to provide the appropriate prompts to motorists.

The SAT consider that the current hatched shoulder markings along the western side of the shoulder should be removed and a full left turn auxiliary lane provided into the Grovetown Park facility. In addition, a concrete kerb or swale should be installed along both sides of the highway on the northern approach to the bridge as part of this work.

Consideration should also be given to moving the existing 100 km/h to 50 km/h speed change to the northern side of the existing Grovetown Park entrance.

Recommendation:

Change the current hatched shoulder markings along the western side of the shoulder to provide a left turn auxiliary lane into the Grovetown Park facility.

Install concrete swale drain or kerb and channel along both sides of the sealed shoulder on the northern approach to the bridge from the speed threshold.

Consider the relocation of the existing 100km/h to 50 km/h speed limit change to a position north of the access to the Grovetown Park facility.

Figure 1 View of Northern Bridge Approach

Recommendation:

Change the current hatched shoulder markings along the western side of the shoulder to provide a left turn auxiliary lane into the Grovetown Park facility.

Install concrete swale drain or kerb and channel along the western side of the sealed shoulder.

Consider the relocation of the existing 100km/h to 50 km/h speed limit change to a position north of the access to the Grovetown Park facility.

Frequency Rating:	Occasional	Severity Rating:	Likely
Designer Response:			
Agree urbanising northern approach needs to be considered in detailed design through use of channels, pavement marking, landscaping, lighting and relocation of threshold.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.3 Dodson Street Intersection - Moderate

The current plans indicated the extent of the works terminate at the existing SH1 / Dodson Street intersection, with no works indicated at the intersection.. However the SAT view is that this intersection should be included within the project extents.

A number of heavy commercial vehicles were observed using this intersection, with a particularly high number of left turning trucks exiting the intersection on the weekday afternoon the SAT visited the site.

Consideration needs to be given to providing safe and clear paths for pedestrians and cyclists through the intersection to the proposed shared path facility on the eastern side that leads to the existing bridge.

The impact of the new bridge and approach alignment in terms of sight distance will also have an effect on this intersection given that southbound vehicles are more likely to be travelling at higher speeds

Recommendation:

The SH1/ Dodson Street intersection should be considered as part of the detailed design stage.

Figure 2 Dodson Street west showing queuing vehicles

Frequency Rating:	Occasional	Severity Rating:	Likely
Designer Response:			
Beyond current project scope but agree that should be included to manage issues highlighted. NZTA to confirm to include and consider as part of detailed design.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.4 Cyclist and Pedestrian Facilities - Moderate

The existing bridge has a clip-on structure on the downstream side which is able to be used by pedestrians and cyclists. However there is no suitable existing connection to existing footpaths and cycle routes on the southern side of the bridge. The proposed scheme retains the exiting bridge for use by recreational cyclists and pedestrians and develops a connection to the south through the formation of a shared path facility along the eastern highway shoulder.

The width of this facility is shown on the plans as 2.50 metres. The SAT consider that this is the absolute minimum width and a more desirable width would be 3.0 metres.

A barrier is currently shown on the drawings, with the barrier type and extent to be confirmed as part of the detailed design. While agreeing that barrier protection is required for the shared path, the SAT also note that a solid barrier has the potential to reduce sight distance, particularly for vehicles on the eastern Dodson Street approach to the SH1/ Dodson Street intersection when looking north from the limit line.

There are currently no provisions indicated on the plans for routing cyclists and pedestrians to the proposed shared path across the highway and south of the Dodson Street intersection on the eastern side. A safe crossing point is also required for both pedestrians and cyclists to cross SH1 from the west side to the proposed shared path. The SAT consider that a location south of the SH1/ Dodson Street intersection is appropriate for a new refuge island to be provided in the existing median for this crossing point. This could be located between existing accesses and would supplement the existing pedestrian refuge located to the south near the Budge Street intersection.

The shared path facility should also be considered to continue along the eastern side of the highway south of the SH1/ Dodson Street intersection to the new highway crossing point. There is sufficient width in the footpath through this section, with some pavement marking work and possible rationalisation of accesses required to provide a safe path.

Recommendation:
That the feasibility of increasing the width of the shared path to a more desirable width of 3.0 metres minimum is explored.

That a pedestrian/ cyclist refuge be formed on SH1 south of the SH1/ Dodson Street intersection to provide a safe crossing place to the shared path facility.

That the proposed shared path be continued south of the SH1/ Dodson Street intersection to the proposed highway crossing point.

That visibility and sight distance is considered in the selection of an appropriate barrier and the extent of that barrier alongside the proposed shared path

Frequency Rating:	Infrequent	Severity Rating:	Likely
Designer Response:			
Agree pedestrian and cyclist SH crossing point an issue that needs to be addressed in the detailed design. Note any median island will need to cater for property accesses and northbound right turn movements into Dodson St. Early consideration of additional width will be required early as part of property negotiations.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.5 Existing Trees Adjacent to the Grove Park Motor Lodge - Moderate

The drawings indicate that the highway will be widened along the western side adjacent to the existing Grove Park Motor Lodge property, south of the bridge. There are mature trees along the entire length of the boundary north of the existing Motor Lodge access off SH1. It is not shown on the drawings whether these trees are removed as part of the proposed work.

In the opinion of the SAT, these trees will limit the available sight distance to and from the Dodson Street western approach at the SH1/ Dodson Street intersection.

Recommendation:
That the trees along the boundary of the Grove Park Motor Lodge property, north of the existing access off SH1 are removed as part of the works to improve available sight distance.

Figure 3 Trees along western property boundary immediately south of Bridge

Frequency Rating:	Occasional	Severity Rating:	Likely
Designer Response:			
Agree correct sight lines and distances need to be achieved in detailed design.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.6 Sight Distance to Dodson Street from the Bridge - Moderate

For vehicles waiting at limit line on the Dodson Street western approach of the SH1/ Dodson Street intersection, the traffic approaching southbound off the new bridge will appear from behind their left shoulder, rather from in front of their shoulder with the existing bridge position. The reduction in sight distance should be checked to confirm that current requirements are met with the new alignment.

Recommendation:
That the sight distance to the western approach of the SH1/ Dodson street intersection be checked to ensure that sight distance requirements are met for southbound traffic approaching the intersection.

Frequency Rating:	Occasional	Severity Rating:	Likely
Designer Response:			
Agree correct sight lines and distances need to be achieved in detailed design and may need to consider amending angle of Dodson St limit line.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.7 Reverse Curve on Southern Approach - Significant

The horizontal geometry shown on the current plan drawings indicates a reverse curve immediately south of the southern bridge abutment. This results in a "lane-shift" of approximately one full lane width. The plans indicate that this curve has been designed for a 50 km/h design speed.

While this will be appropriate for northbound traffic heading out of town, the SAT consider that vehicles approaching from the higher-speed northern approach will be traversing the reverse curve at speeds significantly higher than that of the slower speed urban southern approach. A reverse curve is undesirable under these conditions.

Recommendation:
That the reverse curve shown on the current plan drawings be removed from the final design.

Frequency Rating:	Occasional	Severity Rating:	Very Likely
Designer Response:			
Detailed design to consider removal or easing of reverse curve on southern approach.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.8 Geometric Design - Moderate

The drawings for the bridge incorporate a horizontal curve at the southern end of the proposed structure. The SAT understand that the vertical geometry of the bridge has not yet been confirmed and is subject to confirmation of flood freeboard requirements and stormwater runoff collection. The consistency of the vertical and horizontal geometry for the bridge is critical to meeting the adopted design speed and in providing the required sight distance.

While the plans are at concept level only, the SAT notes that there is currently a mismatch between the horizontal speed (70km/h) and the vertical speed (50km/h). This has the effect of reducing the safe stopping distance which is particularly important when entering or exiting the bridge.

Recommendation:
On confirmation of bridge finished surface levels and final bridge vertical and horizontal design, the designer to check for compliance against sight distance requirements.

Designer to provide consistency of vertical geometry and horizontal geometry to the adopted design speed.

Frequency Rating:	Infrequent	Severity Rating:	Likely
Designer Response:			
Agree detailed design needs to align horizontal and vertical design geometry.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.9 Barrier Type and Extents - Minor

The current plans indicate new barriers to be installed over the bridge and on the immediate approaches. The barrier type and the final location and extents of the barrier are not yet confirmed. The SAT consider the choice of barrier type and extent is critical in terms of safeguarding that no limit is placed on the available sight distance. The designer should review this aspect as part of detailed design.

Recommendation:
The new barrier should be checked against sight distance requirements to ensure that visibility is not limited by either the barrier type or the positioning and extents of the barrier. This is particularly critical for visibility to and from both the Dodson Street approaches of the SH1/ Dodson Street intersection.

Frequency Rating:	Infrequent	Severity Rating:	Unlikely
Designer Response:			
Detailed design to ensure required sight distances are achieved and that safety barriers do not impact on these.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.10 Lighting - Minor

No lighting details are shown on the current plans as these have yet to be designed. The designer will need to complete lighting design in compliance with relevant standards and with consideration to Safety in Design, particularly in relation to location of light poles and access for maintenance.

Recommendation:
That lighting design is completed as part of detailed design to the relevant standards and with due consideration to Safety in Design.

Frequency Rating:	Infrequent	Severity Rating:	Unlikely
Designer Response:			
Noted in Safety In Design register for maintenance issues. Detailed design to consider lighting. Lighting standard to be agreed as to whether urban or rural considering light spill issue into camp ground below.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.1.11 Drainage - Minor

No details of proposed stormwater drainage and control are shown on the current plans as these have yet to be designed. The designer will need to undertake drainage design compliant with relevant standards and with consideration to Safety in Design in terms of aspects such as traversiblity of culvert headwalls and access for maintenance.

Recommendation:
That drainage design be completed as part of detailed design to the relevant standards and with consideration to Safety in Design.

Frequency Rating:	Infrequent	Severity Rating:	Unlikely
Designer Response:			
Drainage inlet and outlet protection to be considered in detailed design. Depth of flow along bridge shoulders to be assessed and managed.			
Safety Engineer			
Agree with designers response.			
Client Decision:			
Agree with designers response.			
Action Taken:			
Safety Audit provided to NZTA Project Manager, Andrew Adams			

2.2 Additional Comments

2.2.1 Retention of Existing Bridge

The existing Opawa River Bridge is to be retained as part of the preferred option and will be used for recreational cyclists and pedestrians. The SAT understand that due to the Class 1 Heritage classification on the structure, this would necessitate a high consenting threshold for demolition to be approved.

However the retention of the existing structure as part of the preferred scheme limits the options for any new bridge position and alignment. This also impacts the methodology for constructing the new structure adjacent to the existing structure while the existing bridge remains operational. In particular, the restriction placed on the location of the southern abutment of the new bridge is a constraint to the overall horizontal geometry that can be achieved for the replacement bridge and approaches. While acknowledging that retention of the existing bridge is deemed appropriate on heritage grounds it should also be understood that this decision will have a negative impact, albeit slightly, on what would otherwise be the preferred new bridge position

2.2.2 Adjoining Property Constraints

In a similar manner to the previous comment, the SAT are aware of the constraints the adjoining properties create the project and the balance in minimising property impact and resulting purchase and in achieving the preferred design outcome. The project is significant in terms of capital expenditure, of which the overall property costs will still only be a small proportion. The SAT view is that should property purchase be necessary in order to achieve the most efficient and safest design possible, then this requirement should be identified and progressed as part of the detailed design.

3. Audit Statement

We certify that we have used the available plans, and have examined the specified roads and their environment, to identify features of the project we have been asked to look at that could be changed, removed or modified in order to improve safety. The problems identified have been noted in this report.

Signed: Dated: 31 August 2016

Ari Fon, BE (Civil), MIPENZ
Senior Engineer
Aurecon NZ Ltd

Signed: Dated: 31 August 2016

Melanie Muirson, Melanie Muirson, BE (Civil), MET, MIPENZ, CPEng
Technical Director
Aurecon NZ Ltd

Designer	Name	Brent Morgan, CPEng, MIPENZ	Position	Design Team Leader
	Signature		Date	8 September 2016
Safety Engineer	Name	Steve James	Position	Senior Safety Engineer
	Signature		Date	14 September 2016
Project Manager	Name	Andrew James, BSc(Hons), DipPM, CPEng, IntPE (NZ), MIPENZ	Position	Principal Transport Planner
	Signature		Date	14 September 2016
Action Completed	Name	Andrew James	Position	Principal Transport Planner
	Signature		Date	14 September 2016

Project Manager to distribute audit report incorporating decision to designer, Safety Audit Team Leader, Safety Engineer and project file.

Date: 14 Sept 2016

Appendices

Appendix A
Audit Drawings

Aurecon New Zealand Limited
1st Floor, 62 Bridge Street
Nelson 7040
PO Box 1545
Nelson 7040
New Zealand

T +64 3 539 0190
F +64 4 472 9922
E nelson@aurecongroup.com
W aurecongroup.com

APPENDIX Q –PROJECT RISK ANALYSIS

Concept Design Project Risk Register

Ian Rich – HNO Risk Advisor (Tel: 04 894 6287)
Ian.Rich@nzta.govt.nz
August 2013

Risk Register

ZTA Lead: Andrew James | Opus

					Current Exposure											Residual (Target) Exposure										
					Semi-Quantitative			%	Time (days)			Cost ($)			Treatment Strategy	Semi-Quantitative			%	Time (days)			Cost ($)			
Risk Title	Description/ Cause/ Consequence	Risk Owner	Phase	Established Controls	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	(refer to Actions Register for detail)	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	Commentary & Closure Statement
Compulsory purchase	THREAT. **Description:** There is a threat that we won't have the land and property purchase will require compulsory acquisition. **Cause:** The cause of the threat is that negotiations fail to reach agreement. **Consequence:** The consequence of the threat is the time delay in compulsory process.	Andrew James	Pre Implementation	Early agreement on option mitigtations, quality negotiations	Very High	Very High	25	90%	81	108	135	2,700,001	4,050,000	5,400,000	Property consultant to identify trigger events where compulsory action might be started	High	Very High	22	90%	54	67	80	270,001	1,485,000	2,700,000	
Landowner objection	THREAT. **Description:** There is a threat that we won't have the land and property purchase will require compulsory acquisition. **Cause:** Option not finalised delaying negotiations in good faith. **Consequence:** The consequence of the threat is the time delay in compulsory process.	Andrew James	Pre Implementation	Early finalisation of recommended option	Very High	Very High	25	90%	81	108	135	2,700,001	4,050,000	5,400,000	Property consultant to identify trigger events where compulsory action might be started	High	Very High	22	90%	54	67	80	270,001	1,485,000	2,700,000	
Planning delays	THREAT. **Description:** There is a threat that a resource consent application could be appealed to the Environment Court. **Cause:** The cause of the threat is the style of river bed mitigation around bridge piers and abutments. **Consequence:** The consequence of the threat is additional cost and delay to	David Jackson	Detailed Business Case	Adequate assessment of ground conditions, and design solutions. Consultation with MDC over which stakeholders should be consulted.	Very High	Medium	23	50%	45	60	75	1,500,001	2,250,000	3,000,000	Adequate SI programme, analysis, solution development and consultation	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
Public relitigation of options	THREAT. **Description:** There is a threat that their could be a public relitigation of the options. **Cause:** The cause of the threat is taking the final options to public consultation. **Consequence:** The consequence of the threat is additional delay and the cost.	Andrew James	Pre Implementation	A robust option recommendation backed up by clear decision methodology and clean presentation of the facts.	Very High	Medium	23	50%	45	60	75	1,500,001	2,250,000	3,000,000	Resolve options asap with well reasoned case to back it up	Very High	Medium	23	50%	45	60	75	1,500,001	2,250,000	3,000,000	Can prepare for risk, but can't influence till after it occurs.
Consultant Behind Schedule	THREAT. **Description:** There is a threat that consultant falls behind on programme and will not meet government time line **Cause:** The cause of the threat is a poor project management, unexpected delays information, staff illness or problems and rework. **Consequence:** The consequence of the threat is late delivery of DBC.	Brent Morgan	Detailed Business Case	Professional Insurannces	High	High	21	75%	45	56	67	225,001	1,237,500	2,250,000	Risk adjusted programme updated monthly, weekly meeting of Deputy project managers, monthly client meetings, direct communication with NZTA project manager, if delivery of any task falls behind by	High	Medium	19	50%	30	37	45	150,001	825,000	1,500,000	
Poor ground conditions encountered	THREAT. **Description:** There is a threat that poor ground conditions affecting bridge pier and abutment foundations are encountered leading to a wide range of potential forecast costs. **Cause:** The cause of the threat is that only limited site investigations have been undertaken, and available data is insufficient to form a confident view. **Consequence:** The consequence of the threat is the mitigation scheme is so broad that the work is over-priced.	Greg Saul	Detailed Business Case	Recommend and undertake site investigation	High	High	21	75%				225,001	1,237,500	2,250,000	Recommended SI programme	Medium	Low	11	25%				7,500	41,250	75,000	
Incorrect geotechnical assumptions	THREAT. **Description:** There is a threat that geotechnical assumptions based on inadequate information, do not accurately predict the liquefaction and lateral spread potential at the site. **Cause:** The cause of the threat is that site data is mis-interpreted leading to an inaccurate view of the materials under seismic response or flood conditions. **Consequence:** The consequence of the threat is the mitigation scheme is so	Greg Saul	Detailed Business Case	Recommend and undertake site investigation	High	High	21	75%				225,001	1,237,500	2,250,000	Recommended SI programme	Medium	Medium	15	50%				15,001	82,500	150,000	
Public Engagement	THREAT. **Description:** There is a threat that when we consult general public they feel there is insufficient information, or process unfair. **Cause:** The cause of the threat is a lack of information and public not being fully informed . **Consequence:** The consequence of the threat is a possible Transport agency review of DBC report and delay in finalising design.	David Jackson	Detailed Business Case	Public aware of project over long history of job, landowners generaly aware of projects through land purchase due diligence work.	Very High	Low	20	25%	23	30	38	750,000	1,125,000	1,500,000	Engagement Strategy, regular newsletters, public displays, direct consultation with affected landowners, Iwi and key stakeholders.	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
H&S and bridge proximity	THREAT. **Description:** There is a threat that side by side bridges will attract a public safety risk.. **Cause:** The cause of the threat is that an open and proximal gap may tempt youth to climb/ jump between bridges. **Consequence:** The consequence of the threat is serious injury or death.	Michael Cowan	Implementation	Safety in Design	Very High	Low	20	25%				750,000	1,125,000	1,500,000	Adequate H&S planning.	Medium	Low	11	25%				7,500	41,250	75,000	
IBC and DBC format	THREAT. **Description:** There is a threat that standard of output unclear **Cause:** The cause of the threat is lack of completed full IBC and DBC **Consequence:** The consequence of the rework, lack of suitable delivery, delivery delay, variations	Andrew James	Indicative Business Case	Current NZTA website proformas	High	Medium	19	50%	30	37	45	150,001	825,000	1,500,000	Use current proformas. Draft reviews by NZTA, Internal Opus Business case training, accessing current best practise examples	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
DBC format	THREAT. **Description:** There is a threat that the content of the output evaluation is unclear **Cause:** The cause of the threat is lack of completed full DBC. **Consequence:** The consequence of the rework, lack of suitable delivery, delivery delay, variations.	Andrew James	Detailed Business Case	Current NZTA website proformas	High	Medium	19	50%	30	37	45	150,001	825,000	1,500,000	Use current proformas. Draft reviews by NZTA, Internal Opus Business case training, accessing current best practise examples	High	Low	16	25%	15	19	22	75,000	412,500	750,000	
DBC format	THREAT. **Description:** There is a threat that standard of output is unclear **Cause:** The cause of the threat is that VAC are imposing a project pause part way through the DBC phase. **Consequence:** The consequence of the rework, lack of suitable delivery, delivery delay, variations.	Andrew James	Detailed Business Case	Take direction from Client representative to cover NZTA needs as well as Government needs within same report.	High	Medium	19	50%	30	37	45	150,001	825,000	1,500,000	Use current proformas. Draft reviews by NZTA, Internal Opus Business case training, accessing current best practise examples	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
Consultant Behind Schedule	THREAT. **Description:** There is a threat that consultant falls behind on programme and will not meet government time line **Cause:** The cause of the threat is a poor project management, unexpected delays information, staff illness or problems and rework. **Consequence:** The consequence of the threat is late delivery of post VAC rewrite of DBC, and delay in impelementation	Brent Morgan	Detailed Business Case	Professional Insurannces	High	Medium	19	50%	30	37	45	150,001	825,000	1,500,000	Risk adjusted programme updated monthly, weekly meeting of Deputy project managers, monthly client meetings, direct communication with NZTA project manager, if delivery	Medium	Very Low	4	10%	3	4	6	3,000	16,500	30,000	

Ian Rich – HNO Risk Advisor (Tel: 04 894 6287)
Ian.Rich@nzta.govt.nz
August 2013

Risk Register

ZTA Lead: Andrew James | Opus

					Current Exposure										Treatment Strategy	Residual (Target) Exposure										
					Semi-Quantitative			%	Time (days)			Cost ($)				Semi-Quantitative			%	Time (days)			Cost ($)			
Risk Title	Description/ Cause/ Consequence	Risk Owner	Phase	Established Controls	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	(refer to Actions Register for detail)	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	Commentary & Closure Statement
Hydrological Issues	THREAT. **Description:** There is a threat that when we do DBC, options are required to meet a high design standard **Cause:** The cause of the threat is additional hydrological requirements by MDC above current MRMP or engineering standards **Consequence:** The consequence of the threat is that DBC option costs	Michael Cowan	Detailed Business Case	Current MDC requirements	High	Medium	19	50%				150,001	825,000	1,500,000	MDC meetings, clear requirements requested, Opus challenges MDC design criteria to assess they are reasonable. Develop two options with a	High	Low	16	25%				75,000	412,500	750,000	
Opawa construction Noise and Vibration Issues	THREAT. **Description:** There is a threat that when lack of noise /vibration information leads to project opposition, misunderstanding of project affects **Cause:** The cause of the threat is a perceived negative impacts of noise and vibration unmitigated or recognised due to lack of information or lack of confidence in data. **Consequence:** The consequence of the threat is additional cost, delays in	Vince D	Detailed Business Case	Prepare a report for distribution to affected parties, outlining proposed mitigation, and get the issue out in the open early.	Medium	High	17	75%	23	33	44	22,501	123,750	225,000	Full noise and vibration testing to be undertaken. Prepare a strategy for informing lessee of mitigation proposal	Low	High	12	75%	11	16	22	2,251	12,375	22,500	
Error in Project Technical output	THREAT. **Description:** There is a threat that when there is a significant technical error in project. **Cause:** The cause of the threat is a lack of internal technical reviews or incorrect information. **Consequence:** The consequence of the threat is rework and project delay or	Martin Crundwell	Detailed Business Case	Robust technical reviews and verfications	High	Low	16	25%	15	19	22	75,000	412,500	750,000	Technical reviews at 30% and 60%, all estimates risk adjusted and reviewed, safety audit and estimate parallel review, All reports reviewed by technical	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
Safety Audit /Estimate/economics/ Property/ legal/ External review/ Advisor delay	THREAT. **Description:** There is a threat that when external reviews are late or raise significant error. **Cause:** The cause of the threat is a delays with external reviewers, lack of warning or availability or mistake highlighted **Consequence:** The consequence of the threat is late project delivery	Andrew James	Detailed Business Case	Good programme management	High	Low	16	25%	15	19	22	75,000	412,500	750,000	NZTA engage Property, Estimate, Safety Auditor, Economics peer reviewer as soon as practical and involve them early. Tech review dates set.	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
Architectural issues with New Bridge	THREAT. **Description:** There is a threat that architectual design of new structure is not accepted by the community or conflicts with the heritage structure **Cause:** The cause of the threat is lack of engagement on architectural or urban design **Consequence:** The consequence of the threat is community backlash leading to project delays, rework	Michael Cowan	Detailed Business Case	Bridging The Gaps NZTA guideline, consultation with Heritage NZ and other key stakeholders	High	Low	16	25%	15	19	22	75,000	412,500	750,000	Engage Architectural and urban dewsign expertise and give reference to NZTA "bridge the Gaps" policy	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
Opawa Heritage Structure Issues	THREAT. **Description:** There is a threat that when options considered we cannot get agreement with Heritage NZ **Cause:** The cause of the threat is a Opawa bridge a class 1 heritage building, statutory protection under legislation and MRMP. Bridge build in 1914 100 years old. **Consequence:** The consequence of the threat is project delays and additional	Matthew Taylor	Detailed Business Case	Class 1 heritage building	High	Low	16	25%	15	19	22	75,000	412,500	750,000	Early consultation with Heritage NZ 23rd Feb 2015. Full archaeological investigation at this site	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	
Opawa Land acquisition Issues and Crown land with Iwi settlement	THREAT. **Description:** There is a threat that if we need land from crown land parcel, this will create complex land negotiations **Cause:** The cause of the threat is a crown land parcel in middle of river which could have a treaty settlement issue. **Consequence:** The consequence of the threat is elimination of some options or increased cost	NZTA property Consultant	Detailed Business Case	Property group and Opus appointed land consultations	High	Low	16	25%				75,000	412,500	750,000	Review TPG property consultant's report on all parcels and confirm if it is an issue	Medium	Low	11	25%				7,500	41,250	75,000	
Opawa operational Noise and Vibration Issues	THREAT. **Description:** There is a threat that when lack of noise /vibration information leads to project opposition, misunderstanding of project affects **Cause:** The cause of the threat is a perceived negative impacts of noise and vibration unmitigated or recognised due to lack of information or lack of confidence in data. **Consequence:** The consequence of the threat is additional cost, delays in delivery and rework.	Vince D	Detailed Business Case	Prepare a report for distribution to affected parties, outlining proposed mitigation, and get the issue out in the open early.	Medium	Medium	15	50%	15	22	30	15,001	82,500	150,000	Full noise and vibration testing to be undertaken. Prepare a strategy for informing lessee of mitigation proposal	Low	Medium	10	50%	7	11	15	1,501	8,250	15,000	
Pedestrian/ cycle expections	THREAT. **Description:** There is a threat that pedestrian/ cycleway connections will not fully support public expectations. **Cause:** The cause of the threat is the only safe crossing point on SH1 is well south of the bridge because the traffic coming off the bridge cannot be slowed till that point. **Consequence:** The consequence of the threat is public perception may be	Matthew Taylor	Detailed Business Case	Consultation with stakeholders.	Medium	Medium	15	50%				15,001	82,500	150,000	Consultation clarifies the limitations of the site. Design optimises the safety of vulnerable users.	Medium	Low	11	25%				7,500	41,250	75,000	
Late delivery of architectural material	THREAT. **Description:** There is a threat of delayed agreement to pre-implementation architectural phase material. **Cause:** The cause of the threat is NZTA departmental review process. **Consequence:** The consequence of the threat is delays to consultation.	Matthew Taylor	Pre Implementation	Good programming, early submission of material	Medium	Medium	15	50%	15	22	30	15,001	82,500	150,000	Early submission of material, don't over-promise the "goodies", but again don't under-estimate what might be expected	Medium	Medium	15	50%	15	22	30	15,001	82,500	150,000	Prepare, but can't influence potential delay by much.
Utility Resilience	Opportunity. **Description:** There is an opportunity that when bridge fails it will cause massive costs to utility or inconvenience to public, which could create additional economic benefits for project. **Cause:** The potential of the opportunity is created by existing utilities on seismic vulnerable structure or future planned upgrade work. **Consequence:** The outcome of the opportunity is improved project benefits, share of relocation costs and justification of resilience.	Michael Cowan	Detailed Business Case	Consultation with stakeholders over their wishes for utility resilience. Allowances for cost in estimate.	Medium	Low	11	25%				7,500	41,250	75,000	Explore project benefits via utility resilience.	High	Low	16	25%				75,000	412,500	750,000	
Delay in NZTA feedback review, approval	THREAT. **Description:** There is a threat that when NZTA feedback delayed will delay project **Cause:** The cause of the threat is a workload of NZTA project manager, lack of warning, illness or leave and lack of backup resources **Consequence:** The consequence of the threat is variation claim or late delivery	Andrew James	Detailed Business Case	Early warning and good programme management	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	NZTA book in review times according to programme in their calendars, Opus to pre-warn NZTA of reviews coming up, NZTA to have a backup staff reviewer familiar with the project.	Low	Low	6	25%	4	5	7	750	4,125	7,500	
Delay in NZTA feedback review, approval	THREAT. **Description:** There is a threat that when NZTA feedback delayed will delay project **Cause:** The cause of the threat is a workload of NZTA project manager, lack of warning, illness or leave and lack of backup resources **Consequence:** The consequence of the threat is variation claim or late delivery	Andrew James	Detailed Business Case		Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	NZTA book in review times according to programme in their calendars, Opus to pre-warn NZTA of reviews coming up, NZTA to have a backup staff reviewer familiar with the project.	Low	Very Low	2	10%	1	2	3	300	1,650	3,000	

Ian Rich – HNO Risk Advisor (Tel: 04 894 6287)
Ian.Rich@nzta.govt.nz
August 2013

Risk Register

NZTA Lead: Andrew James | Opus

					Current Exposure										Treatment Strategy	Residual (Target) Exposure										
					Semi-Quantitative			%	Time (days)			Cost ($)				Semi-Quantitative			%	Time (days)			Cost ($)			
Risk Title	Description/ Cause/ Consequence	Risk Owner	Phase	Established Controls	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	(refer to Actions Register for detail)	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	Commentary & Closure Statement
Utility Services	THREAT. **Description:** There is a threat that we have a conflict with utilities which is not identified. **Cause:** The cause of the threat is SH1 is main utilities corridor with incomplete records of all services. **Consequence:** The consequence of the threat is a significant cost increase.	Matthew Taylor	Detailed Business Case	Standard utility search	Medium	Low	11	25%				7,500	41,250	75,000	Utility Report, Consultation with utility operators as key stakeholders, onsite survey, onsite thorough walk over.	Low	Low	6	25%				750	4,125	7,500	
Archaeological Sites Discovered	THREAT. **Description:** There is a threat that there could be a Iwi or archaeological site within work area. **Cause:** The cause of the threat is insufficient site investigation or records. **Consequence:** The consequence of the threat is change of preferred option to avoid site disturbance, possible delay in construction delivery.	Matthew Taylor	Detailed Business Case	MDC RMP listed sites and Heritage NZ register	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	Undertake consultation with local Iwi and undertake Archaeological investigation and study at Opawa	Medium	Very Low	4	10%	3	4	6	3,000	16,500	30,000	
Variation dispute	THREAT. **Description:** There is a threat that additional works requires variation and agreement cannot be reached **Cause:** The cause of the threat is scope increase with dispute over payment **Consequence:** The consequence of the threat is variation claim disagreement, increases costs and delays delivery	Brent Morgan	Indicative Business Case		Medium	Low	11	25%	8	11	15				Regular client meetings and Opus seeks variations prior to completing work.	Low	Low	6	25%	4	5	7				
Safety in Design Process	THREAT. **Description:** There is a threat that safety in Design process changes preferred option solution **Cause:** The cause of the threat is the new NZTA policy, not a tested process **Consequence:** The consequence of the rework and delays	Michael Cowan	Indicative Business Case	New NZTA policy	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	Dealy this process to DBC and use experience of Darren who is familiar with UK process.	Medium	Very Low	4	10%	3	4	6	3,000	16,500	30,000	
Conflict with seasons	THREAT. **Description:** There is a threat that the timing for construction will be confined to certain times in the year. **Cause:** The cause of the threat is fish spawning, bird nesting, and the summer season for the campground. **Consequence:** The consequence of the threat is opposition from stakeholders and landowners, leading to a less efficient construction programme and	David Jackson	Detailed Business Case	Consultation with stakeholders.	Medium	Low	11	25%				7,500	41,250	75,000	Consultation establishes that the disruption to programme is limited to a longer summer holiday period and the ability to avoid fauna	Medium	Low	11	25%				7,500	41,250	75,000	Accept risk
Health and Safety	Description: There is a threat of injury to staff and /or the public during the construction phase. Cause: The cause of the threat is lack of H&S plan or poor site induction or people not complying with the plan. Consequence: The consequence of the threat is injury or accident risk to staff	Matthew Taylor	Implementation	Establish project H&S plan and induct staff to the project. Site staff to review and sign off on project checklist before going to site and to monitor their activities to ensure public exposure to our activities is	High	Low	11	25%				75,000	412,500	750,000	HSE Plan in place and documented in PQP. All team members advised of protocol and the need to fill in site specific visit H&S form prior to each visit. Audit/monitor compliance.	Medium	Low	4	25%				7,500	41,250	75,000	Continue to monitor and remind staff at regular project meetings. Carry risk forward into next phases.
Tie-in traffic management	THREAT. **Description:** There is a threat of tight access at tie-ins southern end. **Cause:** The cause of the threat is a lack of space to give adequate manoeuvring room. **Consequence:** The consequence of the threat is travelling public or contractor's suppliers mis-interpret signage or temporary traffic lights leading	Matthew Taylor	Implementation	Good quality contractor	Medium	Low	11	25%				7,500	41,250	75,000	Adequate H&S planning.	Medium	Low	11	25%				7,500	41,250	75,000	Accept risk
Site security	THREAT. **Description:** There is a threat that site security may be compromised due to complex access issues (campground, street & footpath). **Cause:** The cause of the threat is that current activities cannot be suspended. **Consequence:** The consequence of the threat is a considered H&S plan will need to be developed and closely monitored.	Matthew Taylor	Implementation	Good quality contractor	Medium	Low	11	25%				7,500	41,250	75,000	Adequate H&S planning.	Medium	Low	11	25%				7,500	41,250	75,000	Accept risk
Construction within stopbanks	THREAT. **Description:** There is a threat that there will be extra design requirements around puncturing the stopbank for the bridge abutments. **Cause:** The cause of the threat is we don't know much about the stopbank materials, and haven't thought through construction methodology for stopbank settlement and protection of the town from flooding during construction. **Consequence:** The consequence of the threat is a more expensive construction methodology.	Michael Cowan	Detailed Business Case	Geotechnical investigation	Medium	Low	11	25%				7,500	41,250	75,000	Consideration in Design	Medium	Low	11	25%				7,500	41,250	75,000	Monitor risk outcome
Hydraulic proximity	THREAT. **Description:** There is a threat that existing and new bridges influence one another hydraulically more than a standalone bridge. **Cause:** The cause of the threat is that proximity may increase scour or hydraulic loading, or from sea level rise. **Consequence:** The consequence of the threat is one or other bridge is underdesigned inadvertently, resulting delays and extra costs later.	Michael Cowan	Detailed Business Case	Hydraulic assessment	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	Consideration in Design	Medium	Low	11	25%	8	11	15	7,500	41,250	75,000	Monitor risk outcome
Design still not settled	THREAT. **Description:** There is a threat that aquifer pressures create infiltration and contamination issues. **Cause:** The cause of the threat is pier construction punctures through from one acquifer to another at differential pressure. **Consequence:** The consequence is we require a higher cost design solution.	Michael Cowan	Pre Implementation	Geotechnical investigation	Medium	Low	11	25%				7,500	41,250	75,000	Consideration in Design	Medium	Low	11	25%				7,500	41,250	75,000	Monitor risk outcome
Late delivery of DBC	THREAT. **Description:** There is a threat that the DBC will be delivered late. **Cause:** The cause of the threat is the need to evaluate suboptions of Option 8. **Consequence:** The consequence of the threat is political embarrasment.	Matthew Taylor	Detailed Business Case	Early wrap up of MCA and option recommendation	Low	Medium	10	50%				1,501	8,250	15,000	Devlelop a localised strategy around task	Low	Low	6	25%				750	4,125	7,500	
Public Engagement	THREAT. **Description:** There is a threat that when we consult general public they feel there is insufficient information, or process unfair. **Cause:** The cause of the threat is a lack of information and public not being fully informed . **Consequence:** The consequence of the threat is a possible Transport agency	David Jackson	Detailed Business Case	Public aware of project over long history of job, landowners generaly aware of projects through land purchase due diligence work.	Low	Low	6	25%	4	5	7	750	4,125	7,500	Engagement Strategy, regular newsletters, public displays, direct consultation with affected landowners, Iwi and key stakeholders.	Low	Very Low	2	10%	1	2	3	300	1,650	3,000	

Ian Rich – HNO Risk Advisor (Tel: 04 894 6287)
Ian.Rich@nzta.govt.nz
August 2013

Risk Register

NZ TRANSPORT AGENCY

ZTA Lead: Andrew James | Opus

					Current Exposure										Treatment Strategy	Residual (Target) Exposure										
					Semi-Quantitative			%	Time (days)			Cost ($)				Semi-Quantitative			%	Time (days)			Cost ($)			
Risk Title	Description/ Cause/ Consequence	Risk Owner	Phase	Established Controls	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	(refer to Actions Register for detail)	Consq.	Prob	Risk Score	Prob	Min	Most Likely	Max	Min	Most Likely	Max	Commentary & Closure Statement
Seismic Resilience can't be defined	THREAT. **Description:** There is a threat that NZTA and local government have differing criteria for seismic resilience for the existing bridge. **Cause:** The cause of the threat is one has an asset management perspective and the other a political perspective. **Consequence:** The consequence of the threat is a broad range of views to be tranversed in in the reporting, leading to conflicts of interest, confusion to the	Andrew James	Detailed Business Case	IBC covers both views. Government reading of the report may provide a change in direction.	Low	Low	6	25%				750	4,125	7,500	Ensure DBC covers both points of view allowing careful judgement around how the Design phase proceeds	Low	Very Low	2	10%				300	1,650	3,000	
Site contamination	THREAT. **Description:** There is a threat that hazardous material spills occur during construction. **Cause:** The cause of the threat is inadequate controls over construction plant and materials. **Consequence:** The consequence of the threat is contamination to river or ground.	Matthew Taylor	Implementation	Good quality contractor	Low	Low	6	25%				750	4,125	7,500	Tight consent conditions. Tight specification inclusive of consent conditions.	Low	Low	6	25%				750	4,125	7,500	Business as usual. Accept risk
Supply of Materials	THREAT. **Description:** There is a threat that super tee beams for the new bridge have to be transported through distances or paths that conflict with traffic. **Cause:** The cause of the threat is the remoteness from manufacturing. **Consequence:** The consequence of the threat is unknown scale of conflict,	Michael Cowan	Detailed Business Case	Investigate where the beams can be built, and the implications for supply route. Procurement for moulds for Standard Super Tee beams.	Low	Low	6	25%				750	4,125	7,500	Has been done before for Awatere so unlikely to be a show stopper	Low	Very Low	2	10%				300	1,650	3,000	
Impact on Rail land	THREAT. **Description:** There is a threat that walking and cycling linkages for some options may require solutions which impact on railway land. **Cause:** The cause of the threat is the need for an underpass at the northern end, causing the cycleway to swing out into rail land. **Consequence:** The consequence of the threat is addition property	Matthew Taylor	Pre Implementation	Early finalisation of recommended option	Medium	Very Low	4	10%	3	4	6	3,000	16,500	30,000	Resolve options asap.	Medium	Very Low	4	10%	3	4	6	3,000	16,500	30,000	Monitor
	THREAT. **Description:** There is a threat that . **Cause:** The cause of the threat is . **Consequence:** The consequence of the threat is .						0	0%				#N/A	#N/A	#N/A				0	0%				#N/A	#N/A	#N/A	
							0	0%				#N/A	#N/A	#N/A				0	0%				#N/A	#N/A	#N/A	

APPENDIX R – GEOTECHNICAL FACTUAL REPORT

New Opawa Bridge

Site Investigations Factual Report

New Opawa Bridge

Site Investigations

Factual Report

Prepared By	Ella Williamson Engineering Geologist	Opus International Consultants Ltd Wellington Civil L7, Majestic Centre, 100 Willis St PO Box 12 003, Wellington 6144 New Zealand	
Reviewed & Approved for Release By	P Brabhaharan Technical Principal, Geotechnical/Earthquake Engineering & Resilience	Telephone: Facsimile:	+64 4 471 7000 +64 4 471 1397
		Date: Reference: Status:	August 2015 5MB982.03 GER 2015-28 Issue 1

Contents

1 Introduction

The Opawa Bridge is located on State Highway 1 at the northern end of the Blenheim Township. This bridge is a heritage structure, is on a poor geometric alignment, has very narrow lane widths and has been assessed to be vulnerable to flood scour and earthquakes. The New Zealand Transport Agency is considering a new two lane state highway bridge alongside the existing bridge, with the existing bridge providing access for pedestrians and cyclists.

NZTA has engaged Opus International Consultants (Opus) to develop a concept for the new Opawa Bridge structure. As part of this process, geotechnical investigations were carried out to provide information on the ground and groundwater conditions and parameters for design. This report presents a summary of the on-site geotechnical investigations and provides the factual results of the testing.

2 Site Description

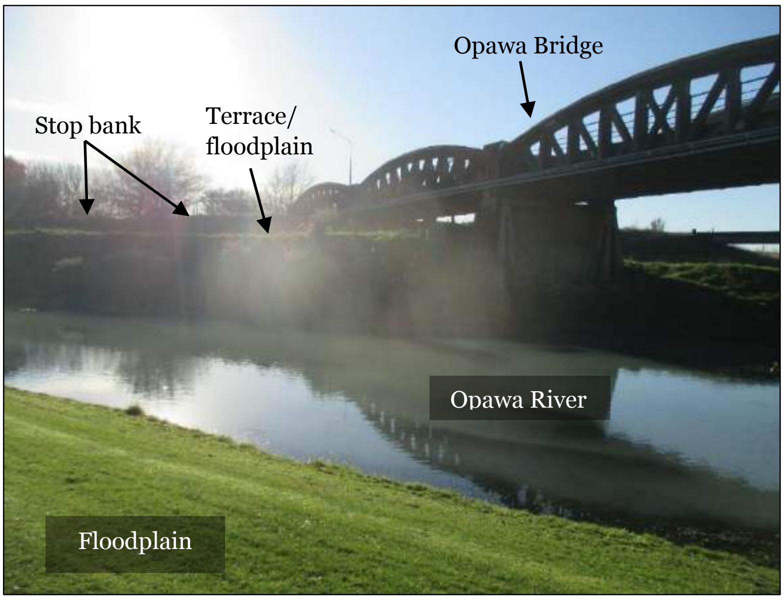
The Opawa Bridge is located on Stage Highway 1, Grove Road, at the northern edge of the Blenheim township. The new Opawa Bridge is planned to be located approximately 20 m to the west of the current Opawa bridge location. A location plan is presented in Figure 1.

2.1 Geomorphology

The Blenheim area is located on the Wairau Plains. These are extensive alluvial plains formed by the Wairau River and its southern tributaries. In the Blenheim area the geomorphology of the plains consists of flat to undulating terraces and the floodplains of the Opawa River.

At the Opawa River bridge site, the bridge traverses both the river and lower lying designated flood plain zones on either side, which are bound by stop banks. The stop banks have been constructed along the river to provide flood protection. There is a significant river terrace along the northern edge of the river.

Photograph 1 – Opawa Bridge



2.2 Geology & Hydrogeology

The geology of the Marlborough Area has been mapped at 1:25,000 scale by the New Zealand Geological Survey (NZGS, 1981) and at 1:250,000 scale by the Institute of Geological and Nuclear Sciences (IGNS, 2000). The mapping shows the Blenheim area to be underlain by Holocene age marine/estuarine silts and sands of the Dillons Point Formation and alluvial gravels and sands of the Rapaura Formation. These strata are underlain by older, clay-bound alluvial gravels of the Speargrass Formation (NZGS, 1981; Landcare Research, 1995; MCRWB, 1987; Davidson and Wilson, 2011).

The site is located on the eastern boundary of the Springs Sector of the Wairau Aquifer, which supplies the municipal water requirements for Blenheim and the towns of Renwick and Woodbourne (Davidson and Wilson, 2011). The site location is inferred to feature a shallow sub-artesian water layer to approximately 20 m.

2.3 Active Faults

The plate boundary between the Pacific and Australian plates passes through Marlborough, and consequently this region is an area of high seismicity. Relative motion between the tectonic plates is accommodated across a zone of active strike-slip faults (the Marlborough fault system), which links the Alpine fault transform plate boundary to the south with the westward-directed Hikurangi subduction margin to the north. The Marlborough fault system comprises four principal strike-slip faults and a number of smaller faults. Those within a 15 km vicinity of the bridge are summarised in Table 1.

Table 1 – Active Fault Summary

Fault	Characteristic Event Magnitude	Recurrence Interval (years)	Distance from site (km)	Direction
Wairau Fault	7.8	2490	3	Northwest
Vernon Fault	8.4	4210	11	Southeast
Awatere Fault	7.6	3200	15	Southeast

3 Geotechnical investigations

3.1 Boreholes

Two boreholes were drilled by DCN Drilling between 22nd and 26th June, 2015. Both boreholes were 125 mm sized and drilled by sonic vibration coring. The locations and depths of the boreholes are given in Table 2 below. The locations are shown in Figure 1.

Table 2 – Borehole Summary

Borehole ID	Location	Easting (m)	Northing (m)	Elevation (m above MSL)	Depth (m)
BH01	Southern Abutment – Top 10 Holiday Park	1680224.945	5405199.302	5.175	26.1

Borehole ID	Location	Easting (m)	Northing (m)	Elevation (m above MSL)	Depth (m)
BH02	Northern Abutment – between stop bank and river edge	1680305.083	5405327.141	6.307	30.2

NB: Borehole locations have been surveyed by Blenheim based company Ensurv.

Standard Penetration Tests (SPTs) were carried out in accordance with NZS4402: 1986, at 1.0 m depth intervals in both boreholes.

The boreholes were carried out to provide information to characterise the thickness, composition and strength of the underlying strata and groundwater conditions. Core samples were collected from the boreholes so laboratory testing could be done to provide information on the grading and plasticity of the soils, which have an important effect on the potential for liquefaction and ground damage.

Engineering geologists from Opus logged the samples recovered from the boreholes. All samples were logged in accordance with the New Zealand Geotechnical Society (2005) Guidelines.

Piezometers were installed at locations BH1 and BH2 to monitor groundwater levels. Borehole BH1 features a dual-piezometer installed with response zones at 3 m to 6 m and 19 m to 23 m depths respectively. Borehole BH2 features a single piezometer installed with a response zone at 7 m to 10 m depth.

The borehole logs are presented in Appendix A.

3.2 Seismic Cone Penetration Tests

Six seismic cone penetration tests (sCPTs) were carried out across the site between 7th and 8th July, 2015, to supplement the geotechnical data from the boreholes. These tests consist of a cone penetration device pushed in to the subsoil at a controlled rate while recording strength and pore pressure.

At every 1.0 m intervals, the penetration was stopped to allow a shear wave to be generated at the ground surface and time required for the wave to reach the seismometer in the cone to be measured. The shear wave is generated by hitting a beam (pressed against the ground by the weight of the CPT vehicle) with a sledgehammer.

The computer in the CPT rig collects and processes the data from the cone.

The locations and depths of the sCPTs are summarised in Table 3. The sCPT locations are depicted in Figure 1, the results are provided in Appendix B and the shear wave velocity analysis is presented in Appendix C.

Table 3 – Cone Penetration Test Summary

CPT ID	Location	Easting (m)	Northing (m)	Elevation (m above MSL)	Depth (m)
CPT01	Top 10 Holiday Park - near southern abutment	1680228.025	5405197.373	5.385	6.60
CPT02	Top 10 Holiday Park - adjacent to southern section of bridge	1680237.039	5405222.565	5.028	10.49
CPT03	Top 10 Holiday Park - near south river bank	1680257.157	5405258.549	4.228	18.67
CPT04	Top 10 Holiday Park - immediately adjacent to south river bank	1680274.862	5405286.48	3.528	3.53
CPT05	Terrace below stop bank - at north river bank	1680303.765	5405329.133	6.301	5.49
CPT06	Adjacent to stop bank - near northern abutment	1680332.257	5405343.045	8.163	11.28

NB: CPT locations have been surveyed by Blenheim based company Ensurv.

3.3 Groundwater Monitoring

Regular monitoring of groundwater level has been carried out subsequent to the installation of piezometers in the boreholes.

Table 4 below presents the measurements of groundwater level at the piezometers.

Table 4 – Groundwater Monitoring Summary

Borehole ID	Surface reduced level (m above MSL)	Piezometer Response Zone (mbgl)	Water Level (mbgl)	Reduced level (m above MSL)	Date Measured
BH01	5.175	3 m to 6 m	2.0	3.175	20/07/15
			1.97	3.205	10/08/15
		19 m to 23 m	0.83	4.345	20/07/15
			0.83	4.345	10/08/15
BH02	6.307	7 m to 10 m	3.47	2.837	20/07/15
			3.40	2.907	10/08/15

3.4 Laboratory Tests

The following laboratory tests were performed on soil samples collected from boreholes, in accordance with NZS 4402:1986:

- Particle size distribution (sieve + hydrometer)
- Atterberg Limits

All the laboratory tests were completed by Opus Research in Petone. Table 5 below presents a summary of the results of the testing undertaken. The full results are presented in Appendix D.

Table 5 – Laboratory Test Summary

BH ID	Sample depth (m)	Plasticity Index	Particle Size Distribution				Water Content (%)
			Clay	Silt	Sand	Gravel	
BH01	3.5 – 4.0	NP	8	41	51	0	37.8
	4.5 – 5.0	-	0	4	96	0	25.4
	10 – 10.45	22 ± 2	23	56	9	12	42.6
	12.45 – 13.0	-	0	4	20	76	5.6
	15.5 – 16.0	-	8	31	61	0	5.2
BH02	3 – 3.45	-	3	13	84	0	25.3
	8.5 – 9.0	-	0	11	81	8	27.1
	11.7 – 11.9	-	7	31	62	0	22.7
	18.5 – 19.0	7 ± 2	13	40	47	0	24.4
	19.5 – 19.9	-	0	10	90	0	24.1

4 References

Davidson, P.; Wilson, S. (2011). *Groundwaters of Marlborough*. Marlborough District Council.

Institute of Geological and Nuclear Sciences (2000). *Geology of the Wellington area, scale 1:250,000*. Institute of Geological and Nuclear Sciences 1:250 000 geological map 10. Institute of Geological and Nuclear Sciences, Lower Hutt. Compiled by Begg, J.G., and Johnston, M.R.

Landcare Research (1995*). Geomorphology of the Wairau Plains: implications for floodplain management planning*. Landcare Research Sciences Series No.11. Manaaki Whenua Press, Lincoln. Prepared by Basher, L.R.; Lynn, I.H.; Whitehouse, I.E.

New Zealand Geological Survey (1981). *Water well data – northern Marlborough. Part sheet P28 – Wairau Plain (geology and water wells) 1:25,000*. Report No NZGS 93. Department of Scientific and Industrial Research, Lower Hutt. Prepared by Brown, L.J.

New Zealand Geotechnical Society Inc. (2005). *Field Description of Soil and Rock; Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*.

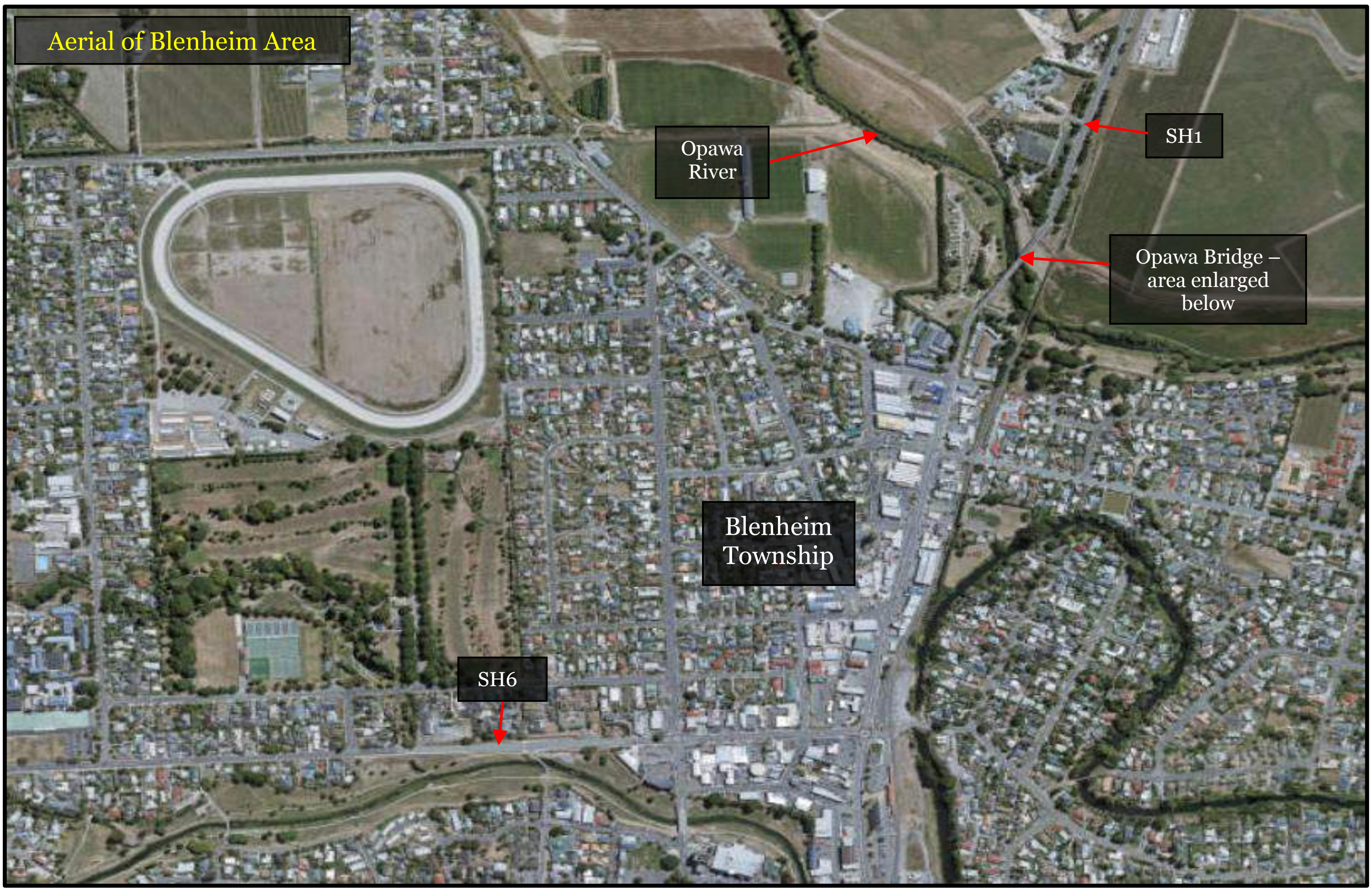
Marlborough Catchment & Regional Water Board (1987). *Water and soil resources of the Wairau, Volume 1*. Marlborough Catchment and Regional Water Board, Blenheim.

Stirling, M., McVerry, G., Gerstenberger, M., Litchfield, N., Van Dissen, R., Berryman, K., Barnes, P., Wallace, L., Villamor, P., Langridge, R., Lamarche, G., Nodder, S., Reyners, M., Bradley, B., Rhoades, D., Smith, W., Nicol, A., Pettinga, J., Clark, K. and Jacobs, K. (2010).

National Seismic Hazard Model for New Zealand: 2010 Update. Bulletin of Seismological Society of America, Vol. 102, No. 4, pp/ 1514-1542, August, 2012.

Figure 1

Site Location Plan



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI	*Prepared by:* OPUS	*Title:* Site and Investigation Location Plan	
		Project: New Opawa River Bridge	
Scale: NTS	*Date:* August 2015	*Project No:* 5MB982.03	*Figure:* 1

Appendix A

Borehole Logs

Borehole No. BH1

OPUS

Project:	New Opawa River Bridge	*Coordinates:*	1680225 E 5405199 N
Client:	The New Zealand Transport Agency	*Ref. Grid:*	NZTM
Project No.:	5MB982.03	*R.L.:*	5.175 m
Location:	SH1, Grove Road, Blenheim Southern Abutment - Top 10 Holiday Park	*Depth:*	26.145 m
		Inclination:	Vertical

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m)	DEPTH (m)
Recent River Deposits	SILT with minor gravel; dark brown, firm, moist, non-plastic. Becomes soft.		0
Recent River Deposits	SILT; brown, soft, moist, non-plastic.	4	0.8
Recent River Deposits	SILT; grey with orange-brown mottling, soft, moist, moderate plasticity.		1.8
Recent River Deposits	Silty SAND with minor clay; grey, very loose, wet.	2	3.0
Recent River Deposits	SAND with trace silt; grey, very loose, wet.	0	4.0
Interbedded Dillons Point and Raupara Formations	Gravelly SAND; grey, dense to very dense, wet.	-2, -4	6.0
Interbedded Dillons Point and Raupara Formations	Clayey SILT with minor sand and gravel; brown-grey, stiff, moist, moderate plasticity.		9.8
Interbedded Dillons Point and Raupara Formations	Sandy GRAVEL; grey, dense, wet.	-6	10.5
Interbedded Dillons Point and Raupara Formations	Sandy GRAVEL with trace silt; dark grey, medium dense to dense, moist. Becomes SAND with some gravel.	-8	11.5

TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE
		70	VC
2	0// 0/0/1/1		SPT
		100	VC
1	1// 0/0/1/0		SPT
			PT
1	0// 0/1/0/0		SPT
		90	VC
1	0// 0/0/1/0		SPT
		100	VC
		0	PT
		100	VC
48	9// 9/11/13/15		SPT
		80	VC
48	12// 12/12/12/12		SPT
		90	VC
50+	15// 10/15/15/11 for 50mm		SPT
		80	VC
50+	51 for initial 140mm	0	SPT
		100	VC
24	0// 0/1/9/14		SPT
		60	VC
24	1// 1/4/7/12		SPT
		100	VC
23	3// 3/4/7/9		SPT
		100	VC
40	5// 7/8/11/14		SPT
		100	VC
24	4// 3/6/6/9		SPT
		100	VC

DRILLING: Drilling Method: Sonic Vibration Coring; Casing: 125 mm 22/06/15; Base of Hole & Water Level: 3.1m 23/06

NOTES:

Gravel is subrounded, <30 mm.

Some organic material.

Leaves, wood fragments and rootlets throughout.
2.5 m: Push tube, shear strength of 9kPa (initial) and 2 kPa (residual).
3.0 m :Fine sand. Rootlets and wood fragments throughout.
Medium sand. Sparse rootlets.

Push tube attempted at 5.0 m, material too loose and wet to be sampled in tube.
Medium sand. Gravel is rounded, fine to 45 mm.

Some organic material.

Medium to coarse sand. Gravel is sub-angular to rounded, fine to 50 mm.
Coarse sand. Gravel is well rounded, up to 60 mm. Well graded from 10 to 60 mm with occasional cobbles up to 80 mm.

Large wood fragment.

INSTALLATION DETAILS: Backfill; Bentonite Seal; Response Zone; Bentonite Seal; Backfill

Notes:			
Started:	22/06/2015	*Finished:*	24/06/2015
Drilling Co.:	DCN Drilling	*Drilling Rig:*	YDX-3L
Logged by:	G Hickey & E Williamson	*Checked by:*	D Hewitt

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:75 @ A4

OPUS

Borehole No. BH1

Project: New Opawa River Bridge
Client: The New Zealand Transport Agency
Project No.: 5MB982.03
Location: SH1, Grove Road, Blenheim
Southern Abutment - Top 10 Holiday Park

Coordinates: 1680225 E 5405199 N
Ref. Grid: NZTM
R.L.: 5.175 m
Depth: 26.145 m
Inclination: Vertical

Main description

Geology/Unit	Depth (m)	Main Description
	~15.2–16.3	Silty SAND with minior clay; dark grey, medium dense to dense, moist.
	16.3–17.0	SILT; dark grey, very stiff, dry to moist, non-plastic.
	17.0–17.8	SAND; dark grey, medium dense, moist.
	17.8–18.5	SILT; dark grey, very stiff, dry to moist, non-plastic.
	18.5–18.75	Gravelly SILT; dark grey, very stiff to hard, moist.
Early Raupara Formation	18.75–26.145	Sandy GRAVEL; dark grey and brown, very dense, wet. Subartesian Wairau Aquifer intercepted.
Early Raupara Formation	~20	Recovered as sandy GRAVEL with some silt.
Early Raupara Formation	~21	Recovered as GRAVEL.
Early Raupara Formation	~22	Recovered as sandy GRAVEL with some silt.
Early Raupara Formation	~23	Recovered as sandy GRAVEL.
	26.145	END OF BOREHOLE

Tests and core

SPT 'N' Value	SPT Blow Counts or Shear Value	Total Core Recovery (%)	Sample Type
16	4// 2/3/4/7		SPT
		100	VC
37	6// 6/7/9/15		SPT
		100	VC
21	4// 4/5/6/6		SPT
		100	VC
26	5// 5/5/7/9		SPT
		100	VC
50+	19// 18/22/11 for 50mm	0	SPT
		100	VC
50+	36// 26/25 for 55mm		SPT
		100	VC
50+	26// 21/30 for 55mm		SPT
		56	VC
50+	39// 41/10 for 10mm	0	SPT
		100	VC
50+	30// 23/28 for 65mm		SPT
		35	VC
50+	28// 51 for 70mm		SPT
		31	VC
50+	51 for initial 140mm	0	SPT
		28	VC
50+	51 for initial 145mm		SPT

Drilling

Drilling method: Sonic Vibration Coring
Casing: 125 mm 23/06/15; 125 mm 24/06/15
Base of hole & water level: 0.3m 24/06

Notes

Medium to coarse sand.
Gravel is well rounded, up to 40 mm.
Medium to coarse sand.
Gravel is mostly <20 mm. Some cobbles to 80 mm.
Silt is sticky.
Gravel is fine to 70 mm cobbles, well rounded and graded.
Medium sand.

Installation details

Backfill
Bentonite Seal
Response Zone
Backfill

Notes:

Started:	22/06/2015	*Finished:*	24/06/2015
Drilling Co.:	DCN Drilling	*Drilling Rig:*	YDX-3L
Logged by:	G Hickey & E Williamson	*Checked by:*	D Hewitt

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.
Scale 1:75 @ A4

Borehole No. BH2

OPUS

Project:	New Opawa River Bridge	*Coordinates:*	1680305 E 5405327 N
Client:	The New Zealand Transport Agency	*Ref. Grid:*	NZTM
Project No.:	5MB982.03	*R.L.:*	6.307 m
Location:	SH1, Grove Road, Blenheim Northern Abutment - Terrace below stop bank	*Depth:*	30.25 m
		Inclination:	Vertical

Main Description

GEOLOGY/UNIT	MAIN DESCRIPTION	NOTES
Recent River Deposits	Sandy SILT; light brown, soft, dry to moist. Contact approximate (within push tube).	Fine sand. Rootlets throughout.
Recent River Deposits	Silty SAND; light brown, loose, dry to moist. Too sandy for shear vane reading in push tube at 0.5 m. Becomes mottled with SILT; dark brown, very soft, dry to moist.	Fine sand.
Recent River Deposits	SILT with some sand; light brown, very soft, dry to moist, non-plastic. Contact approximate (within push tube).	Fine sand.
Recent River Deposits	SAND with some silt and trace clay; brown, moist, loose. Shear strength 28 kPa at 3.0 m. Sand broke up and a residual strength could not be measured. Becomes less silty with depth.	Sand is medium.
Interbedded Dillons Point and Raupara Formations	Gravelly SAND; dark grey-brown, dense to very dense, moist to wet. Becomes sandy GRAVEL; dark grey. Minor silt. No silt. Becomes saturated.	Medium to coarse sand. Gravel is fine to 40 mm, well rounded and graded. Coarse sand. Some cobbles to 60 mm. Medium sand. Coarse sand. Large wood fragments.
Interbedded Dillons Point and Raupara Formations	SAND with minor silt and gravel; dark grey-brown, medium dense, moist to wet.	Coarse sand. Minor fine gravel and wood fragments. Abundant wood fragments and twigs.
Interbedded Dillons Point and Raupara Formations	Sandy GRAVEL; dark grey-brown, medium dense, wet. Becomes more brown.	Coarse sand. Gravel is well rounded and graded, up to 40 mm.
Interbedded Dillons Point and Raupara Formations	SAND; brown, medium dense, moist to wet. Interbedded layers of silty SAND with minor clay; brown, firm, moist. Becomes darker brown.	Fine to medium sand. Large wood fragment in 11.0 SPT sample.
Interbedded Dillons Point and Raupara Formations	Sandy GRAVEL; brown-grey, very dense, moist to wet. Dark grey gravel with brown matrix.	Coarse sand. Gravel is fine to 80 mm cobbles. Well rounded and graded. Medium sand.

Tests and Core

Drilling method: Sonic Vibration Coring

SPT 'N' VALUE	SPT BLOW COUNTS OR SHEAR VALUE	TOTAL CORE RECOVERY (%)	SAMPLE TYPE
		80	VC
			PT
4	3// 1/1/1/1		SPT
		100	VC
2	1// 0/1/0/1		SPT
			PT
4	3// 1/1/1/1		SPT
		82	VC
41	10// 13/10/9/9		SPT
		36	VC
29	11// 6/7/8/8		SPT
		100	VC
38	17// 10/8/11/9		SPT
		72	VC
50+	17// 13/19/11/12		SPT
		100	VC
15	5// 3/3/4/5		SPT
		100	VC
16	2// 3/3/4/6		SPT
		100	VC
22	6// 4/5/5/8		SPT
		100	VC
20	15// 4/4/5/7		SPT
		100	VC
50+	21// 14/15/22 for 55mm		SPT
		100	VC
50+	11// 15/22/14 for 35mm	0	SPT
		38	VC
50+	43// 39/12 for 15mm	0	SPT
		100	VC

Installation Details

Installation
Backfill
Bentonite Seal
Response Zone
Bentonite Seal
Backfill

Notes:

Started:	25/06/2015	*Finished:*	26/06/2015
Drilling Co.:	DCN Drilling	*Drilling Rig:*	YDX-3L
Logged by:	E Williamson	*Checked by:*	D Hewitt

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:75 @ A4

BOREHOLE SOIL LOG A4 (PM) ELLA.GPJ OPUS_DATA_TEMPLATE_MARCH2015.GDT 21/8/15

OPUS

Borehole No. BH2

Project:	New Opawa River Bridge	*Coordinates:*	1680305 E 5405327 N
Client:	The New Zealand Transport Agency	*Ref. Grid:*	NZTM
Project No.:	5MB982.03	*R.L.:*	6.307 m
Location:	SH1, Grove Road, Blenheim Northern Abutment - Terrace below stop bank	*Depth:*	30.25 m
		Inclination:	Vertical

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m)	DEPTH (m)	SPT 'N' VALUE	SPT BLOW COUNTS OR SHEAR VALUE	TOTAL CORE RECOVERY (%)	SAMPLE TYPE	NOTES
Interbedded Dillons Point and Raupara Formations	.(continued)			50+	28// 26/25 for 60mm		SPT	
						100	VC	
	Silty SAND with minor gravel; blue-grey, dense, moist to wet.	-10	16	47	10// 8/12/16/11		SPT	Fine sand. Fine, well rounded gravel.
	SILT; blue-grey, very stiff, moist to wet, non-plastic.					100	VC	
			17	32	5// 5/7/8/12		SPT	
						54	VC	
	SAND; dark grey, medium dense, wet.							Coarse sand.
		-12	18	13	4// 2/2/4/5	0	SPT	
	Silty SAND with some clay; blue-grey, medium dense, moist to wet, low plasticity.					80	VC	Some shell fragments and organic material.
	SAND with minor silt; dark grey, medium dense, wet.		19	22	3// 3/4/6/9		SPT	Coarse sand.
						100	VC	
	SILT with some clay; blue-grey, stiff, moist, moderate plasticity.	-14	20	24	5// 4/6/6/8		SPT	
						100	VC	
			21	18	3// 3/4/5/6		SPT	
						100	VC	
Early Raupara Formation	Sandy GRAVEL with minor silt; brown, very dense, wet to saturated. Subartesian Wairau Aquifer intercepted.	-16	22	50+	32// 36/15 for 35mm		SPT	Medium to coarse sand. Gravel is well rounded and graded, fine to 40 mm.
						54	VC	
			23	50+	24// 20/20/11 for 25mm		SPT	
	Recovered as GRAVEL.					15	VC	Cobbles up to 80 mm.
		-18	24	50+	32// 20/31 for 55mm		SPT	
						42	VC	
	Recovered as sandy GRAVEL with minor silt.		25	50+	44// 30/21 for 45mm		SPT	Fine sand.
						55	VC	
	Becomes saturated.	-20	26	50+	33// 28/23 for 50mm		SPT	
						55	VC	
	Recovered as sandy GRAVEL with some silt.		27	50+	50 for initial 55mm	0	SPT	Fine to medium sand.
						42	VC	
		-22	28	50+	51 for initial 145mm		SPT	
						43	VC	Cobbles to 90 mm.
			29	50+	49// 40/11 for 15mm		SPT	
						13	VC	

DRILLING: Drilling method: Sonic Vibration Coring. Casing: 125 mm 25/06/15; 125 mm 26/06/15. Base of hole & water level: 2.3m 26/06.

INSTALLATION DETAILS: Backfill; Bentonite Seal; Backfill.

Notes:

Started:	25/06/2015	*Finished:*	26/06/2015
Drilling Co.:	DCN Drilling	*Drilling Rig:*	YDX-3L
Logged by:	E Williamson	*Checked by:*	D Hewitt

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:75 @ A4

Borehole No. BH2

Project:	New Opawa River Bridge	*Coordinates:*	1680305 E 5405327 N
Client:	The New Zealand Transport Agency	*Ref. Grid:*	NZTM
Project No.:	5MB982.03	*R.L.:*	6.307 m
Location:	SH1, Grove Road, Blenheim Northern Abutment - Terrace below stop bank	*Depth:*	30.25 m
		Inclination:	Vertical

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES	INSTALLATION DETAILS
					50+	50// 33/18 for 25mm		SPT					
	END OF BOREHOLE	-24											
			31										
		-26	32										
			33										
		-28	34										
			35										
		-30	36										
			37										
		-32	38										
			39										
		-34	40										
			41										
		-36	42										
			43										
		-38	44										

BOREHOLE SOIL LOG A4 (PM) ELLA.GPJ OPUS_DATA_TEMPLATE_MARCH2015.GDT 21/8/15

Notes:

Started:	25/06/2015	*Finished:*	26/06/2015
Drilling Co.:	DCN Drilling	*Drilling Rig:*	YDX-3L
Logged by:	E Williamson	*Checked by:*	D Hewitt

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:75 @ A4

Appendix B

Seismic Cone Penetration Test Results

CPT
TEST REPORT

OPUS

Client :	NZ Transport Agency
Project :	S.H1 - Blenheim
Location :	Opawa Bridge
Hole Number:	1
Tested by :	J Kavanaugh
Date tested :	7/07/15
Coordinates :	E: 1680230
	N: 5405196
	EL: 7
Water level :	EOH - Dipped - Collapsed Dry @ 0.7m

Project No :	5-MB982.03
Lab Ref No :	15/886/001
Client Ref No :	

Test Results

Start Time	15:18:00
Time at penetration	00:00:00
End Time	00:00:00
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	6.6
Remarks	Refusal (inclination)
GPS Type	Garmin eTrex 20
GPS Accuracy	+/- 10m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100
Rig ID	Cpt03
Reaction Force	Dead weight (10.5 Tonnes)
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	1
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	N/A
Observations During Testing	None

Date tested : 7/07/15
Date reported : 13/07/15

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 13/07/15

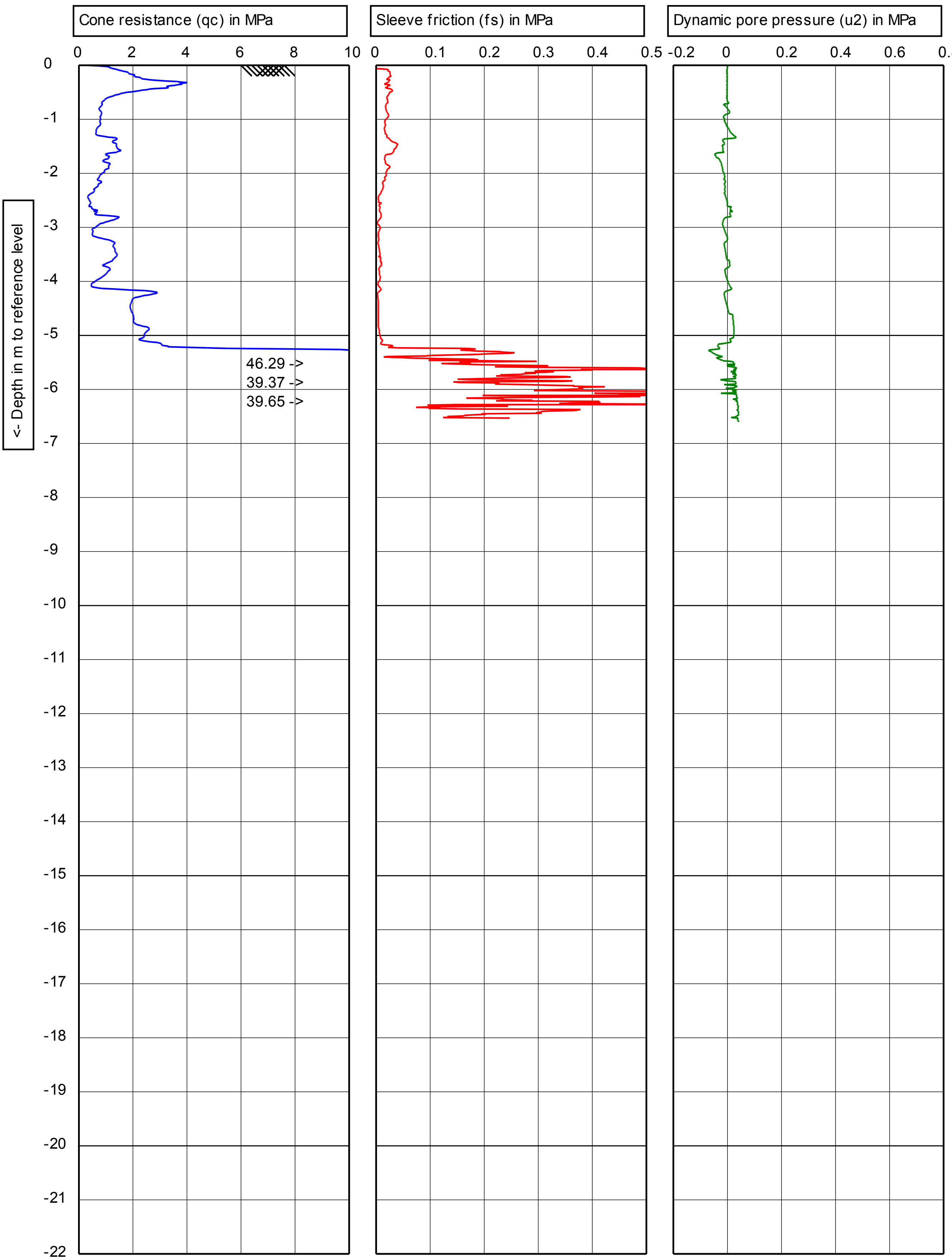
IANZ ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Opus International Consultants Ltd
Hamilton Laboratory
Quality Management Systems Certified to ISO 9001

Fox Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone +64 7 856 2870
Facsimile +64 7 856 2873
Website www.opus.co.nz



Refusal (inclination)

EOH - Dipped - Collapsed Dry @ 0.7

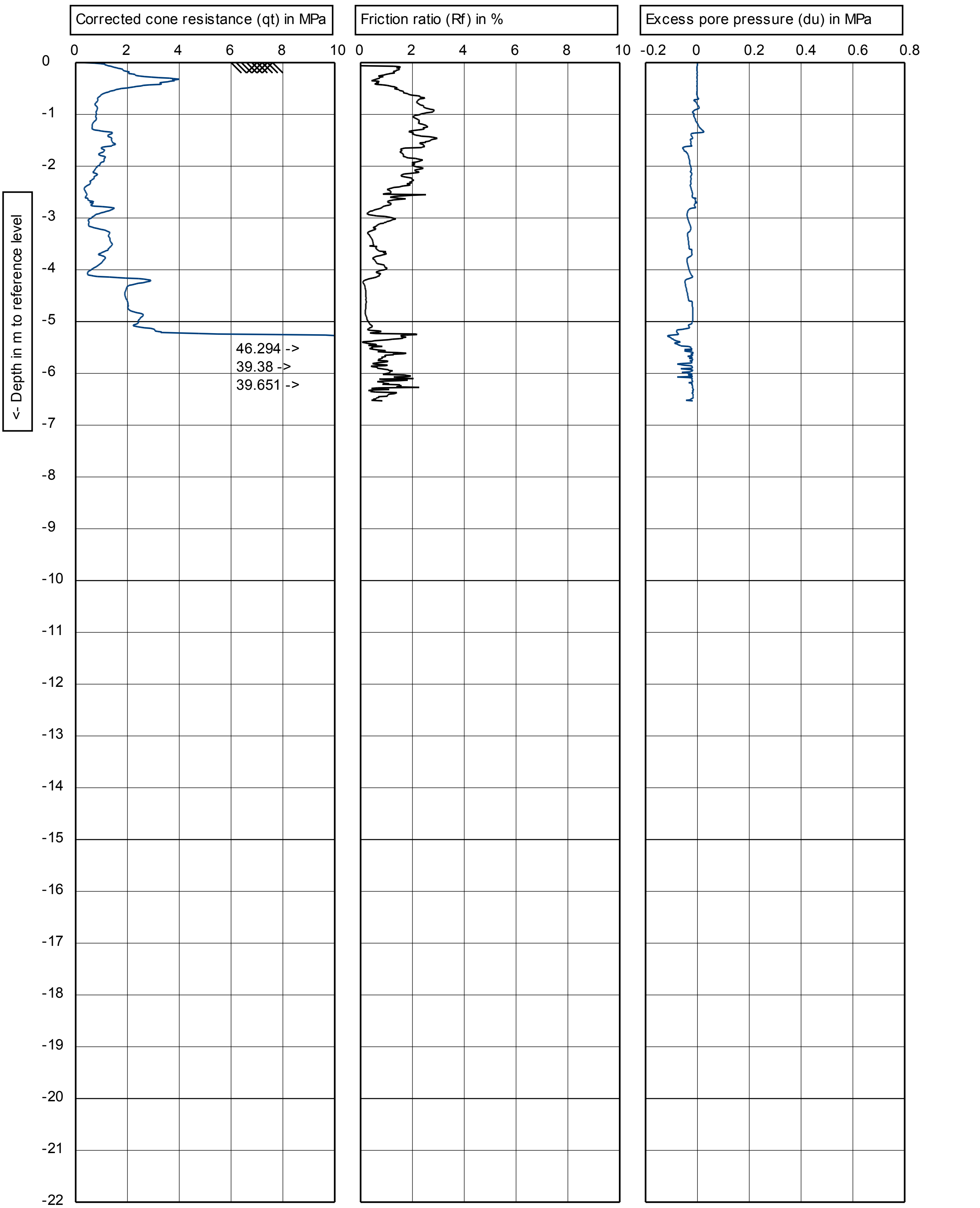
OPUS

IANZ ACCREDITED LABORATORY

Graphs indicated as not accredited are outside the scope of the laboratory's accreditation

u2 150 cm² 10 cm²	Test according ASTM D5778-12 & ISO 22476-1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-0.70 m**	Date:	**7/07/2015**
	Project: **S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.:	**5MB982.03_001**
	Position: **1680230, 5405196 NZTM**	CPT no.:	**01** **1/6**

1.44



Refusal (inclination)

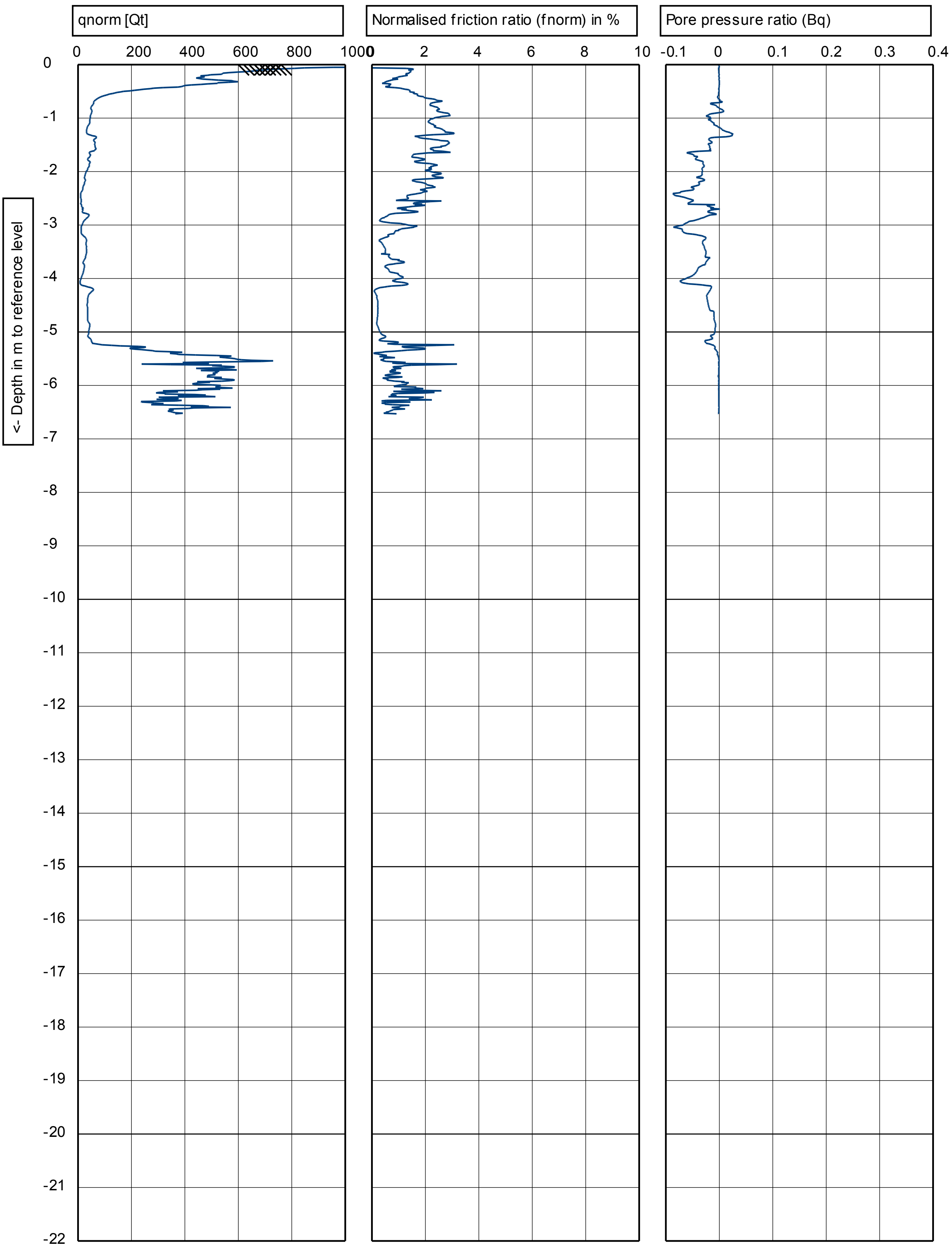
EOH - Dipped - Collapsed Dry @ 0.7

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778-12 & ISO 22476-1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-0.70 m**	Date:	**7/07/2015**
Project:	**S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
Location:	**Opawa Bridge**	Project no.:	**5MB982.03_001**
Position:	**1680230, 5405196 NZTM**	CPT no.:	**01** **2/6**

1.44



Refusal (inclination)

EOH - Dipped - Collapsed Dry @ 0.7

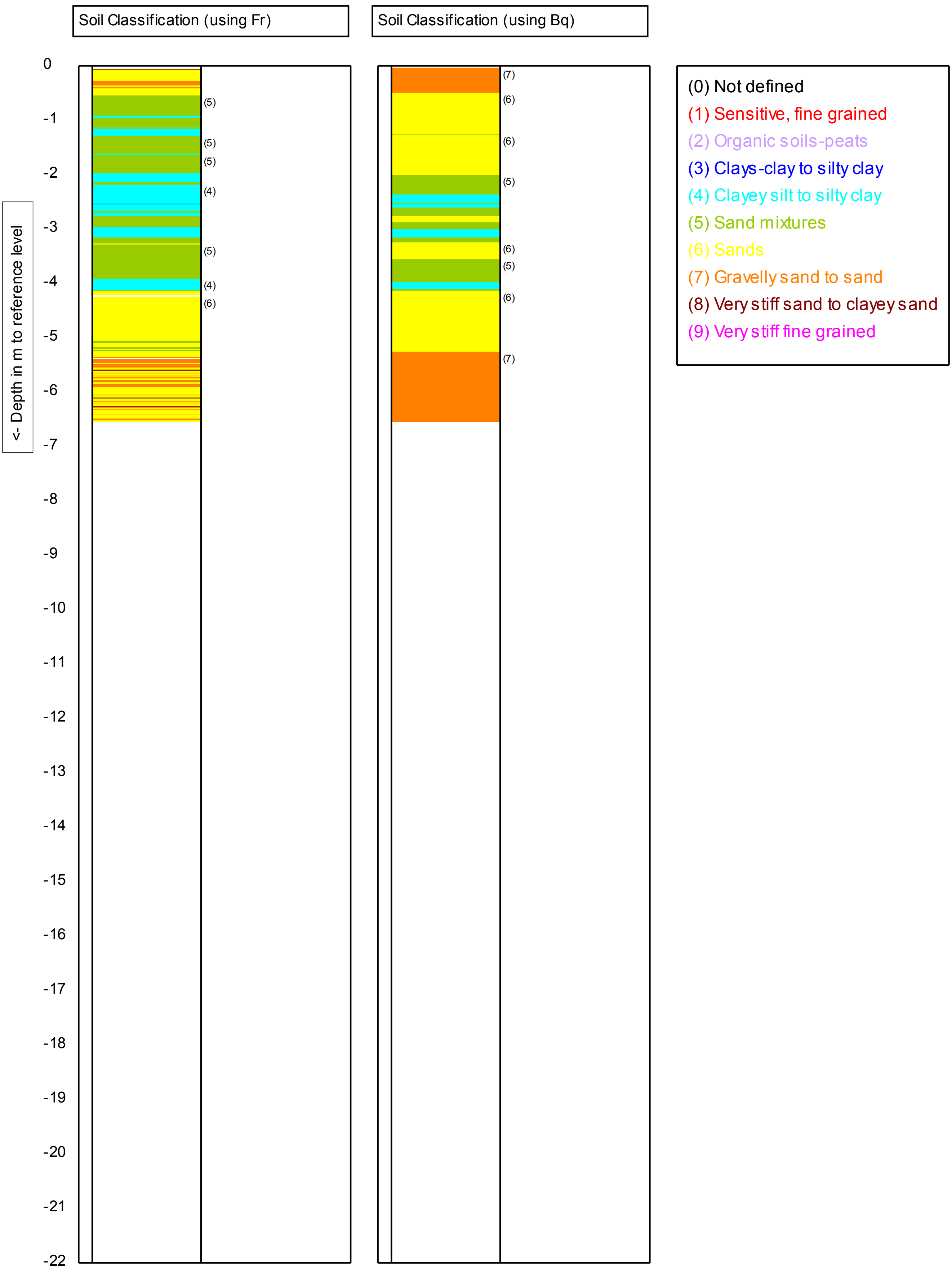
OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-0.70 m**	Date:	**7/07/2015**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680230, 5405196 NZTM**		CPT no.:	**01** 3/6

1.44

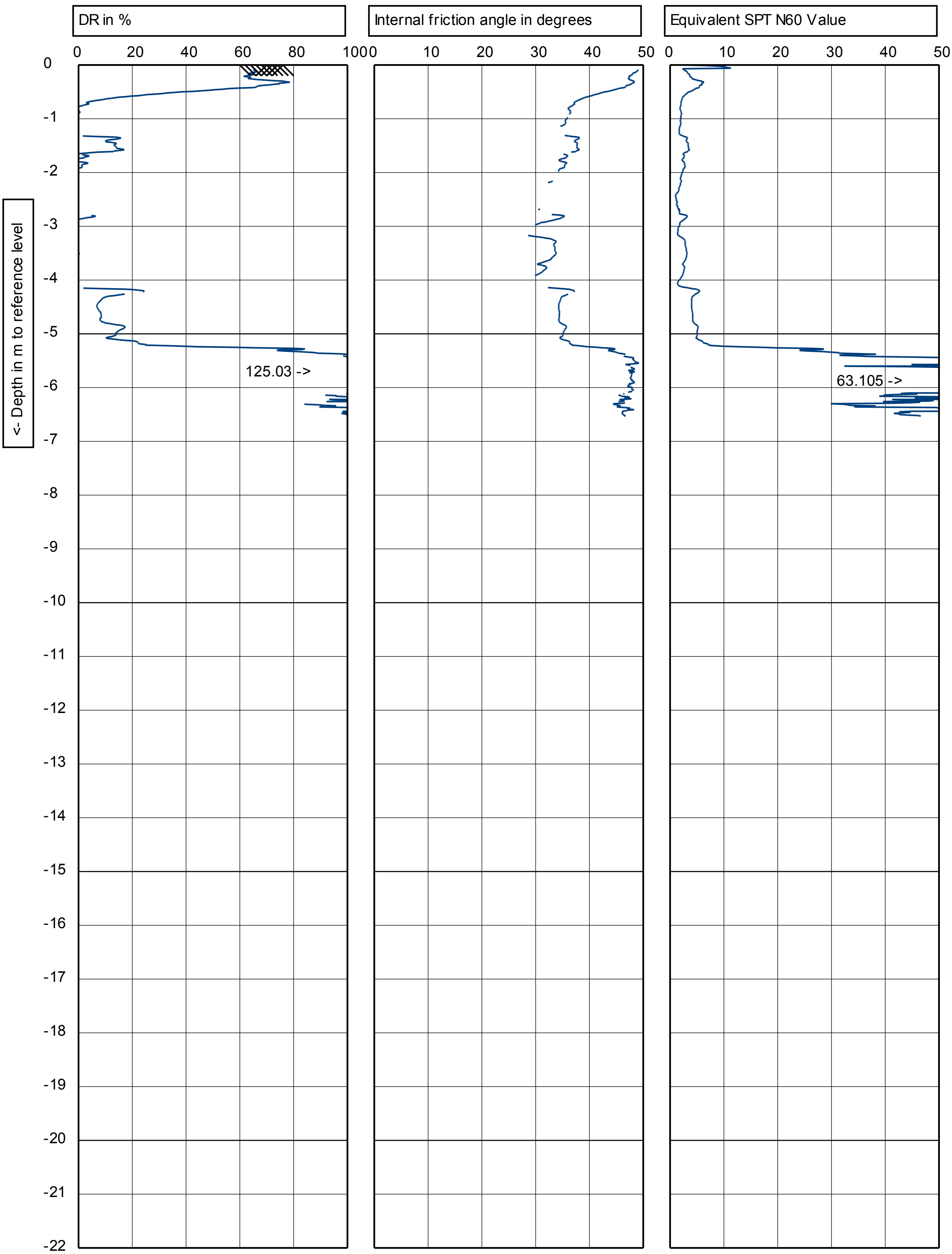


OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778-12 & ISO 22476-1:2012	Predrill: **0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-0.70 m**	Date: **7/07/2015**
	Project: **S.H1 - Blenheim**	Cone no.: **C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.: **5MB982.03_001**
	Position: **1680230, 5405196 NZTM**	CPT no.: **01** 4/6

1.44



Refusal (inclination)

EOH - Dipped - Collapsed Dry @ 0.7

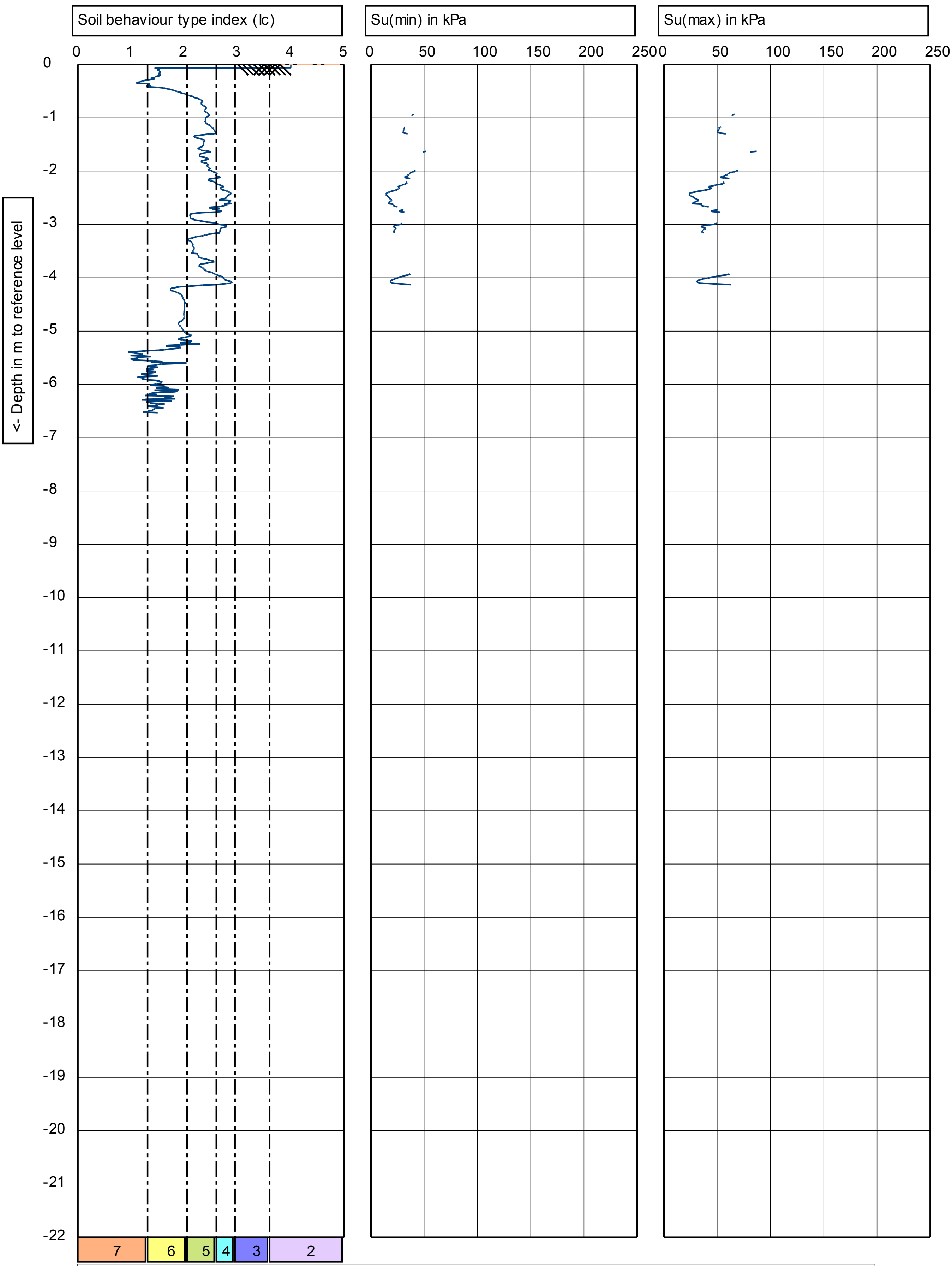
OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-0.70 m**	Date:	**7/07/2015**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680230, 5405196 NZTM**		CPT no.:	**01** 5/6

1.44



Refusal (inclination)

EOH - Dipped - Collapsed Dry @ 0.7

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-0.70 m**	Date:	**7/07/2015**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680230, 5405196 NZTM**		CPT no.:	**01** 6/6

1.44

CPT TEST REPORT

Client :	NZ Transport Agency
Project :	S.H1 - Blenheim
Location :	Opawa Bridge
Hole Number:	2
Tested by :	J Kavanaugh
Date tested :	7/07/15
Coordinates :	E: 1680239
	N: 5405222
	EL: 8
Water level :	EOH - Dipped - Collapsed Dry @ 0.8m

Project No :	5-MB982.03
Lab Ref No :	15/886/001
Client Ref No :	

Test Results

Start Time	14:37:00
Time at penetration	00:00:00
End Time	00:00:00
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	10.49
Remarks	Refusal (tonnage/qc)
GPS Type	Garmin eTrex 20
GPS Accuracy	+/- 10m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100
Rig ID	Cpt03
Reaction Force	Dead weight (10.5 Tonnes)
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	1
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	N/A
Observations During Testing	None

Date tested : 7/07/15
Date reported : 9/07/15

IANZ Approved Signatory

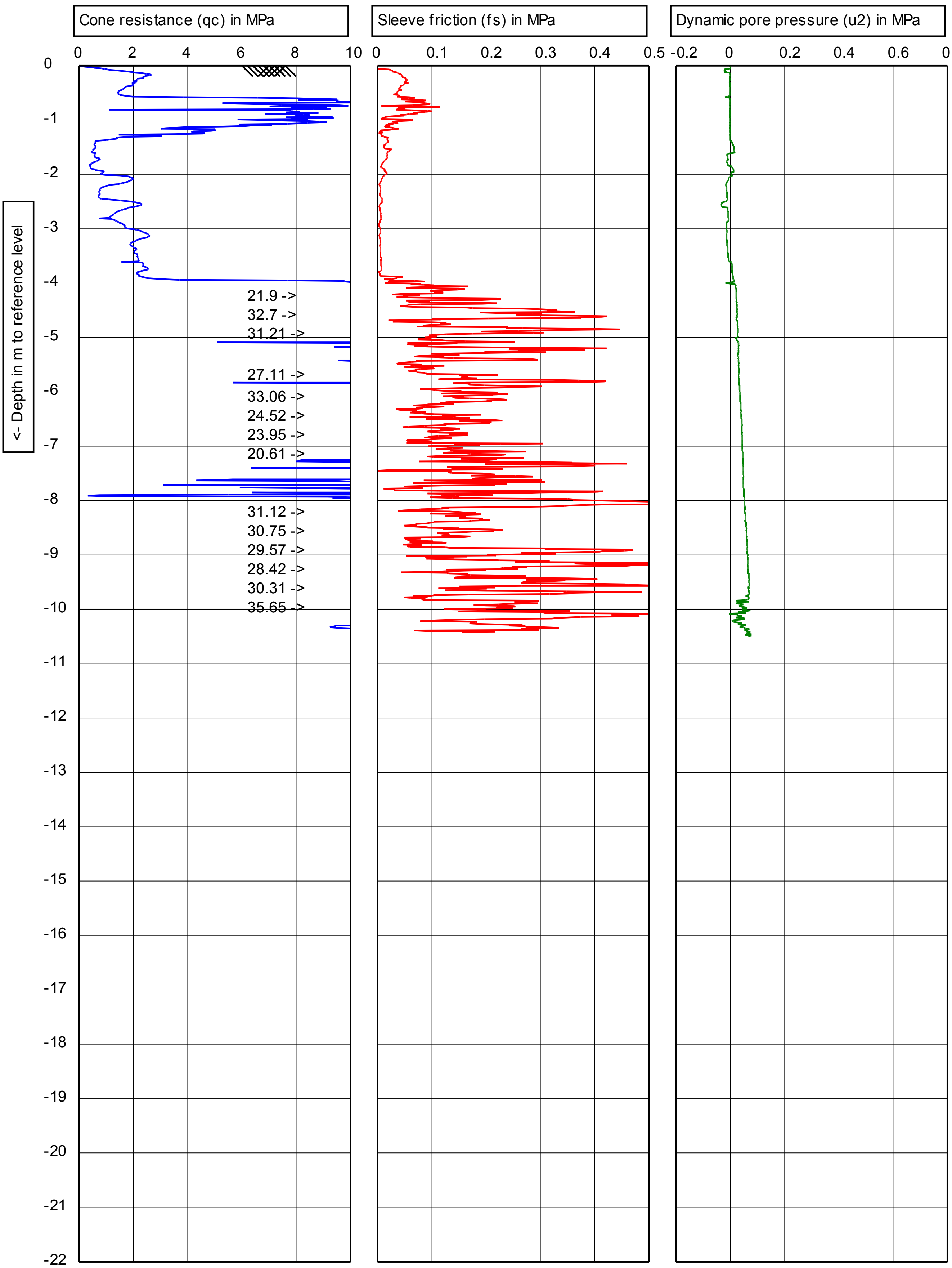
Designation : *CPT North Island Manager*
Date : 09/07/15

IANZ ACCREDITED LABORATORY
Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Opus International Consultants Ltd
Hamilton Laboratory
Quality Management Systems Certified to ISO 9001

Fox Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone +64 7 856 2870
Facsimile +64 7 856 2873
Website www.opus.co.nz



Refusal (tonnage qc)

EOH - Dipped - Collapsed Dry @ 0.8m

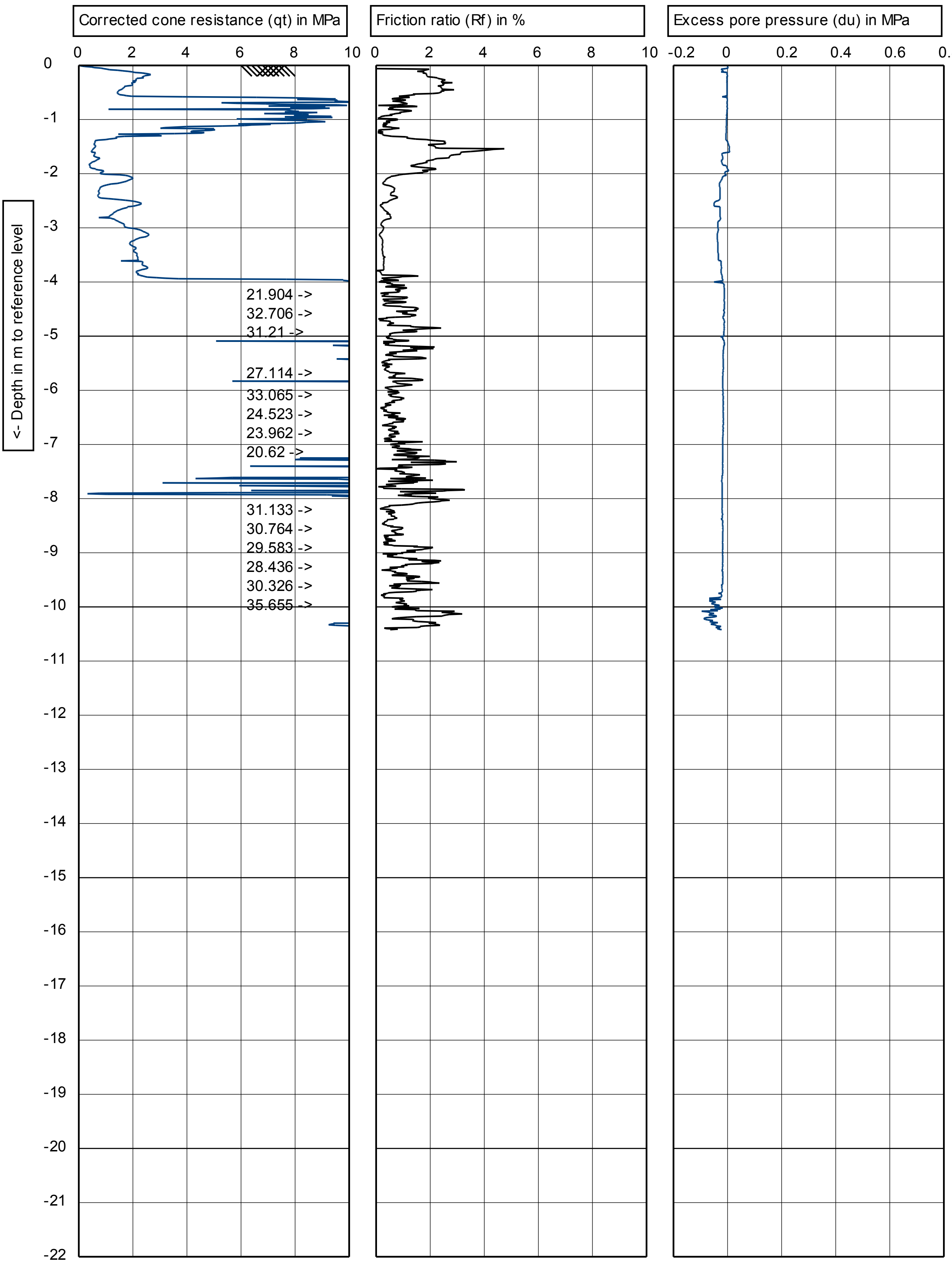
OPUS

IANZ ACCREDITED LABORATORY

Graphs indicated as not accredited are outside the scope of the laboratory's accreditation

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-0.80 m**	Date:	**07/07/15**
	Project: **S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.:	**5MB982.03_001**
	Position: **1680239, 5405222 NZTM**	CPT no.:	**02** 1/6

1.44

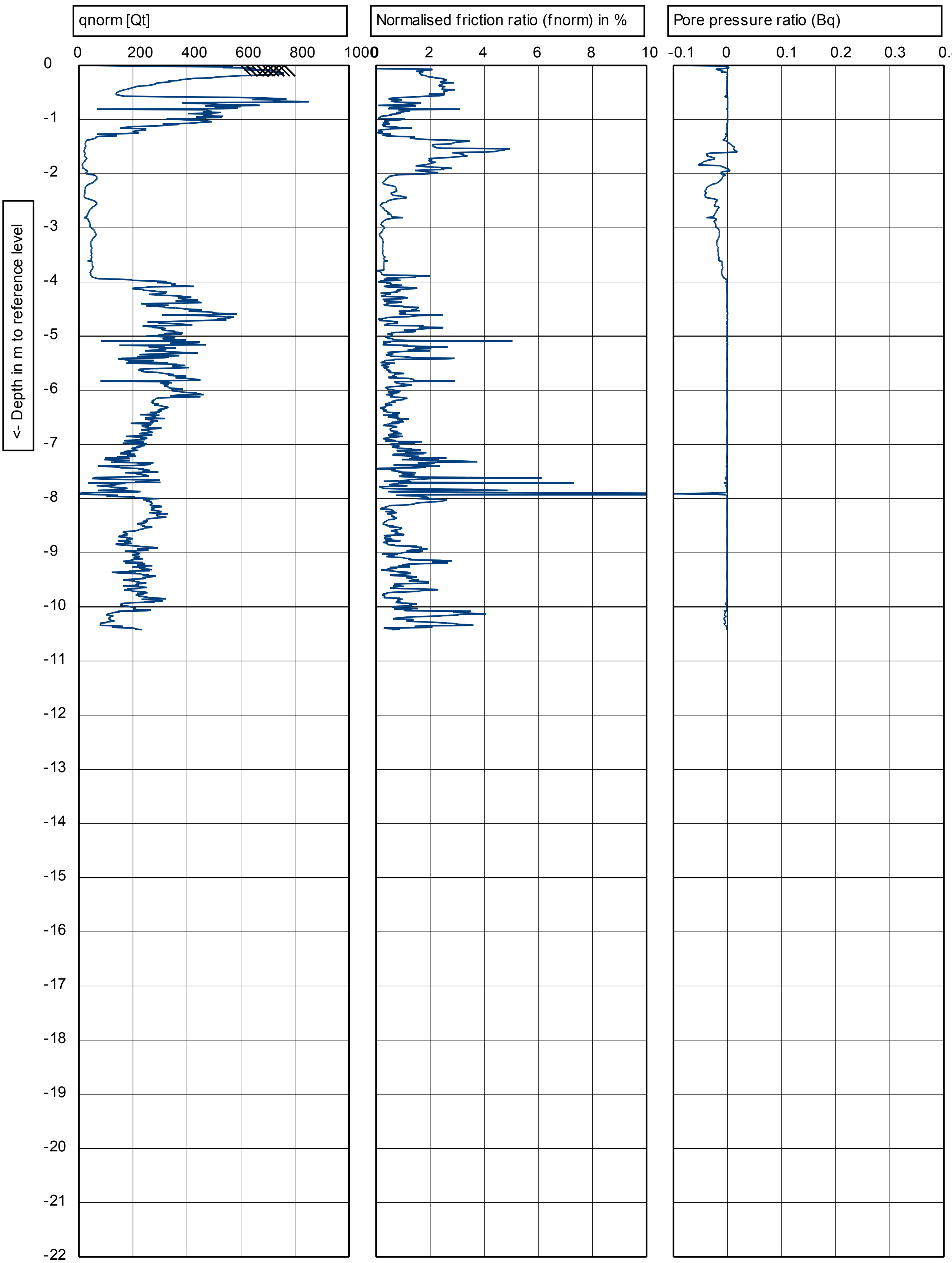


Refusal (tonnage qc)

EOH - Dipped - Collapsed Dry @ 0.8m

OPUS	u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill: **0.00 m Predrilled**
Graphs on this page are not IANZ accredited		G.L.: **0.00 m MSL** W.L.: **-0.80 m**	Date: **07/07/15**
		Project: **S.H1 - Blenheim**	Cone no.: **C10CFIIP.C14267**
		Location: **Opawa Bridge**	Project no.: **5MB982.03_001**
		Position: **1680239, 5405222 NZTM**	CPT no.: **02** 2/6

1.44



Refusal (tonnage qc)

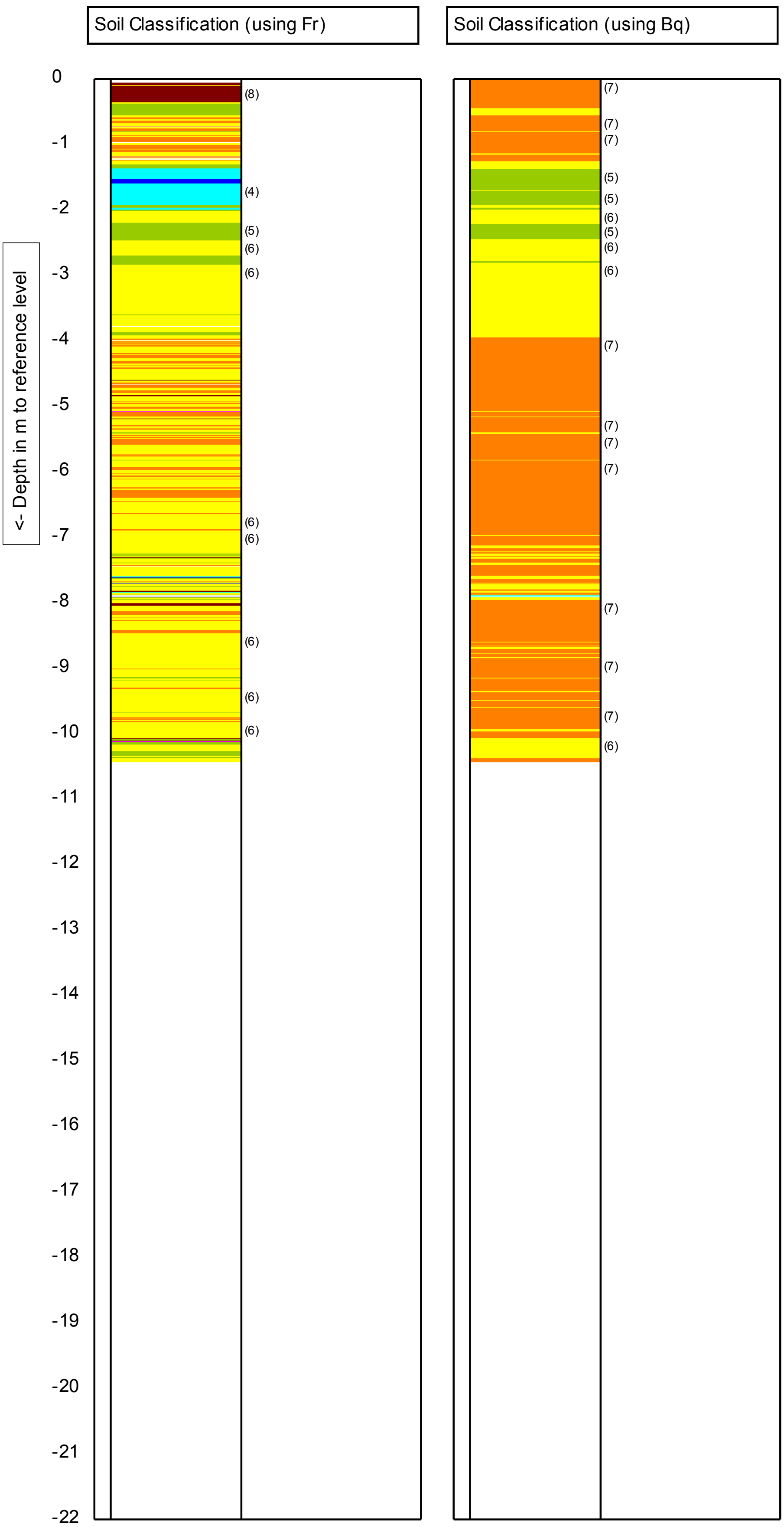
EOH - Dipped - Collapsed Dry @ 0.8m

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill: **0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-0.80 m**	Date: **07/07/15**
	Project: **S.H1 - Blenheim**	Cone no.: **C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.: **5MB982.03_001**
	Position: **1680239, 5405222 NZTM**	CPT no.: **02** 3/6

OPUS

Graphs on this page are not IANZ accredited

1.44



(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained

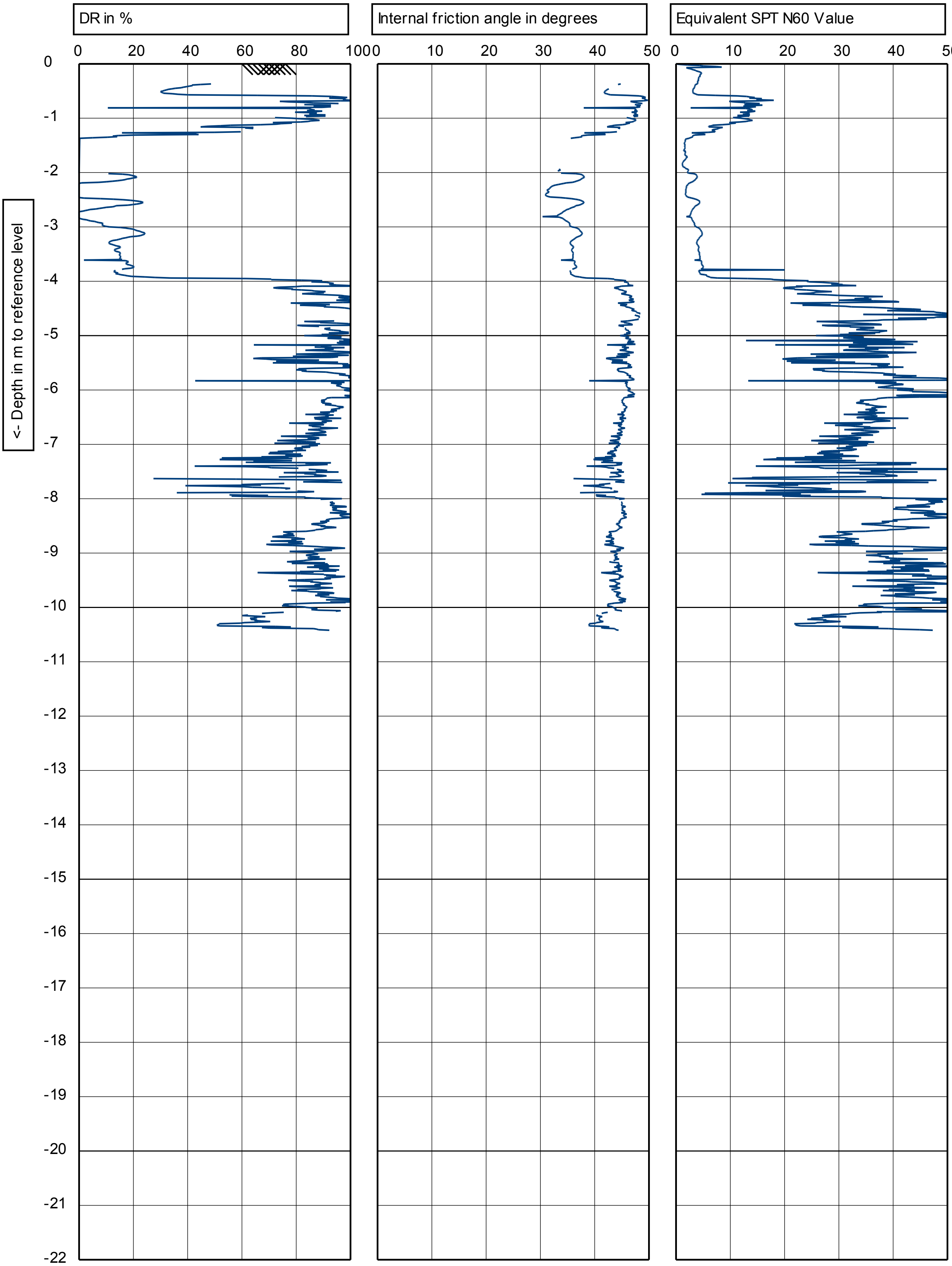
Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778 -12 & ISO 22476 -1:2012

G.L.: **0.00 m MSL**	W.L.: **-0.80 m**	Predrill:	**0.00 m Predrilled**
		Date:	**07/07/15**
Project:	**S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
Location:	**Opawa Bridge**	Project no.:	**5MB982.03_001**
Position:	**1680239, 5405222 NZTM**	CPT no.:	**02**

1.44



Refusal (tonnage qc)

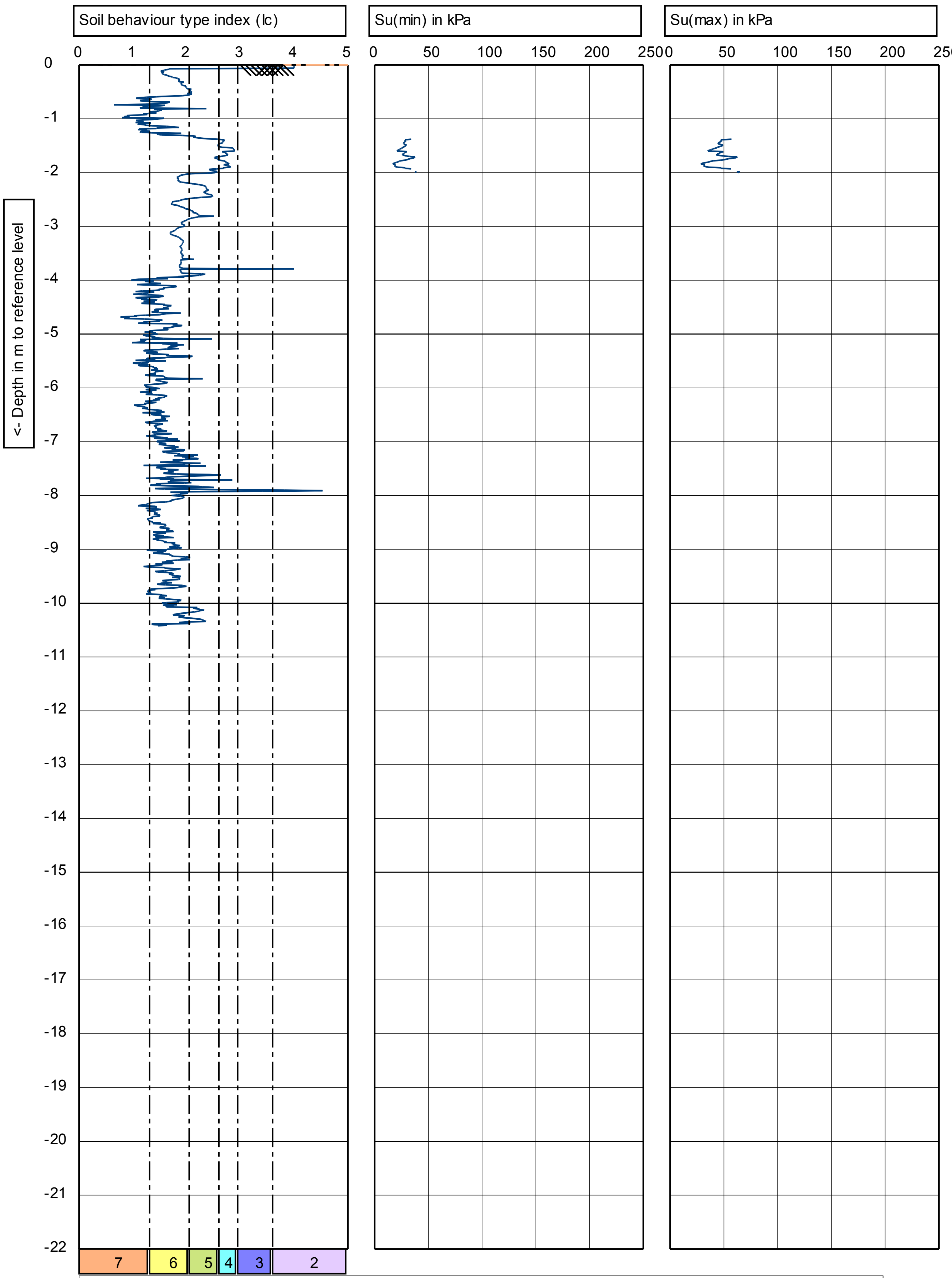
EOH - Dipped - Collapsed Dry @ 0.8m

OPUS

Graphs on this page are not IANZ accredited

1.44

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012		Predrill:	0.00 m Predrilled
	G.L.: 0.00 m MSL	W.L.: -0.80 m	Date:	07/07/15
Project: **S.H1 - Blenheim**			Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**			Project no.:	**5MB982.03_001**
Position: **1680239, 5405222 NZTM**			CPT no.:	**02** 5/6



Refusal (tonnage qc)

EOH - Dipped - Collapsed Dry @ 0.8m

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	0.00 m Predrilled
	G.L.: **0.00 m MSL** W.L.: **-0.80 m**	Date:	07/07/15
Project:	**S.H1 - Blenheim**	Cone no.:	C10CFIIP.C14267
Location:	**Opawa Bridge**	Project no.:	5MB982.03_001
Position:	**1680239, 5405222 NZTM**	CPT no.:	02 6/6

1.44

CPT TEST REPORT

OPUS

Client :	**NZ Transport Agency**
Project :	**S.H1 - Blenheim**
Location :	**Opawa Bridge**
Hole Number:	**3**
Tested by :	**J Kavanaugh**
Date tested :	**7/07/15**
Coordinates :	**E: 1680256**
	N: 5405254
	EL: 4
Water level :	**EOH - Dipped - GWL @ 1.4m**

Project No :	**5-MB982.03**
Lab Ref No :	**15/886/001**
Client Ref No :	

Test Results

Start Time	12:46:00
Time at penetration	00:00:00
End Time	00:00:00
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	18.67
Remarks	Refusal (qc)
GPS Type	Garmin eTrex 20
GPS Accuracy	+/- 10m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100
Rig ID	Cpt03
Reaction Force	Dead weight (10.5 Tonnes)
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	1
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	N/A
Observations During Testing	None

Date tested : 7/07/15
Date reported : 9/07/15

IANZ Approved Signatory

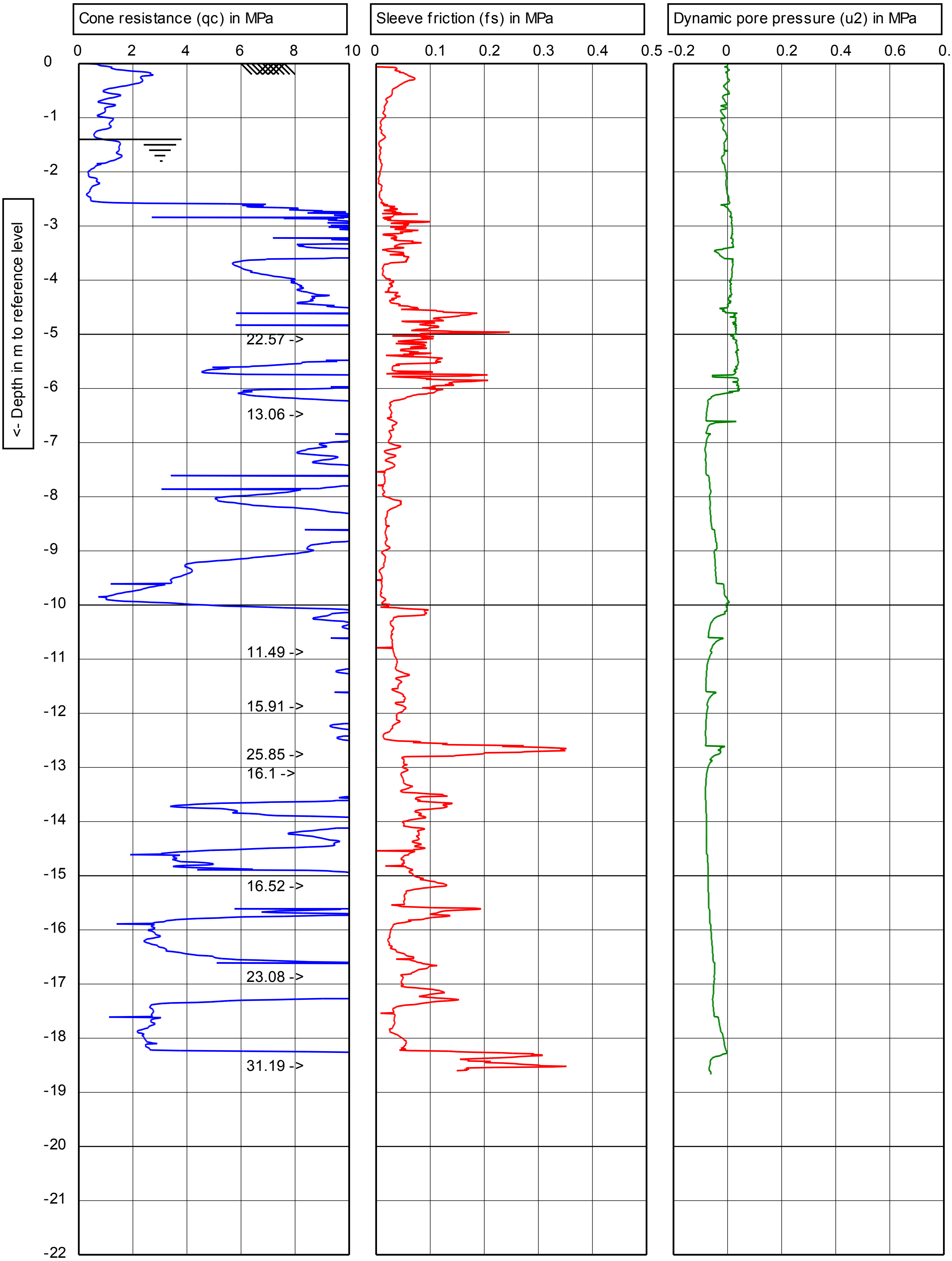
Designation : *CPT North Island Manager*
Date : 09/07/15

IANZ ACCREDITED LABORATORY — Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Opus International Consultants Ltd
Hamilton Laboratory
Quality Management Systems Certified to ISO 9001

Fox Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone +64 7 856 2870
Facsimile +64 7 856 2873
Website www.opus.co.nz



Refusal (qc)

EOH - Dipped - GWL 1.4m

OPUS

IANZ ACCREDITED LABORATORY

Graphs indicated as not accredited are outside the scope of the laboratory's accreditation

u2 150 cm² 10 cm²

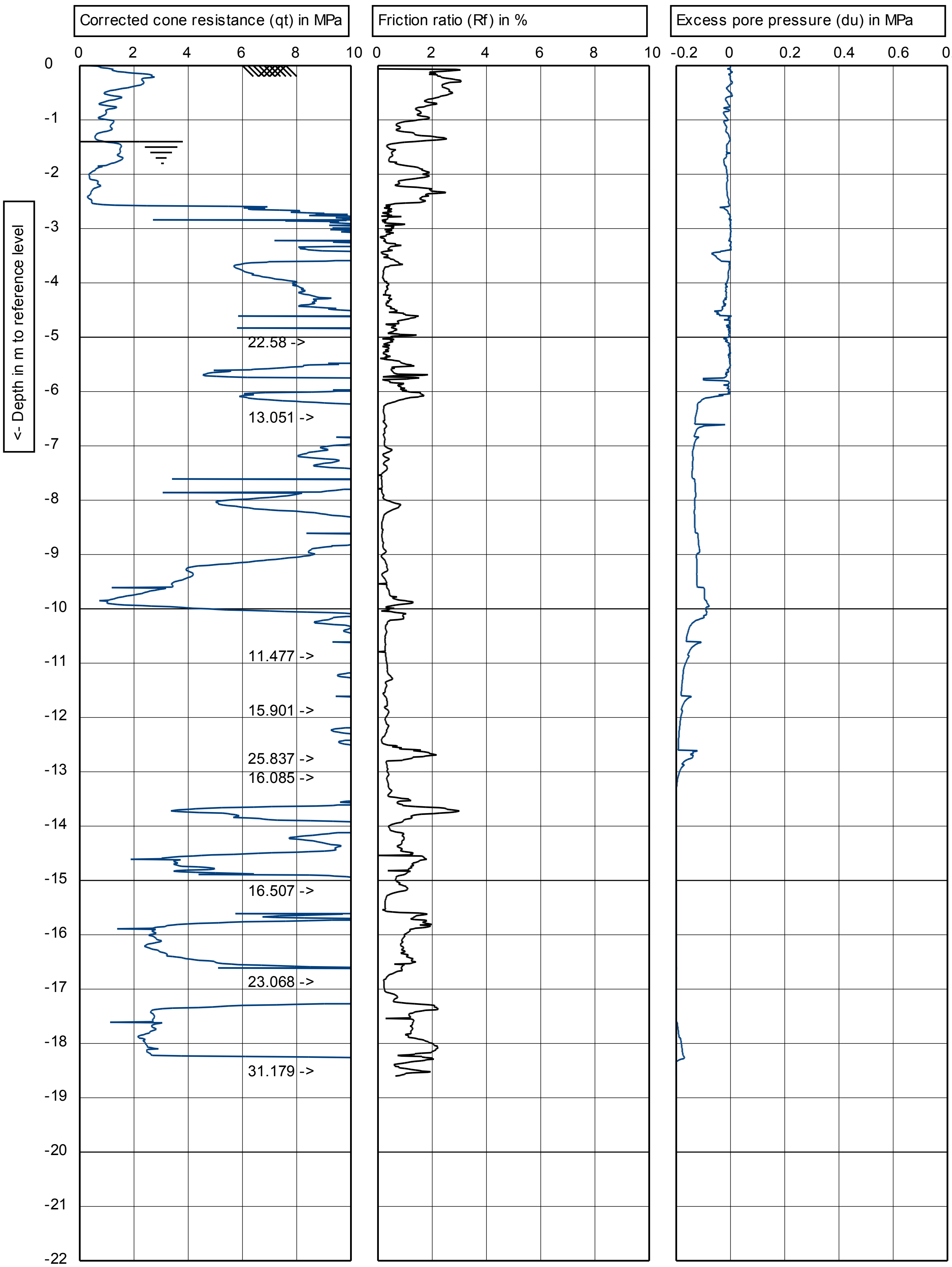
Test according ASTM D5778 -12 & ISO 22476 -1:2012

G.L.: **0.00 m MSL** W.L.: **-1.40 m**

Project: **S.H1 - Blenheim**
Location: **Opawa Bridge**
Position: **1680256, 5405254 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**07/07/15**
Cone no.:	**C10CFIIP.C14267**
Project no.:	**5MB982.03_001**
CPT no.:	**03** **1/6**

1.44



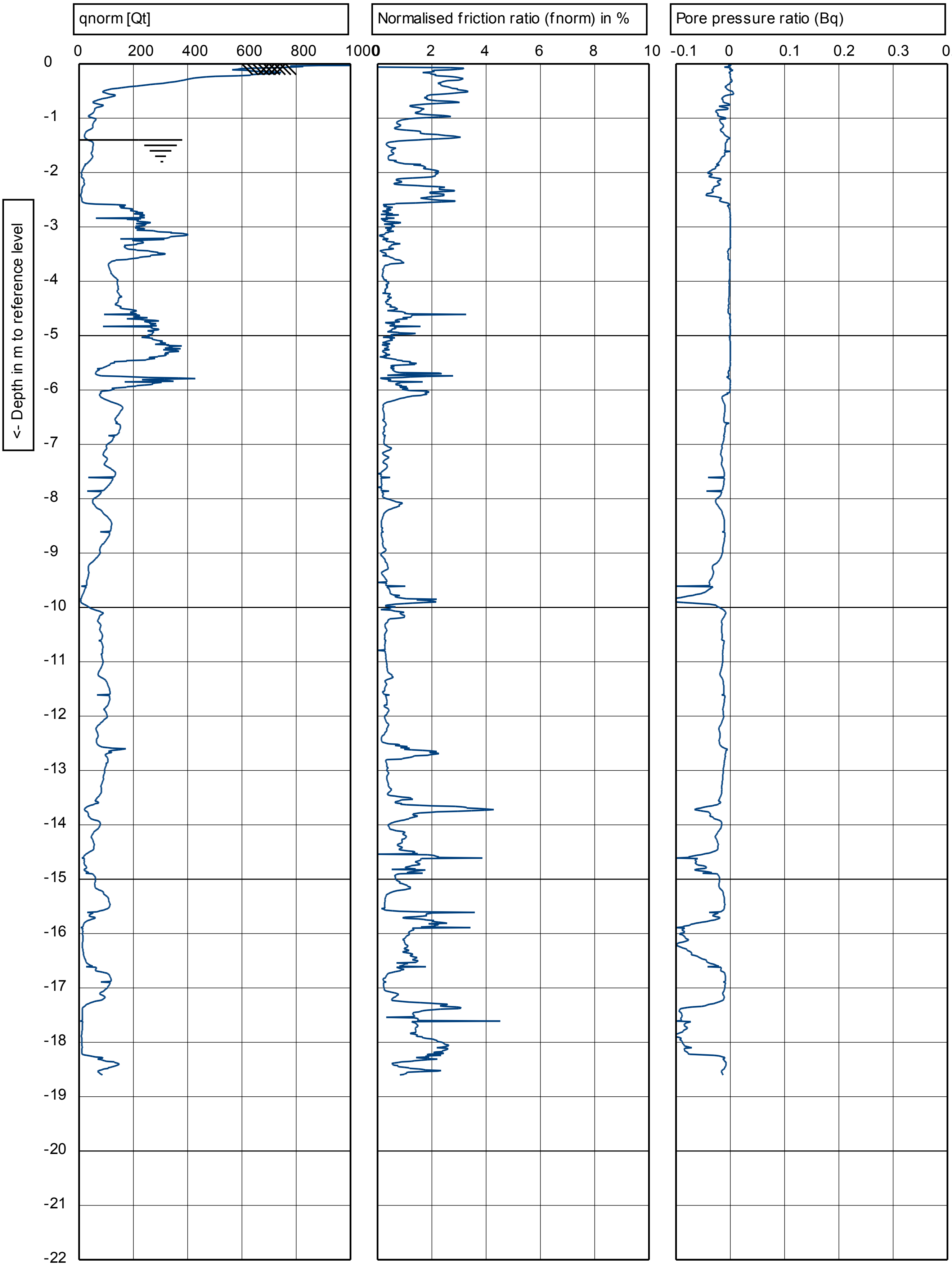
Refusal (qc)

EOH - Dipped - GWL 1.4m

Graphs on this page are not IANZ accredited

u2, 150 cm², 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-1.40 m**	Date:	**07/07/15**
	Project: **S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.:	**5MB982.03_001**
	Position: **1680256, 5405254 NZTM**	CPT no.:	**03** 2/6

1.44



Refusal (qc)

EOH - Dipped - GWL 1.4m

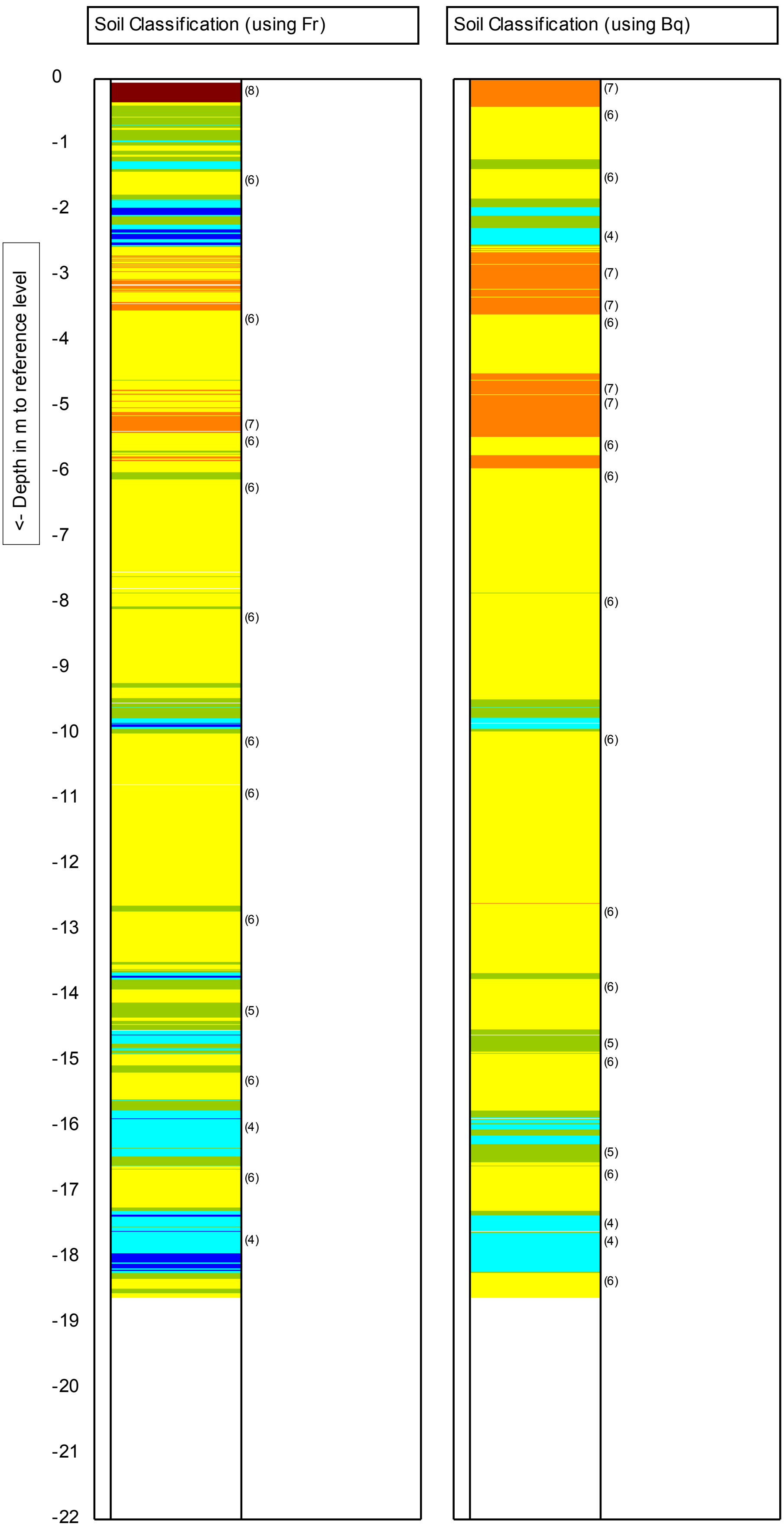
OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778 -12 & ISO 22476 -1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-1.40 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680256, 5405254 NZTM**		CPT no.:	**03** **3/6**

1.44



(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

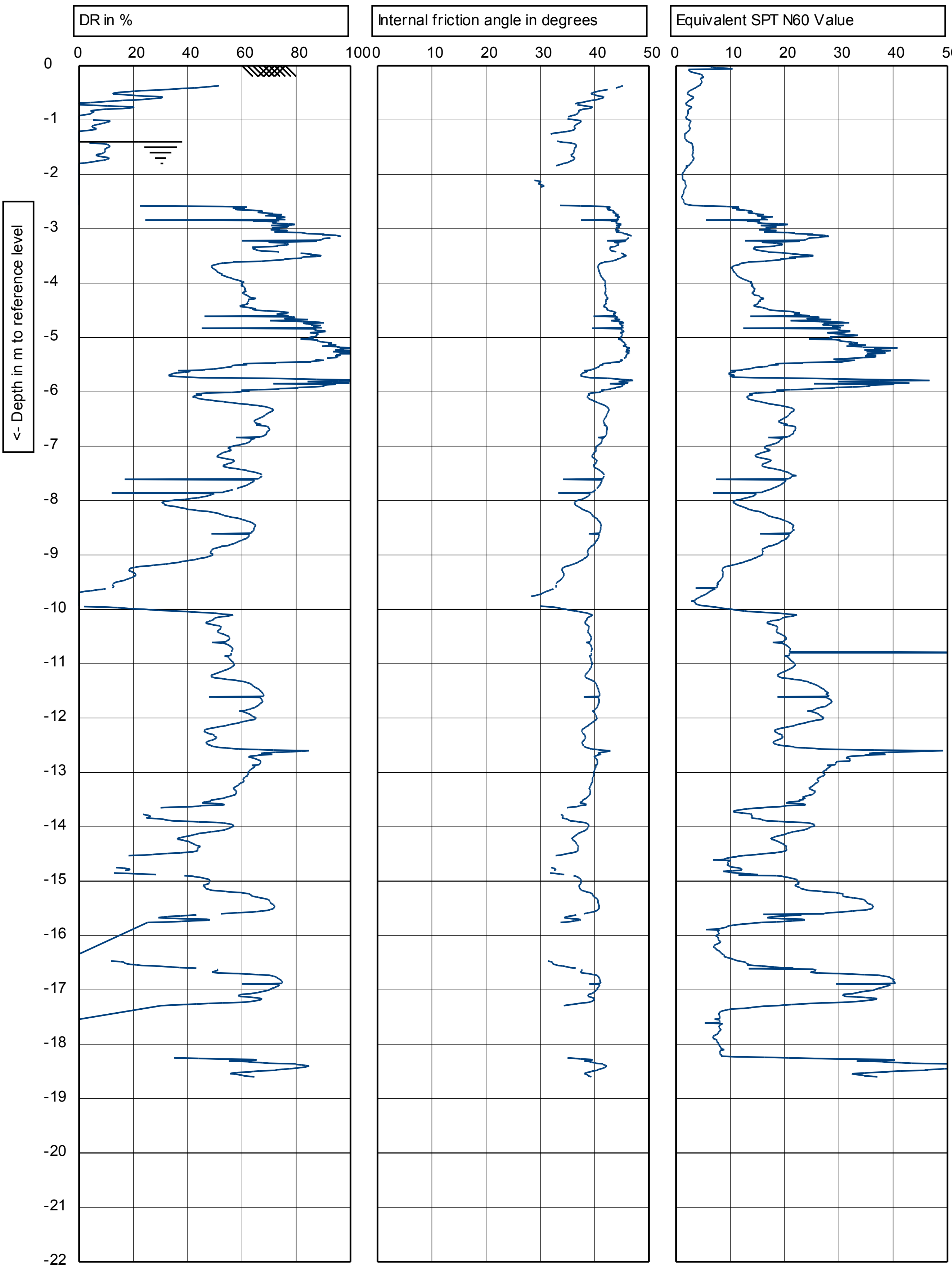
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.40 m**

Project: **S.H1 - Blenheim**
Location: **Opawa Bridge**
Position: **1680256, 5405254 NZTM**

Predrill: **0.00 m Predrilled**
Date: **07/07/15**
Cone no.: **C10CFIIP.C14267**
Project no.: **5MB982.03_001**
CPT no.: **03** **4/6**

1.44



Refusal (qc)

EOH - Dipped - GWL 1.4m

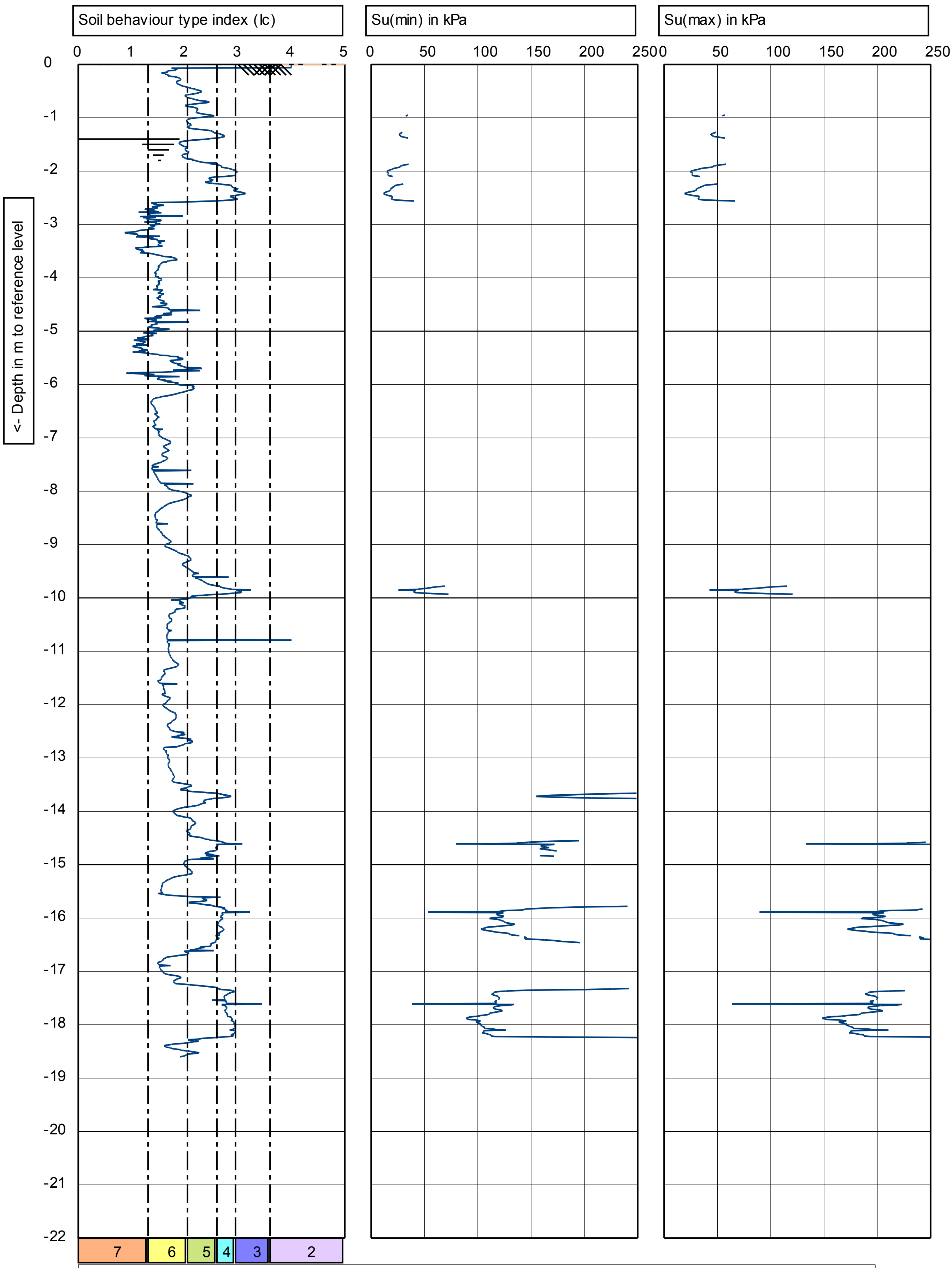
OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	0.00 m Predrilled
G.L.: **0.00 m MSL**	W.L.: **-1.40 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680256, 5405254 NZTM**		CPT no.:	**03** 5/6

1.44



Refusal (qc)

EOH - Dipped - GWL 1.4m

OPUS	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	0.00 m Predrilled
	u2 150 cm² 10 cm² · G.L.: **0.00 m MSL** · W.L.: **-1.40 m**	Date:	**07/07/15**
	Project: **S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.:	**5MB982.03_001**
	Position: **1680256, 5405254 NZTM**	CPT no.:	**03** 6/6

Graphs on this page are not IANZ accredited

1.44

CPT
TEST REPORT

OPUS

Client :	NZ Transport Agency
Project :	S.H1 - Blenheim
Location :	Opawa Bridge
Hole Number:	04A
Tested by :	J Kavanaugh
Date tested :	7/07/15
Coordinates :	E: 1680273
	N: 5405288
	EL: 3
Water level :	EOH - Dipped - GWL @ 0.9m

Project No :	5-MB982.03
Lab Ref No :	15/886/001
Client Ref No :	

Test Results

Start Time	14:10:00
Time at penetration	00:00:00
End Time	00:00:00
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	3.53
Remarks	Refusal (tonnage/qc)
GPS Type	Garmin eTrex 20
GPS Accuracy	+/- 10m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100
Rig ID	Cpt03
Reaction Force	Dead weight (10.5 Tonnes)
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	1
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	N/A
Observations During Testing	None

Date tested : 7/07/15
Date reported : 9/07/15

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 09/07/15

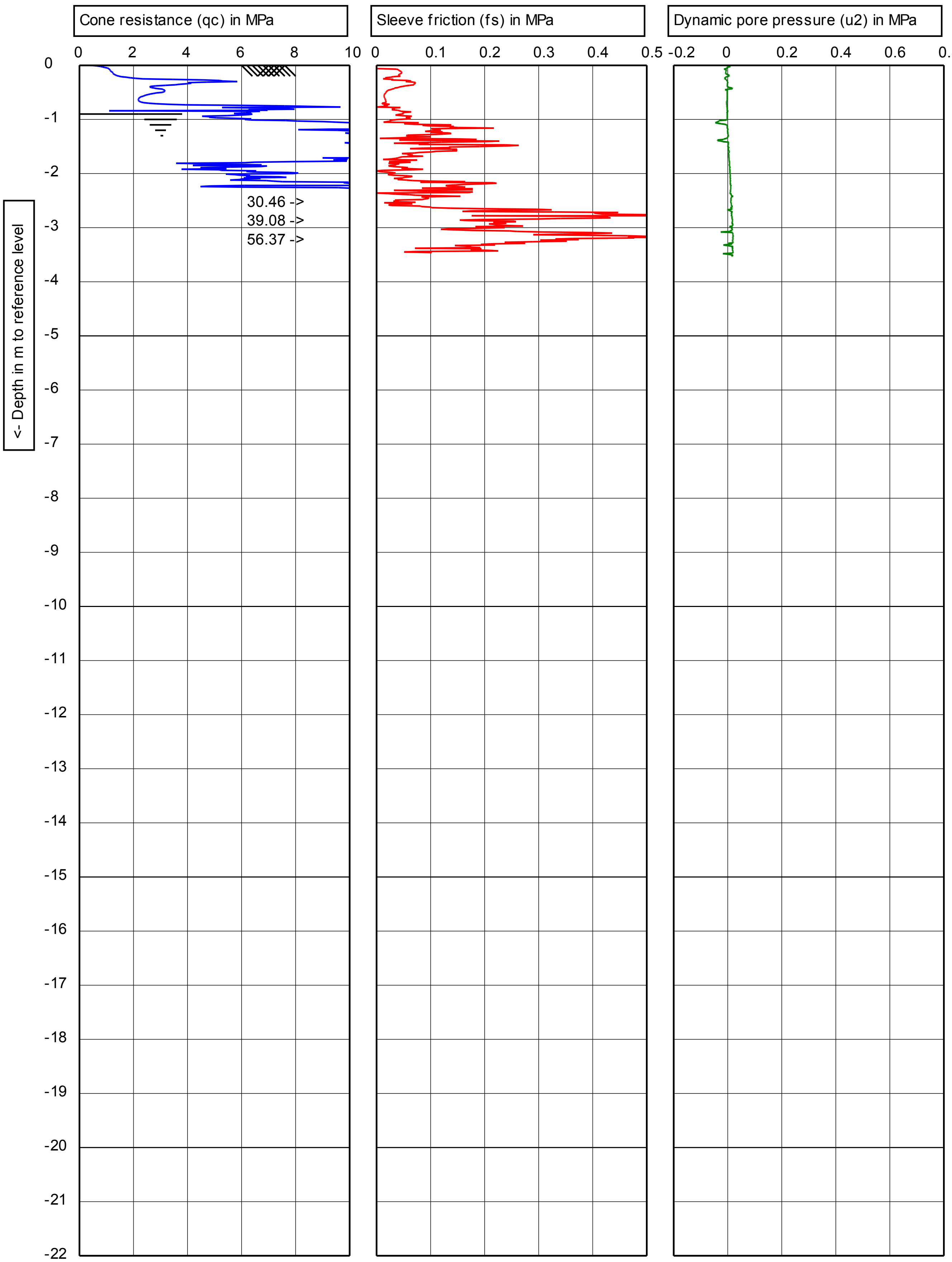
IANZ ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Opus International Consultants Ltd
Hamilton Laboratory
Quality Management Systems Certified to ISO 9001

Fox Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone +64 7 856 2870
Facsimile +64 7 856 2873
Website www.opus.co.nz



Refusal (tonnage qc)

EOH - Dipped - GWL @ 0.9m

OPUS

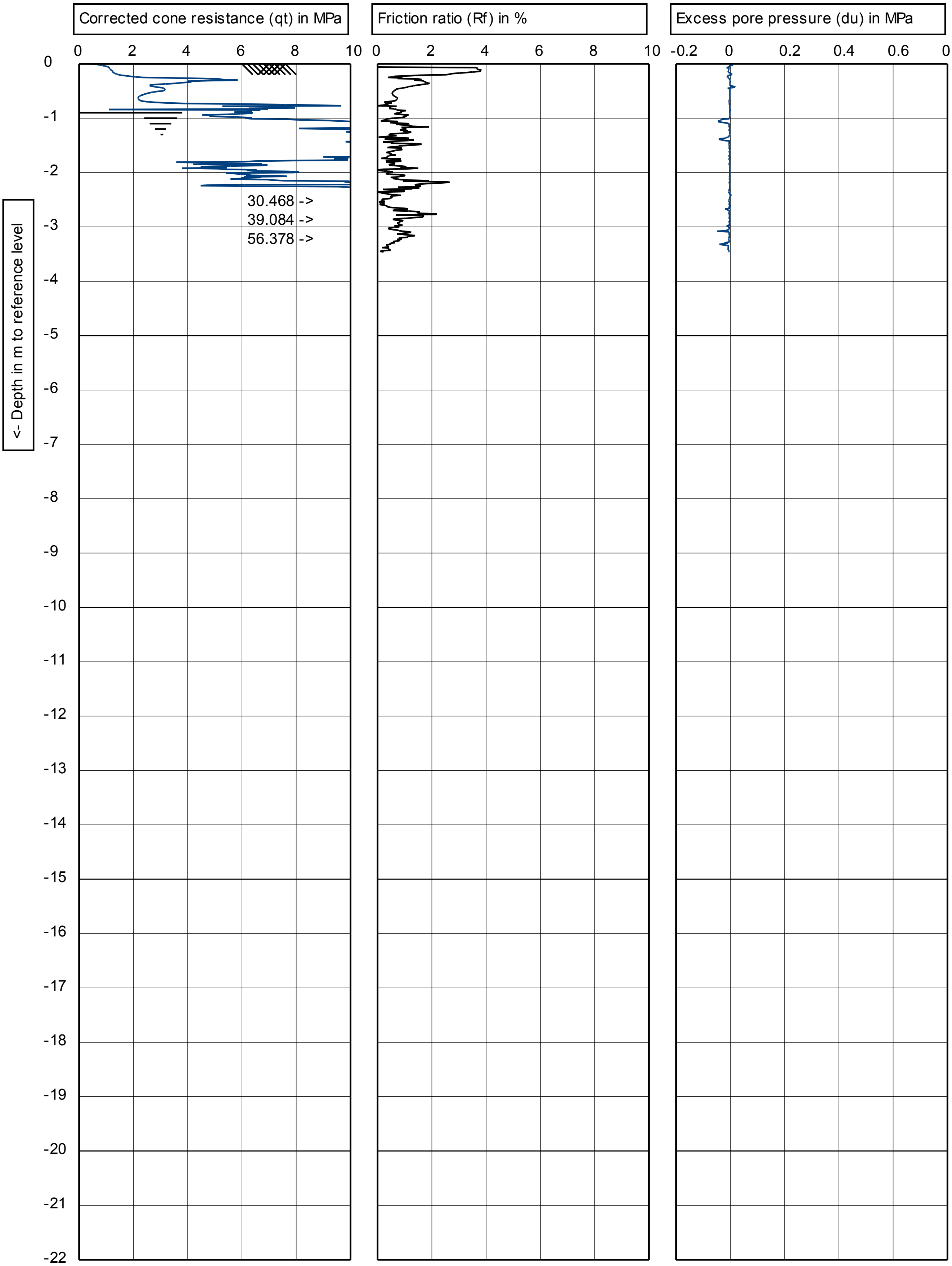
IANZ ACCREDITED LABORATORY

Graphs indicated as not accredited are outside the scope of the laboratory's accreditation

u2 150 cm² 10 cm²

Test according ASTM D5778 -12 & ISO 22476 -1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-0.90 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680273, 5405288 NZTM**		CPT no.:	**04A** 1/6

1.44



Refusal (tonnage qc)

EOH - Dipped - GWL @ 0.9m

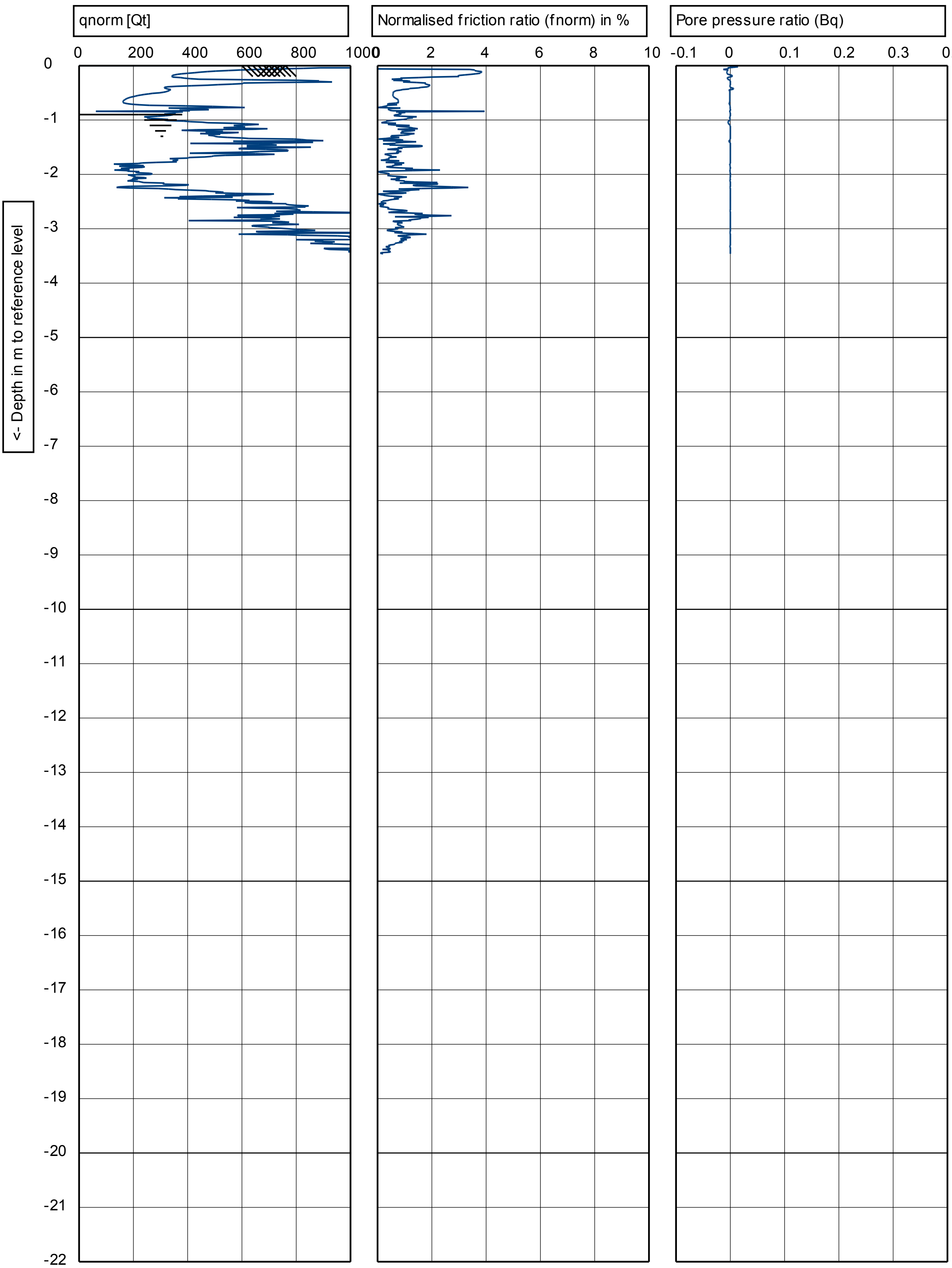
OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778 -12 & ISO 22476 -1:2012		Predrill:	0.00 m Predrilled
G.L.: **0.00 m MSL**	W.L.: **-0.90 m**	Date:	**07/07/15**
Project:	**S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
Location:	**Opawa Bridge**	Project no.:	**5MB982.03_001**
Position:	**1680273, 5405288 NZTM**	CPT no.:	**04A** 2/6

1.44



Refusal (tonnage qc)

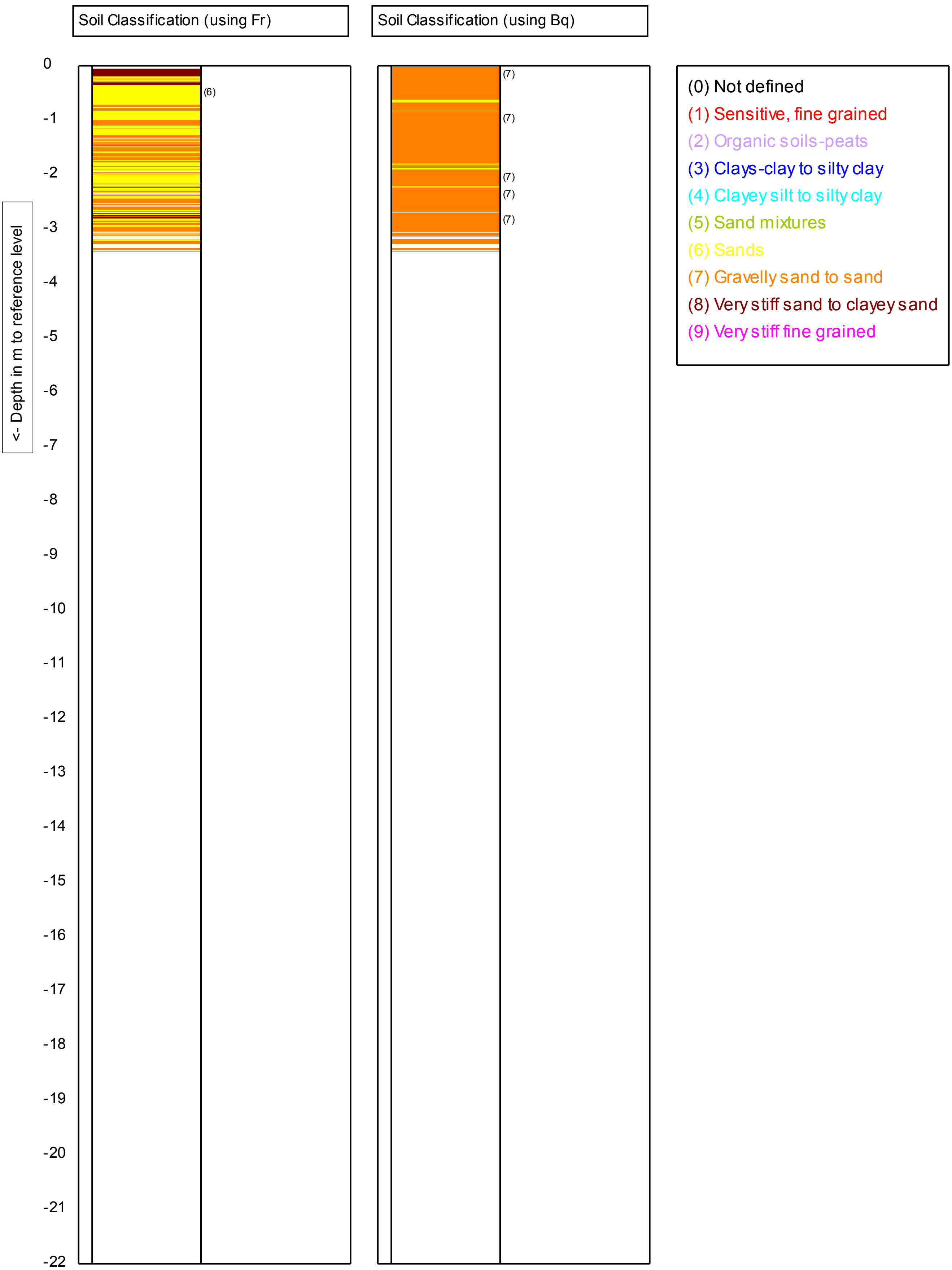
EOH - Dipped - GWL @ 0.9m

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012		Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL**	W.L.: **-0.90 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**			Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**			Project no.:	**5MB982.03_001**
Position: **1680273, 5405288 NZTM**			CPT no.:	**04A** 3/6

1.44



OPUS

Graphs on this page are not IANZ accredited

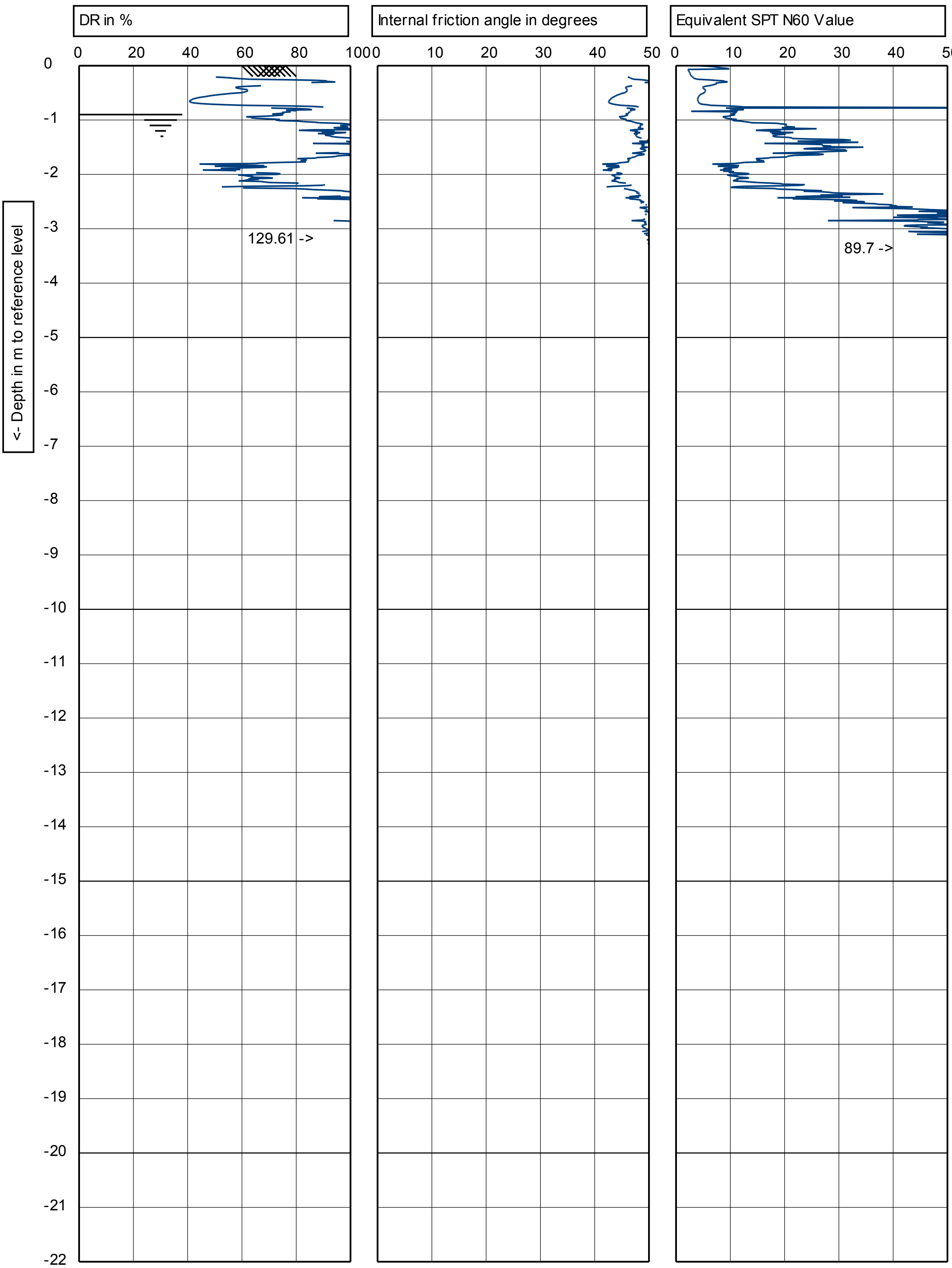
u2 150 cm² 10 cm²

Test according ASTM D5778 -12 & ISO 22476 -1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-0.90 m**	Date:	**07/07/15**

Project: **S.H1 - Blenheim**
Location: **Opawa Bridge**
Position: **1680273, 5405288 NZTM**

Cone no.:	**C10CFIIP.C14267**
Project no.:	**5MB982.03_001**
CPT no.:	**04A** 4/6

1.44

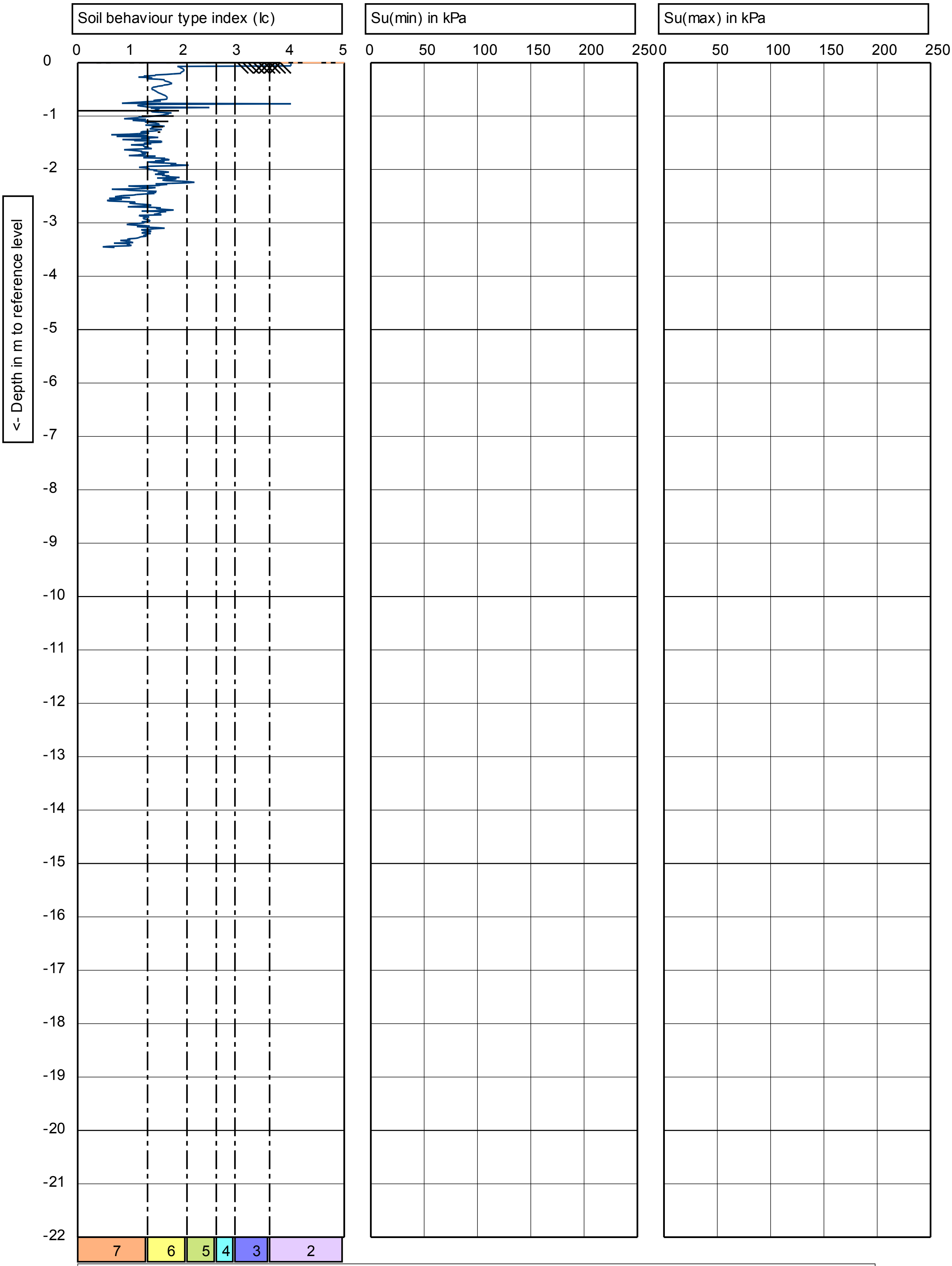


Refusal (tonnage qc)

EOH - Dipped - GWL @ 0.9m

OPUS	u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill: **0.00 m Predrilled**
		G.L.: **0.00 m MSL** W.L.: **-0.90 m**	Date: **07/07/15**
Graphs on this page are not IANZ accredited		Project: **S.H1 - Blenheim**	Cone no.: **C10CFIIP.C14267**
		Location: **Opawa Bridge**	Project no.: **5MB982.03_001**
		Position: **1680273, 5405288 NZTM**	CPT no.: **04A** **5/6**

1.44



Refusal (tonnage qc)

EOH - Dipped - GWL @ 0.9m

OPUS

Graphs on this page are not IANZ accredited

1.44

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-0.90 m**	Date:	**07/07/15**
	Project: **S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.:	**5MB982.03_001**
	Position: **1680273, 5405288 NZTM**	CPT no.:	**04A** **6/6**

CPT
TEST REPORT

OPUS

Client :	NZ Transport Agency
Project :	S.H1 - Blenheim
Location :	Opawa Bridge
Hole Number:	05A
Tested by :	J Kavanaugh
Date tested :	7/07/15
Coordinates :	E: 1680304
	N: 5405329
	EL: 11
Water level :	EOH - Dipped - GWL @3.2m

Project No :	5-MB982.03
Lab Ref No :	15/886/001
Client Ref No :	

Test Results

Start Time	16:44:00
Time at penetration	00:00:00
End Time	00:00:00
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	5.49
Remarks	Refusal (tonnage/qc)
GPS Type	Garmin eTrex 20
GPS Accuracy	+/- 10m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100
Rig ID	Cpt03
Reaction Force	Dead weight (10.5 Tonnes)
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	1
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	N/A
Observations During Testing	None

Date tested : 7/07/15
Date reported : 9/07/15

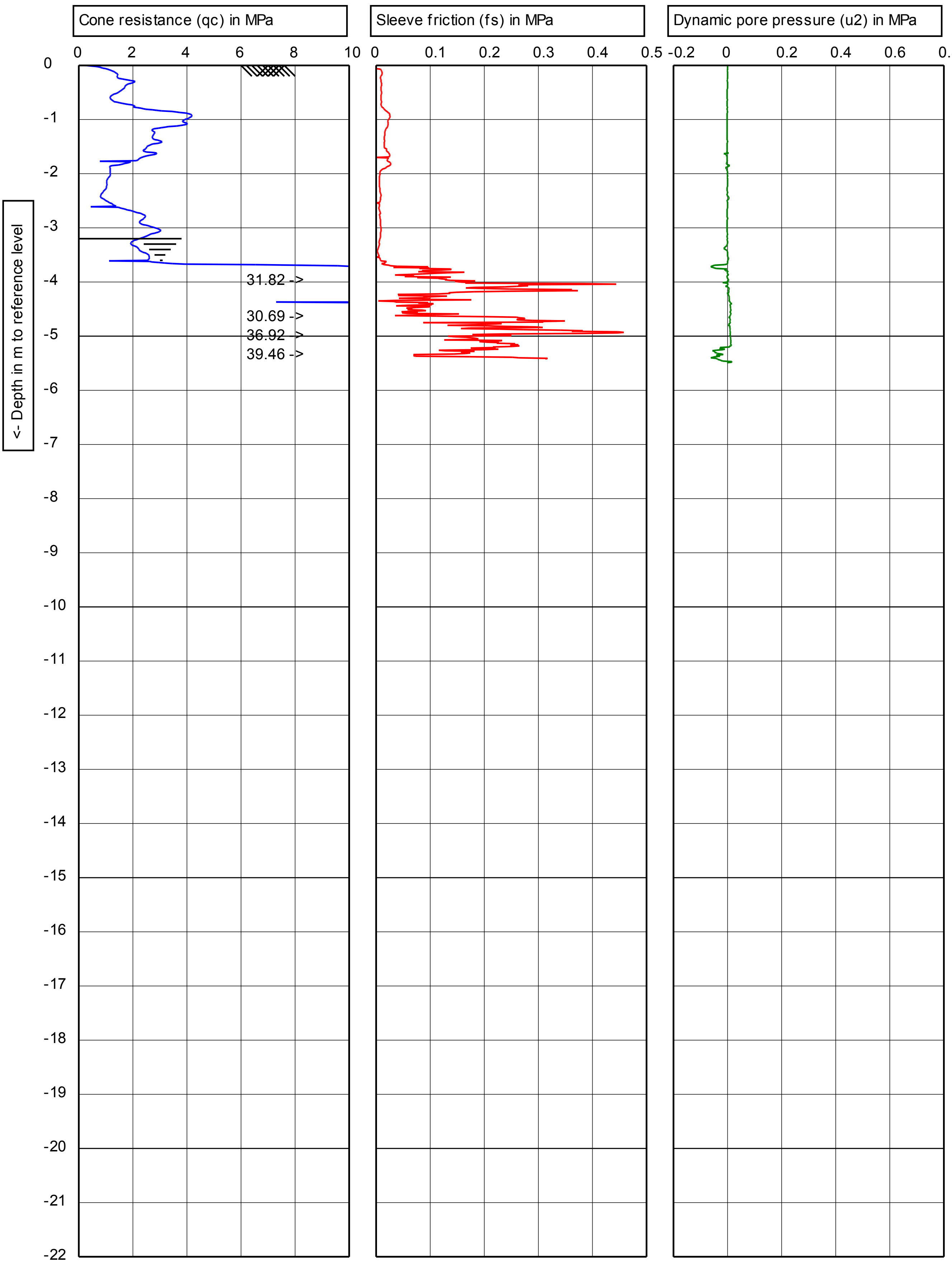
IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 09/07/15

Opus International Consultants Ltd
Hamilton Laboratory
Quality Management Systems Certified to ISO 9001

Fox Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone +64 7 856 2870
Facsimile +64 7 856 2873
Website www.opus.co.nz



Refusal (tonnage qc)

Dipped - GWL - @ 3.2m

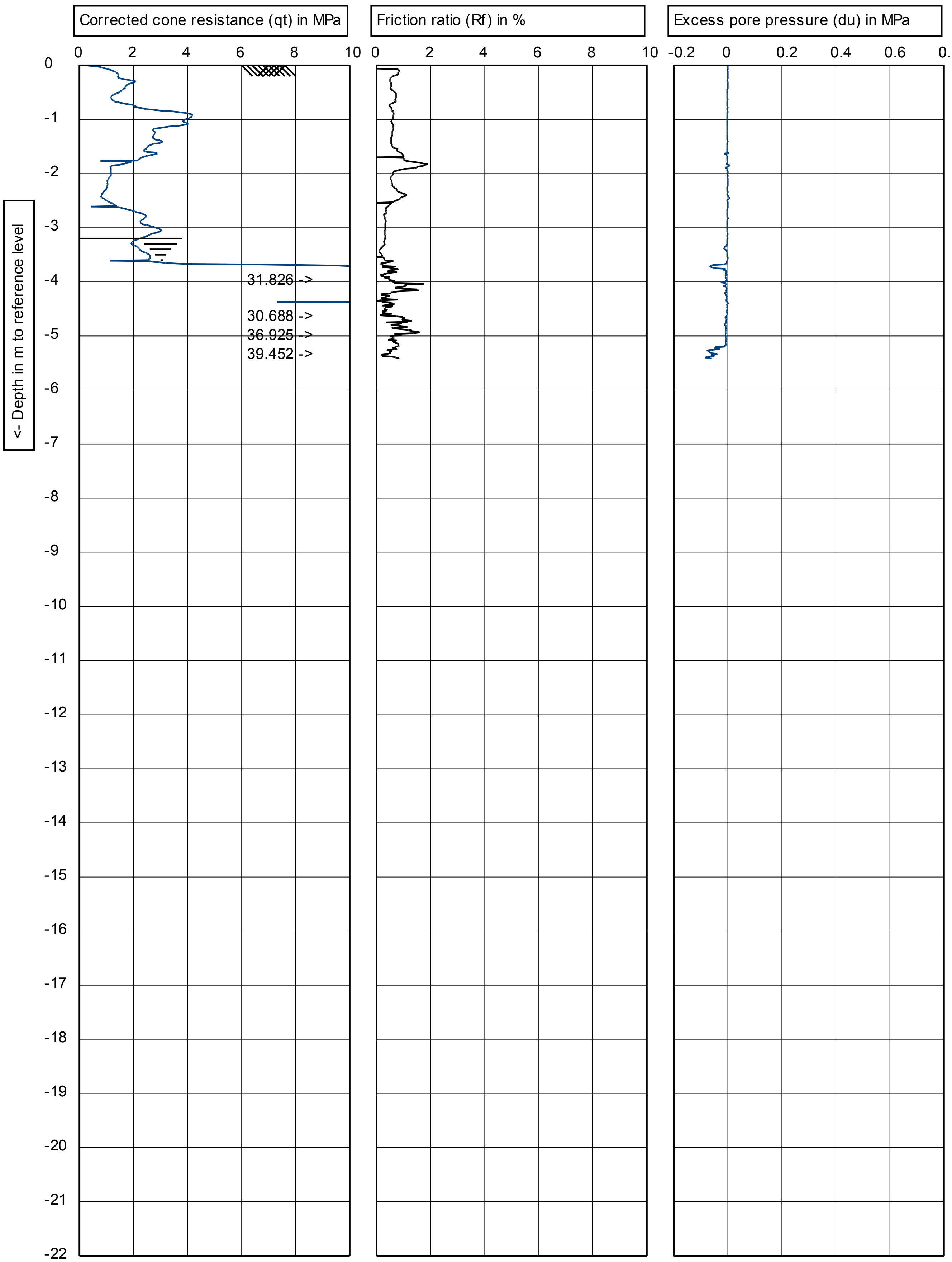
OPUS

IANZ ACCREDITED LABORATORY

Graphs indicated as not accredited are outside the scope of the laboratory's accreditation

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-3.20 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680304, 5405329 NZTM**		CPT no.:	**05A** 1/6

1.44



Refusal (tonnage qc)

Dipped - GWL - @ 3.2m

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778 -12 & ISO 22476 -1:2012

G.L.: **0.00 m MSL** W.L.: **-3.20 m**

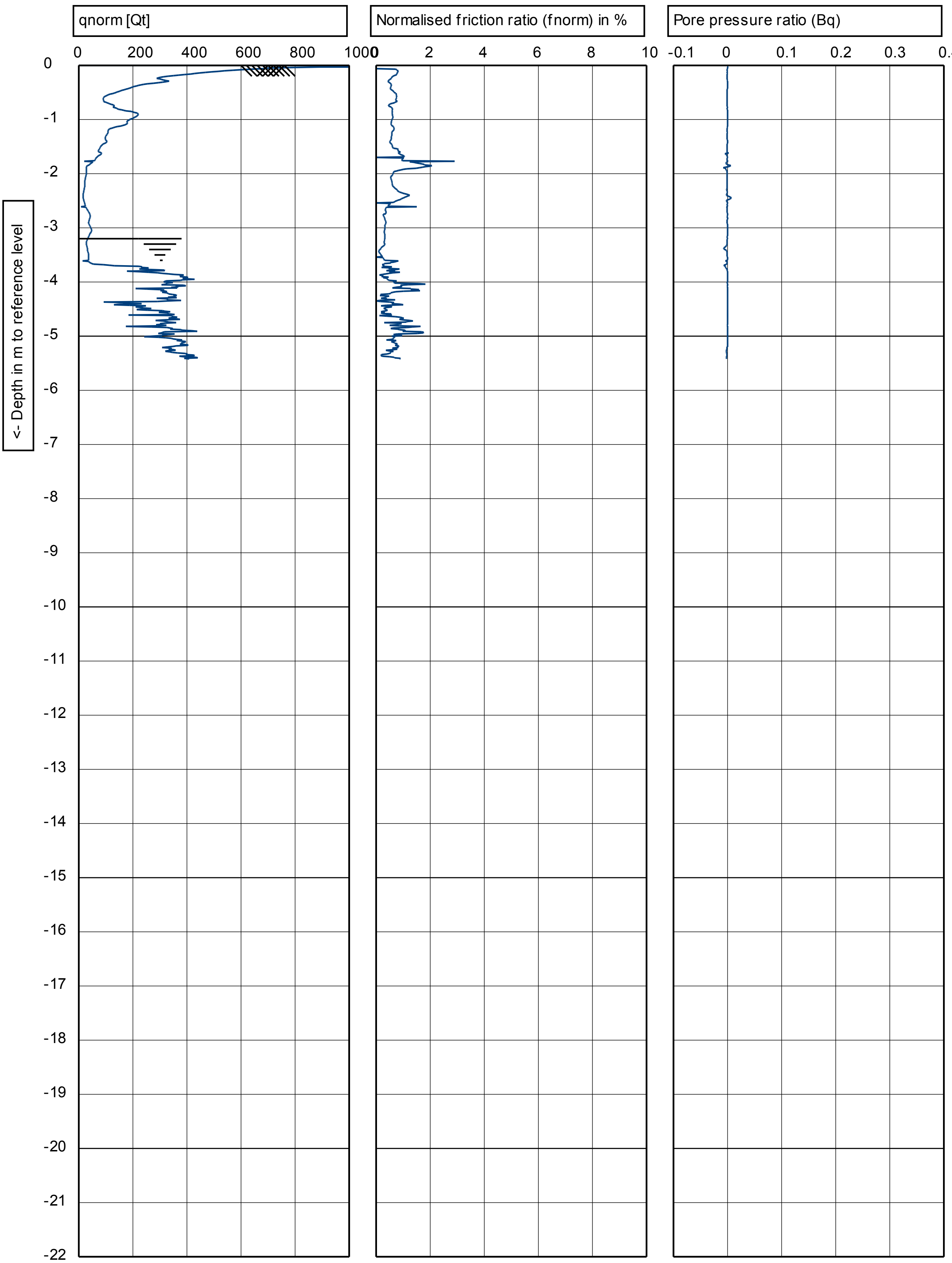
Project: **S.H1 - Blenheim**

Location: **Opawa Bridge**

Position: **1680304, 5405329 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**07/07/15**
Cone no.:	**C10CFIIP.C14267**
Project no.:	**5MB982.03_001**
CPT no.:	**05A** 2/6

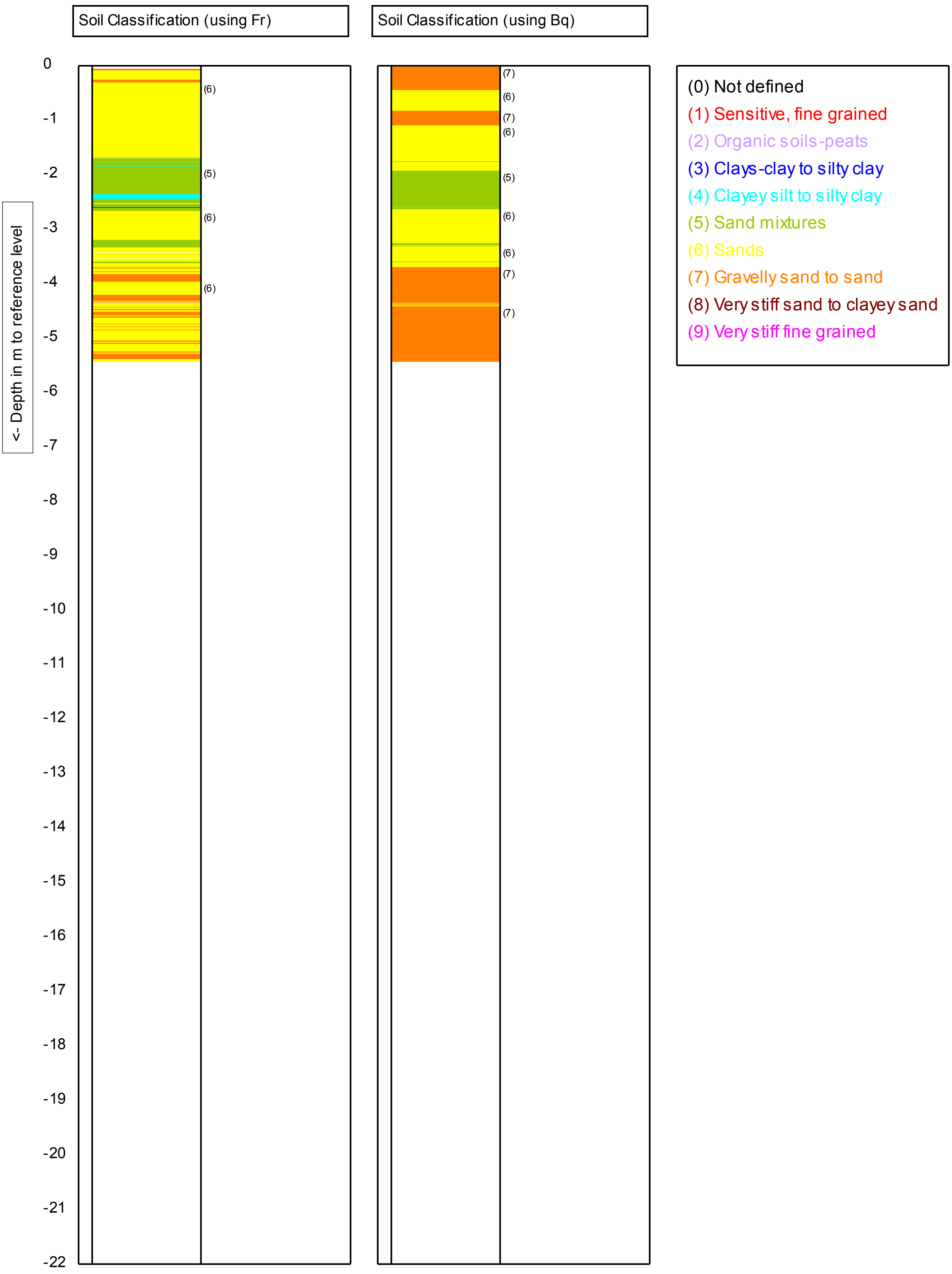
1.44



Refusal (tonnage qc)

Dipped - GWL - @ 3.2m

OPUS	u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill: **0.00 m Predrilled**
		G.L.: **0.00 m MSL** W.L.: **-3.20 m**	Date: **07/07/15**
Graphs on this page are not IANZ accredited	Project: **S.H1 - Blenheim**		Cone no.: **C10CFIIP.C14267**
	Location: **Opawa Bridge**		Project no.: **5MB982.03_001**
1.44	Position: **1680304, 5405329 NZTM**		CPT no.: **05A** **3/6**

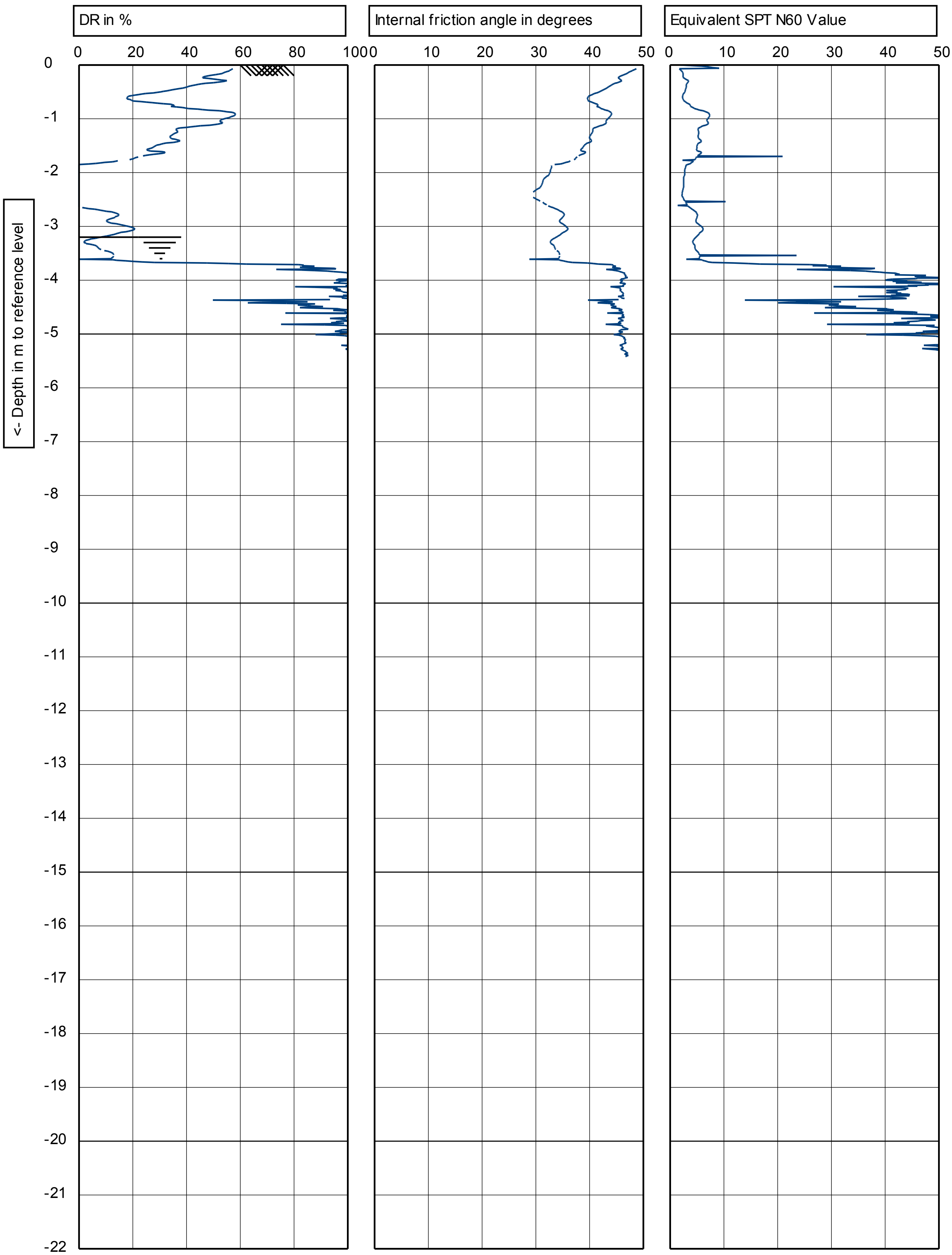


OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778-12 & ISO 22476-1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-3.20 m**	Date:	**07/07/15**
	Project: **S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.:	**5MB982.03_001**
	Position: **1680304, 5405329 NZTM**	CPT no.:	**05A** 4/6

1.44



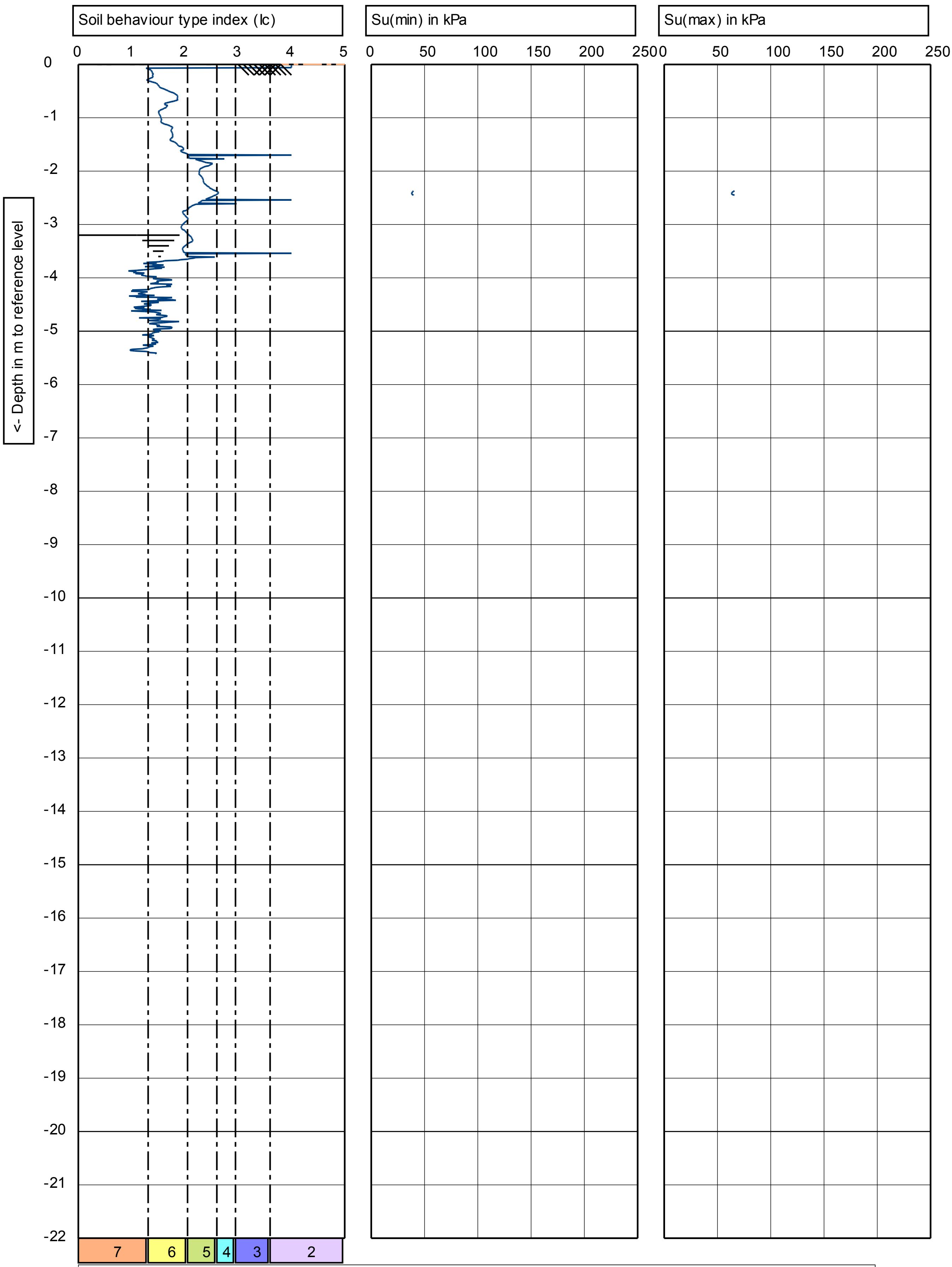
Refusal (tonnage qc)

Dipped - GWL - @ 3.2m

Graphs on this page are not IANZ accredited

u2, 150 cm², 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-3.20 m**	Date:	**07/07/15**
Project:	**S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
Location:	**Opawa Bridge**	Project no.:	**5MB982.03_001**
Position:	**1680304, 5405329 NZTM**	CPT no.:	**05A** 5/6

1.44



Refusal (tonnage qc)

Dipped - GWL - @ 3.2m

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-3.20 m**	Date:	**07/07/15**
	Project: **S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
	Location: **Opawa Bridge**	Project no.:	**5MB982.03_001**
	Position: **1680304, 5405329 NZTM**	CPT no.:	**05A** 6/6

1.44

CPT TEST REPORT

OPUS

Client :	NZ Transport Agency
Project :	S.H1 - Blenheim
Location :	Opawa Bridge
Hole Number:	6
Tested by :	J Kavanaugh
Date tested :	7/07/15
Coordinates :	E: 1680334
	N: 5405343
	EL: 11
Water level :	EOH - Dipped - GWL @6.2m

Project No :	5-MB982.03
Lab Ref No :	15/886/001
Client Ref No :	

Test Results

Start Time	10:07:00
Time at penetration	00:00:00
End Time	00:00:00
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	11.28
Remarks	Refusal (qc)
GPS Type	Garmin eTrex 20
GPS Accuracy	+/- 10m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100
Rig ID	Cpt03
Reaction Force	Dead weight (10.5 Tonnes)
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	1
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	N/A
Observations During Testing	None

Date tested : 7/07/15
Date reported : 9/07/15

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 09/07/15

IANZ ACCREDITED LABORATORY

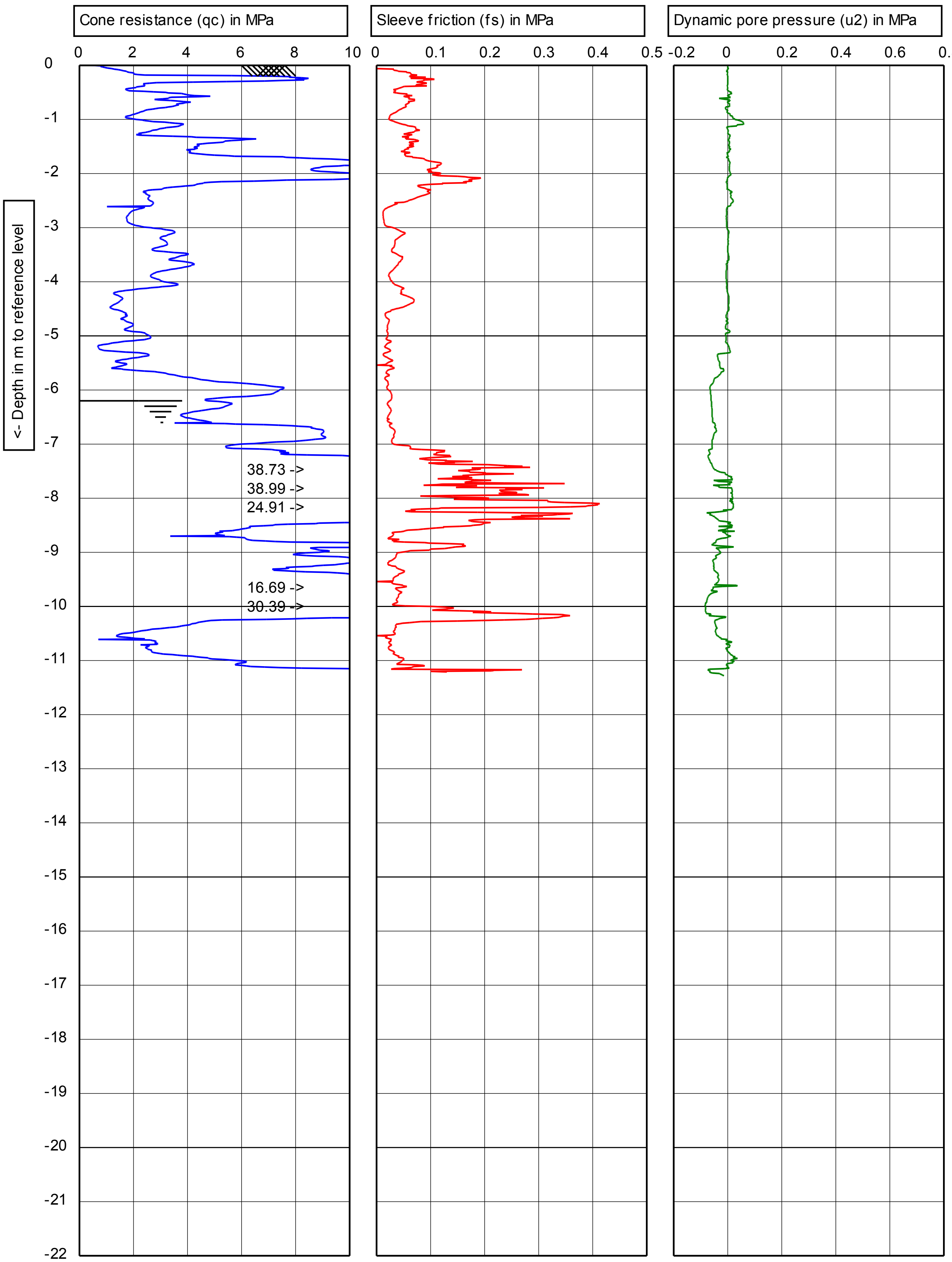
Tests indicated as not accredited are outside the scope of the laboratory's accreditation

LH 2520 (27/08/14)

Opus International Consultants Ltd
Hamilton Laboratory
Quality Management Systems Certified to ISO 9001

Fox Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone +64 7 856 2870
Facsimile +64 7 856 2873
Website www.opus.co.nz

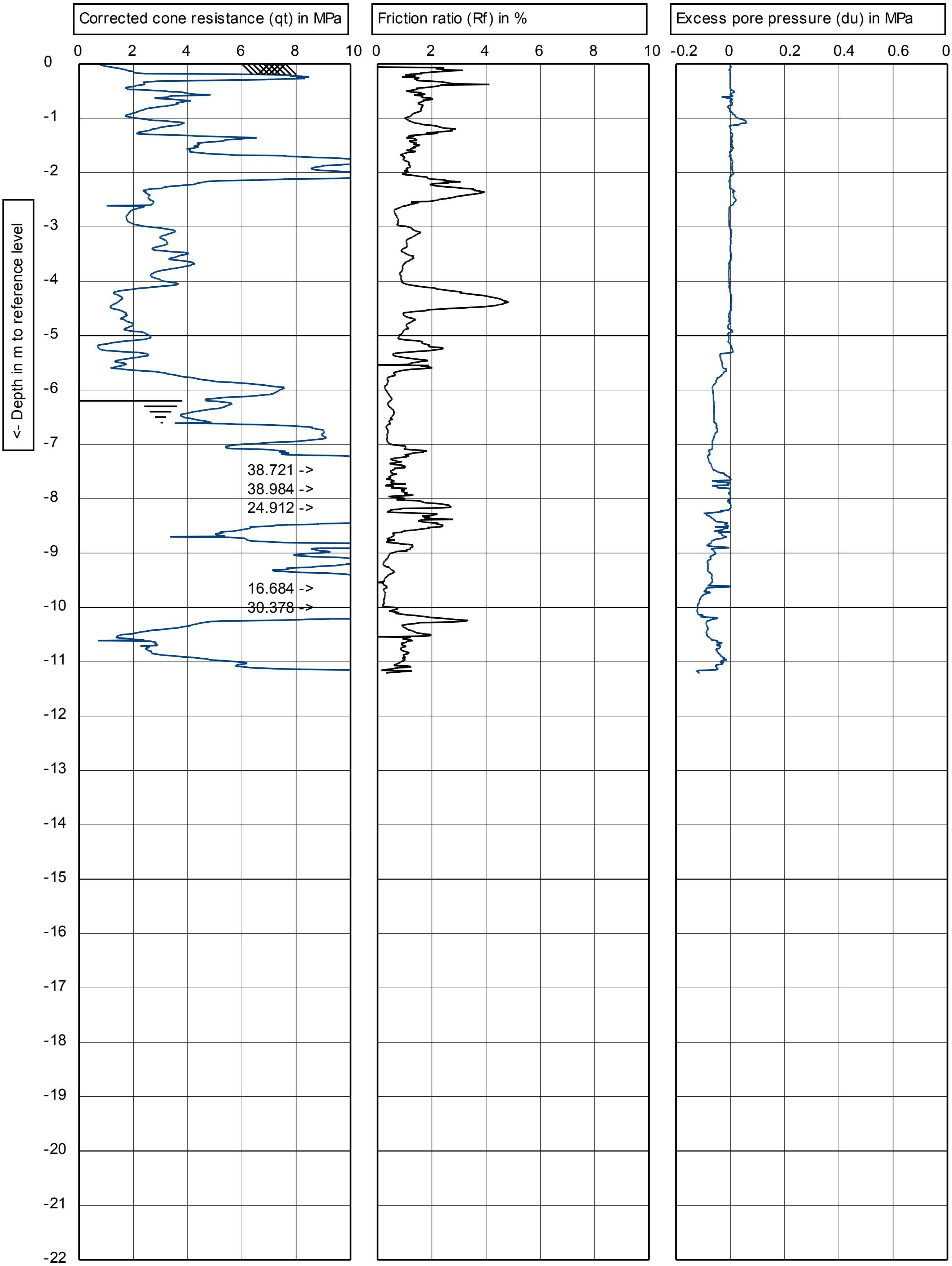


Refusal (qc)

EOH - dipped - GWL @ 6.2

OPUS / IANZ ACCREDITED LABORATORY — Graphs indicated as not accredited are outside the scope of the laboratory's accreditation	u2, 150 cm², 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill: **0.00 m Predrilled**
		G.L.: **0.00 m MSL** W.L.: **-6.20 m**	Date: **07/07/15**
		Project: **S.H1 - Blenheim**	Cone no.: **C10CFIIP.C14267**
		Location: **Opawa Bridge**	Project no.: **5MB982.03_001**
		Position: **1680334, 5405343 NZTM**	CPT no.: **06** 1/6

1.44



Refusal (qc)

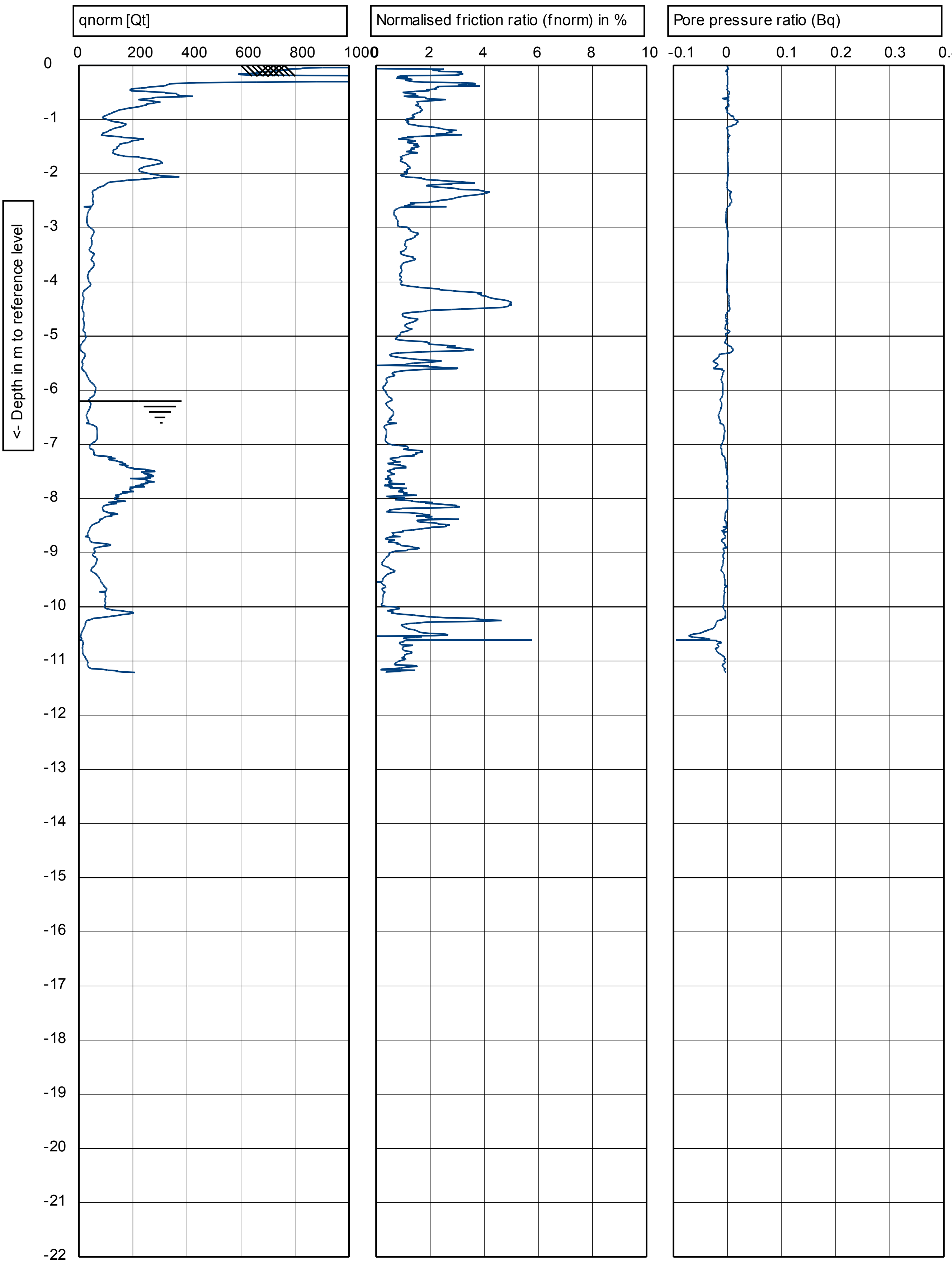
EOH - dipped - GWL @ 6.2

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-6.20 m**	Date:	**07/07/15**
Project:	**S.H1 - Blenheim**	Cone no.:	**C10CFIIP.C14267**
Location:	**Opawa Bridge**	Project no.:	**5MB982.03_001**
Position:	**1680334, 5405343 NZTM**	CPT no.:	**06** 2/6

1.44



Refusal (qc)

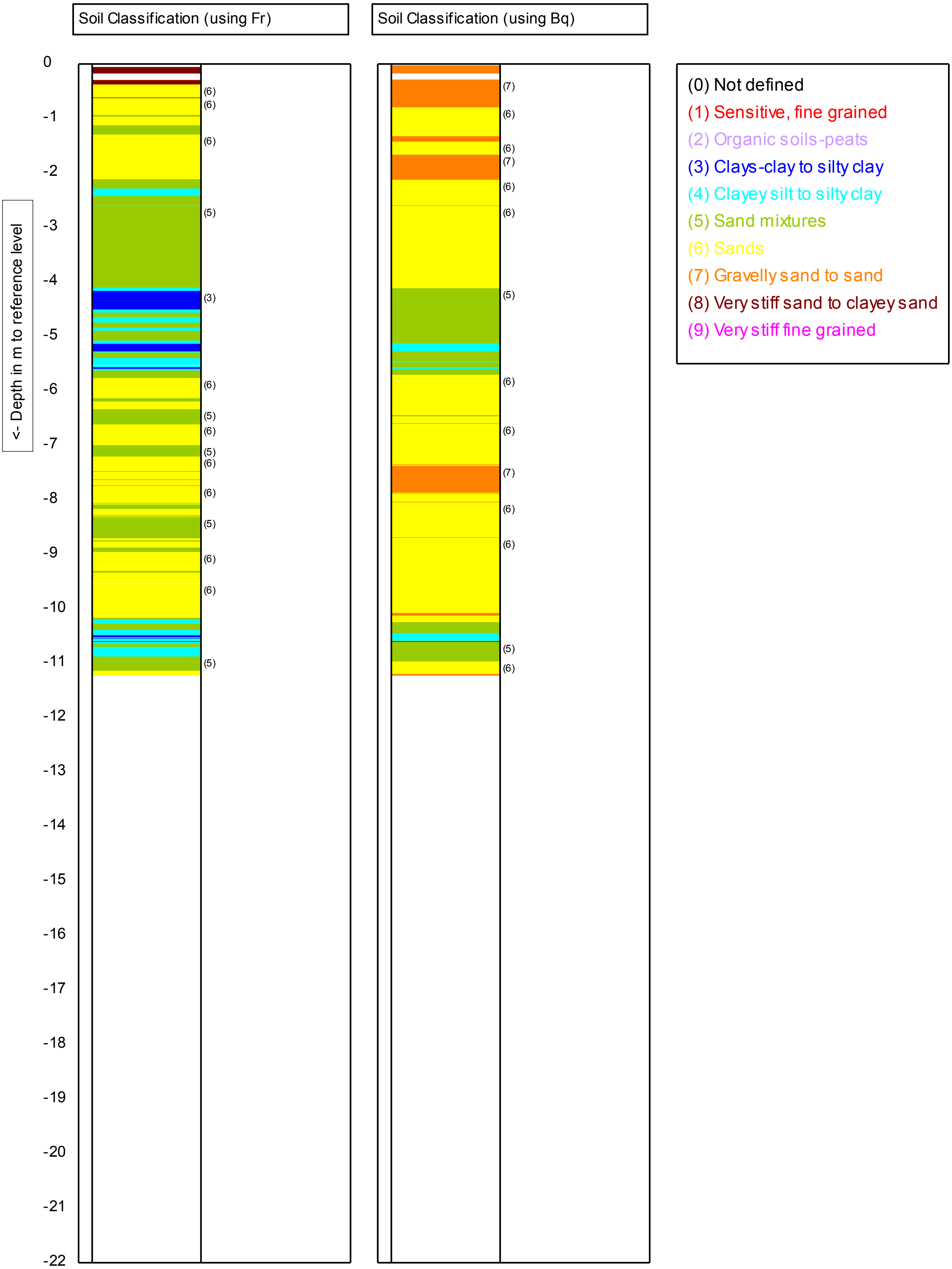
EOH - dipped - GWL @ 6.2

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778 -12 & ISO 22476 -1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL** W.L.: **-6.20 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680334, 5405343 NZTM**		CPT no.:	**06** 3/6

1.44

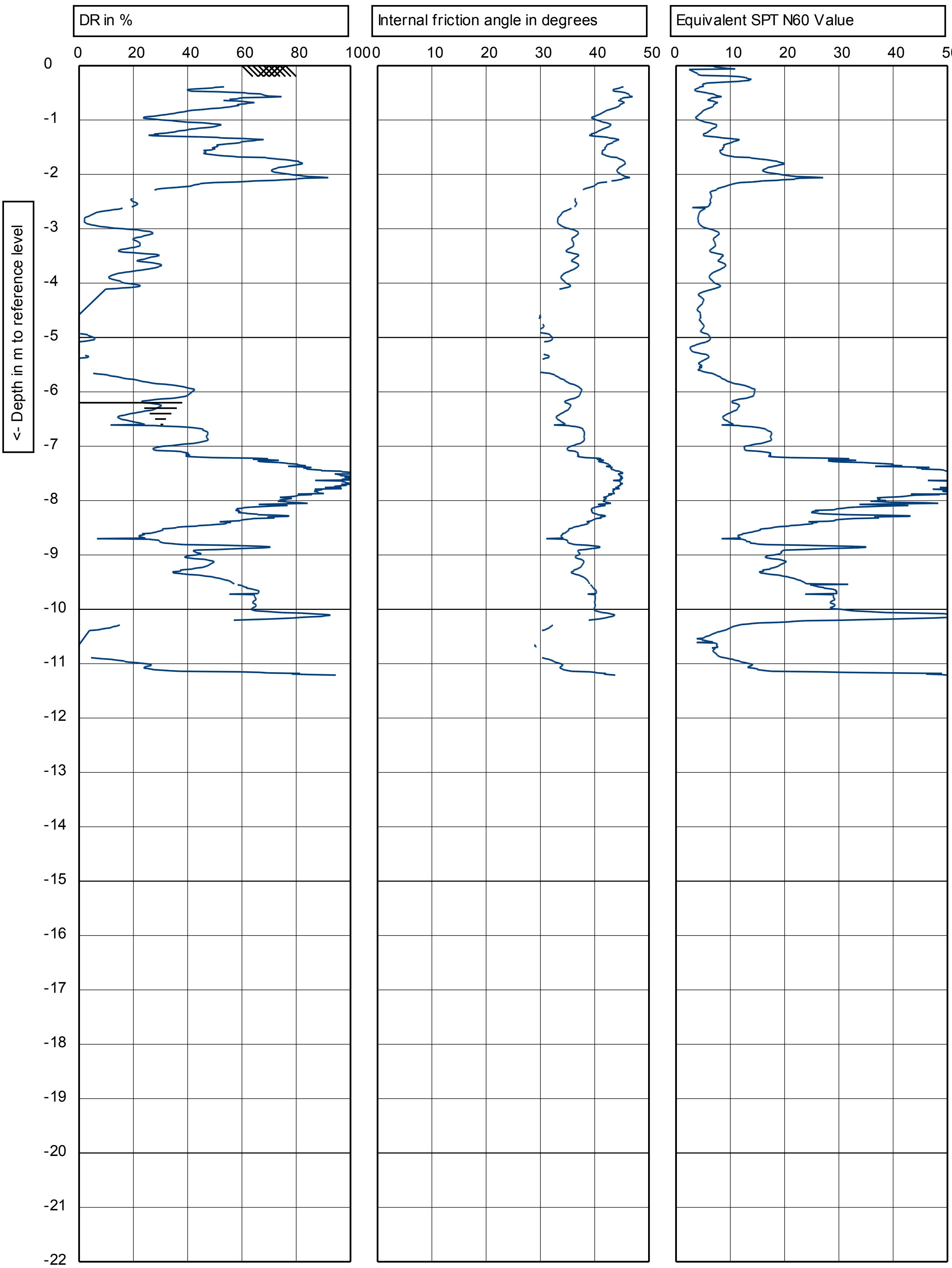


OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²	Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL**	W.L.: **-6.20 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**			Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**			Project no.:	**5MB982.03_001**
Position: **1680334, 5405343 NZTM**			CPT no.:	**06** 4/6

1.44



Refusal (qc)

EOH - dipped - GWL @ 6.2

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

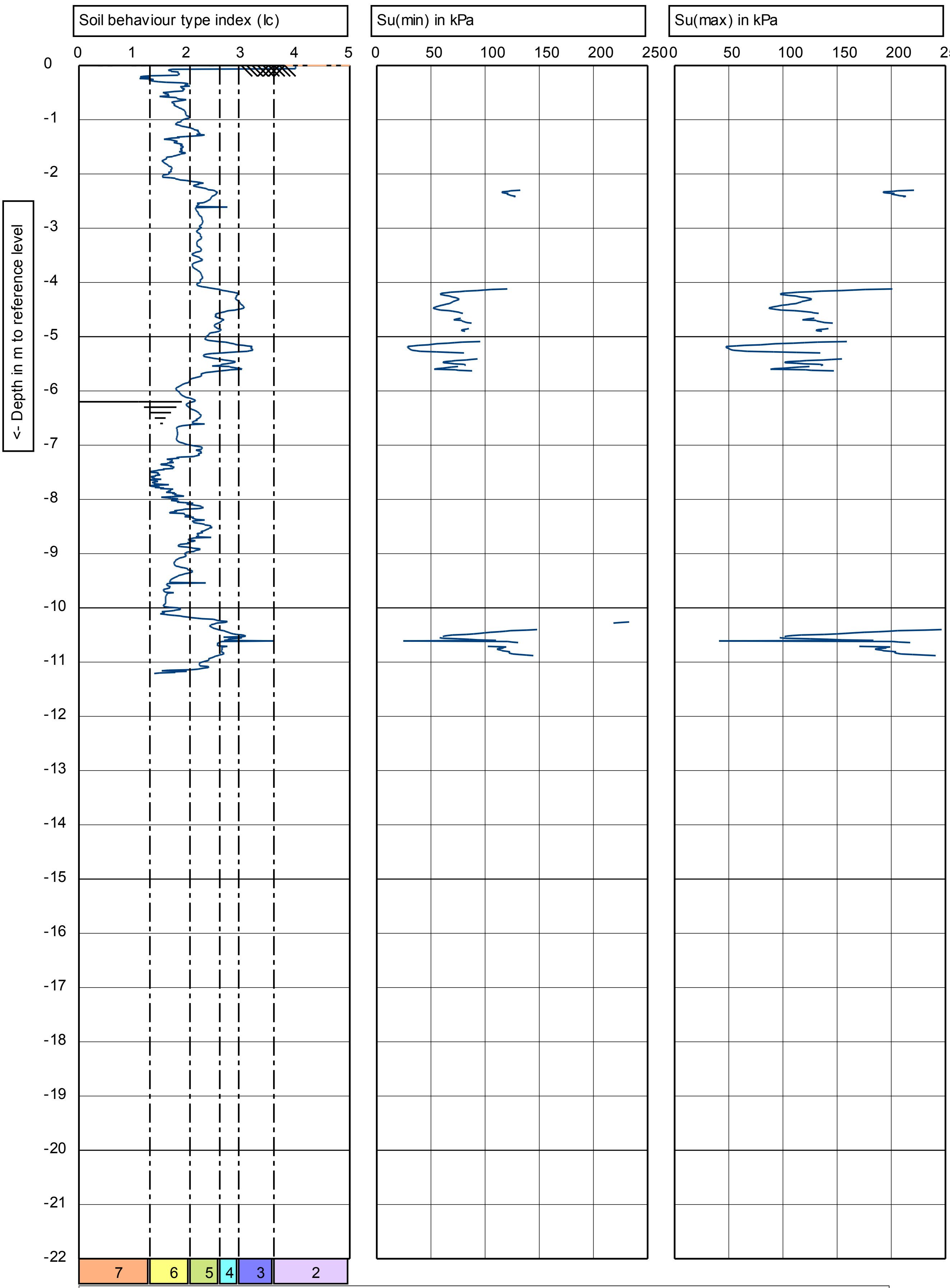
Test according ASTM D5778 -12 & ISO 22476 -1:2012

G.L.: **0.00 m MSL** W.L.: **-6.20 m**

Project: **S.H1 - Blenheim**
Location: **Opawa Bridge**
Position: **1680334, 5405343 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**07/07/15**
Cone no.:	**C10CFIIP.C14267**
Project no.:	**5MB982.03_001**
CPT no.:	**06** 5/6

1.44



Refusal (qc)

EOH - dipped - GWL @ 6.2

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **-6.20 m**	Date:	**07/07/15**
Project: **S.H1 - Blenheim**		Cone no.:	**C10CFIIP.C14267**
Location: **Opawa Bridge**		Project no.:	**5MB982.03_001**
Position: **1680334, 5405343 NZTM**		CPT no.:	**06** 6/6

1.44

Appendix C

Shear Wave Velocity Analysis

1 Field Investigations

1.1 Seismic Cone Penetrometer Test

Shear wave measurements were taken at 1.0m depth intervals during testing using three accelerometers, one for each axis. Source shear waves were generated at the surface with a sledge hammer hitting a steel plate that was held down by one of the CPT outriggers. We struck the steel plate at least two times on the right and left hand side to generate 4 seismic shear wave data files.

2 Calculated Shear wave Velocities

The analysis and processing of the raw data was carried out using Baziw Consultants computer program Sc3 Rav. High and low frequencies were filtered, typically below 20Hz and above 180Hz and the results were stacked to generate a single full waveform for both the left and right measurements.

Shear wave velocities were then calculated using the full waveforms at each depth increment using two different methods.

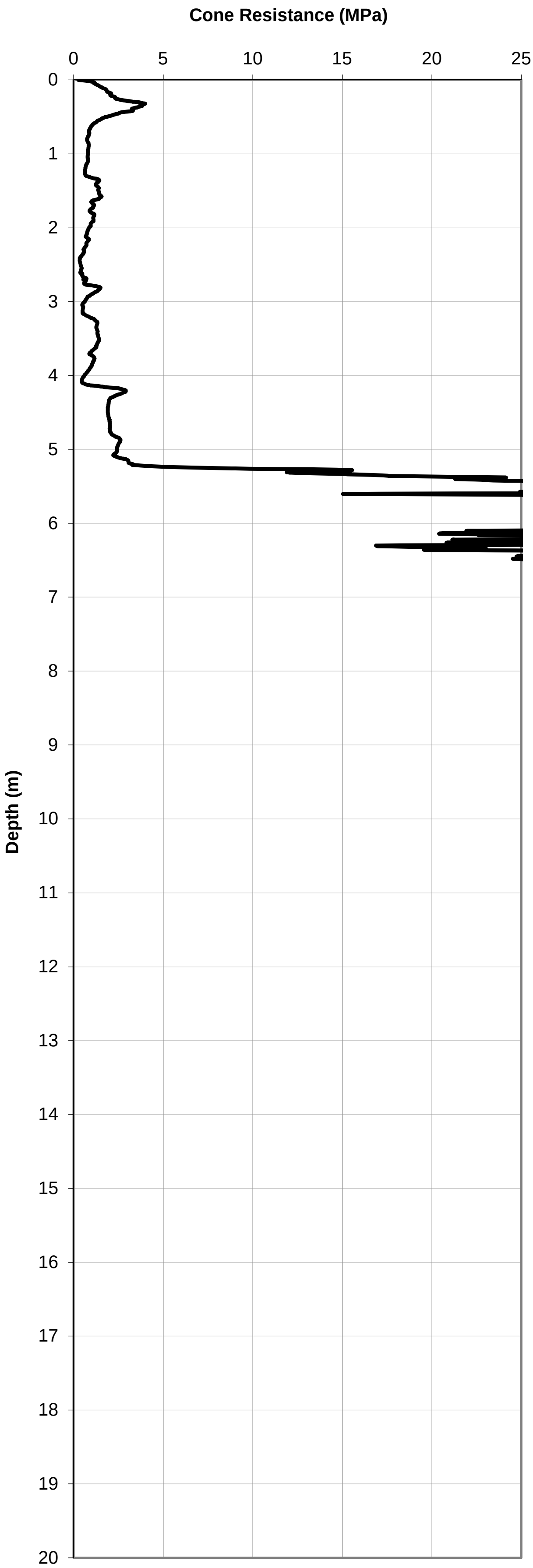
The first method was a batch analysis using cross correlation technique, which involved mathematically cross correlating the full waveforms at consecutive depth intervals to calculate the time shift and hence the interval shear wave velocity. The left and right data files were compared separately to give two independent velocity estimates. Erroneous results are removed from the data set.

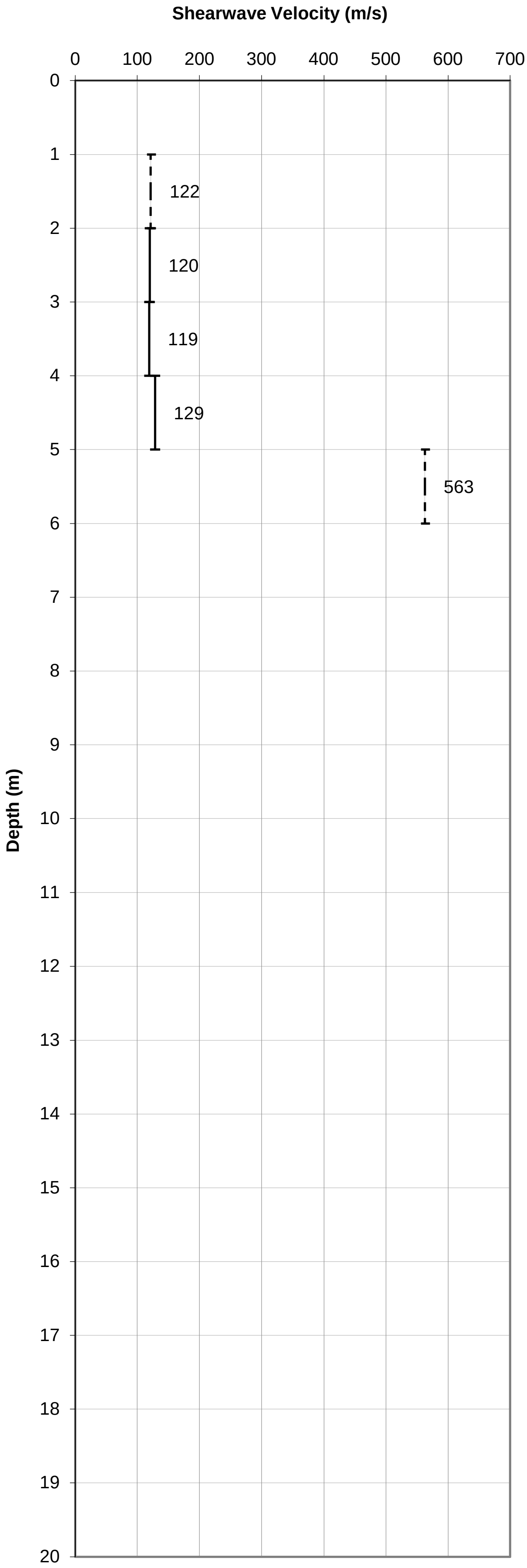
The second method was a single point technique which involved manually identifying the first arrival of the shear wave from the graph of waveform with depth in order to calculate the shear wave velocity.

The interval velocities presented are the average of the velocities calculated from these two methods and are our best estimates of the shear wave velocity. Some of the interval velocities were estimated with less confidence than others, and are shown with a dashed line, as opposed to a solid line. Reasons for this can include:

- Recorded waves, especially near the surface being significantly affected by noise and P waves and we were unable to obtain a clear shear wave response,
- Adjacent waves had a poor correlation thus the time shift could not be found with sufficient accuracy,
- Reflections causing multiple overlaying waves that could not be easily filtered,
- Soil variability between test depths affecting the wave response, for example silts interbedded in sands,
- There were too few depth interval test results to be confident of identifying the S wave.

The shear wave velocity results for SCPT01, SCPT01A, SCPT02, SCPT03, SCPT04, SCPT04A, SCPT05, SCPT05A, and SCPT06 at the Opawa Bridge site are included.





Seismic CPT Test Results

Project: **Opawa Bridge SH1**

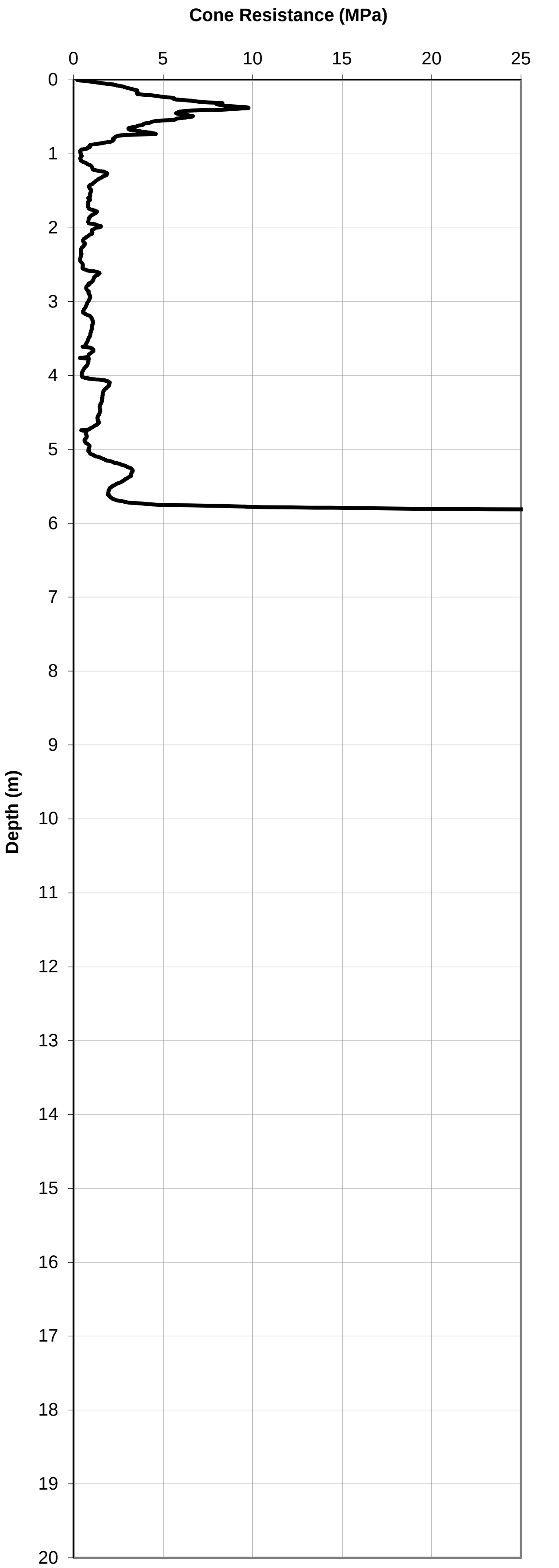
Location: Blenheim

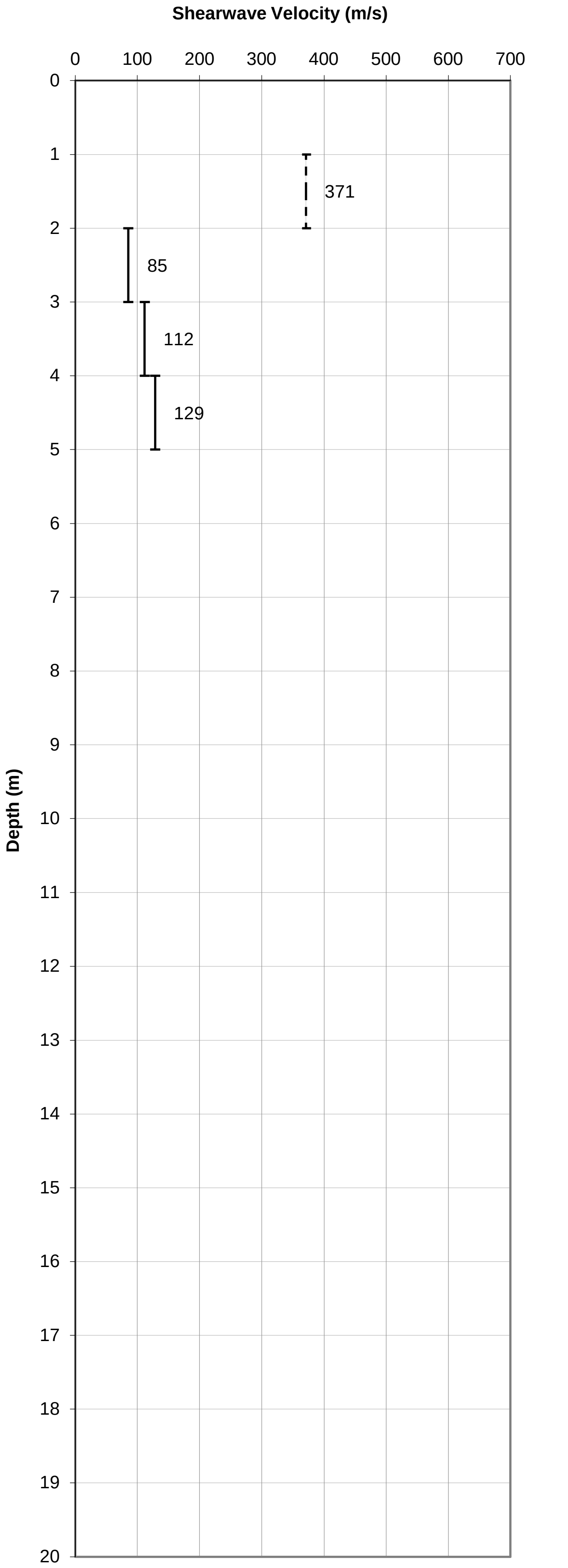
Project no: **5-MB982.03**

Date: 7/07/2015

Cone no: C14267

CPT no: **1**

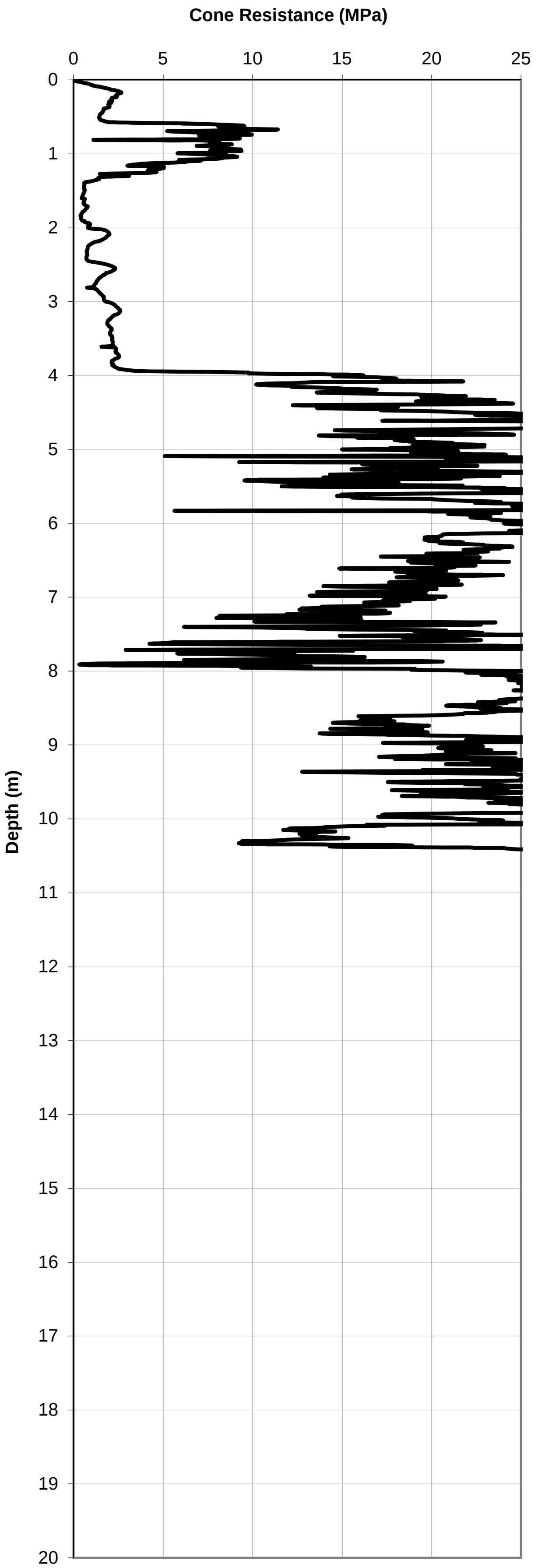


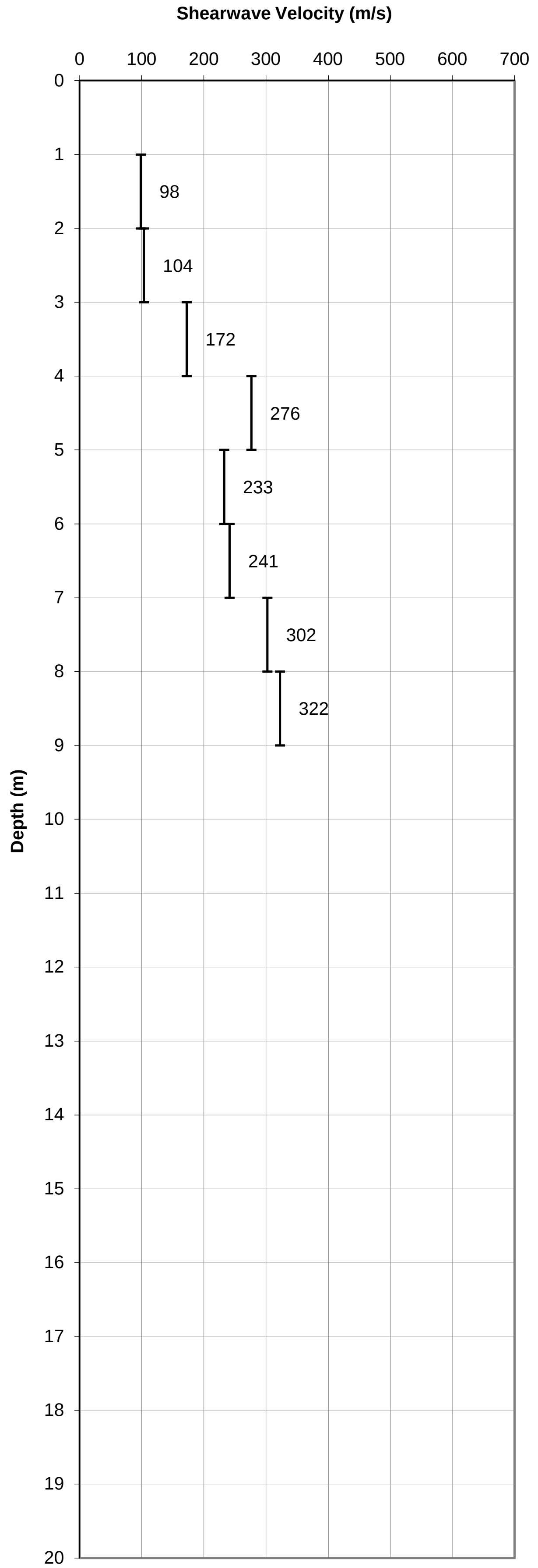


OPUS

Seismic CPT Test Results

Project:	**Opawa Bridge SH1**		
Location:	Blenheim	Date:	7/07/2015
		Cone no:	C14267
Project no:	**5-MB982.03**	CPT no:	**1A**

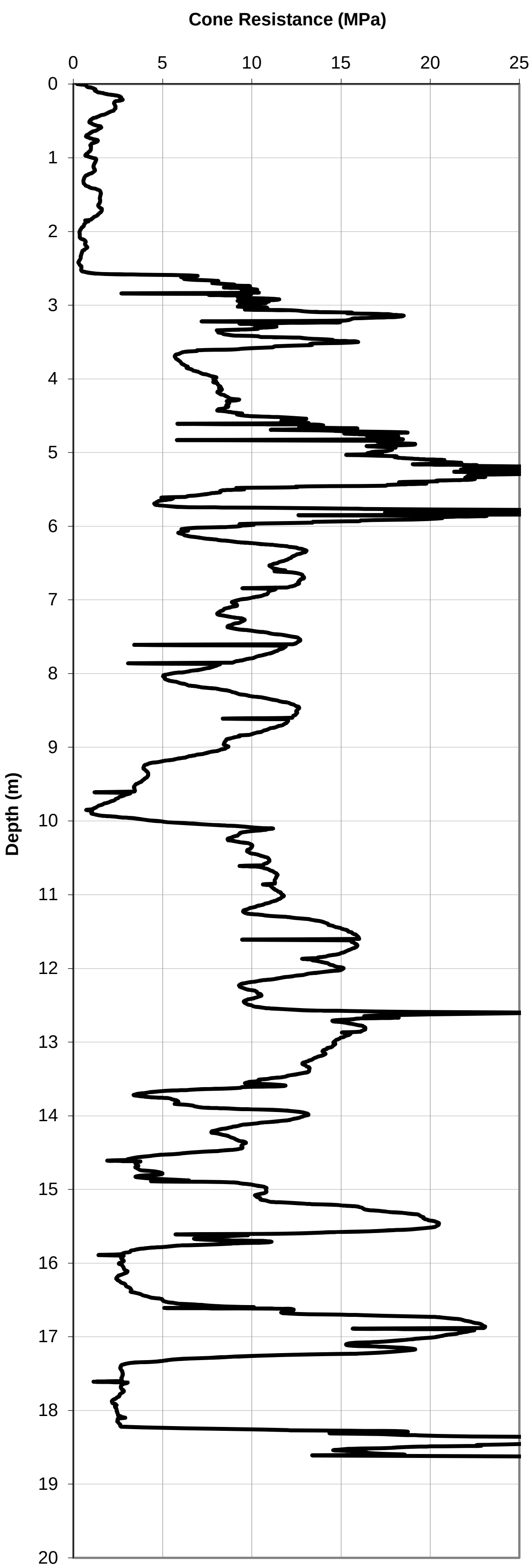


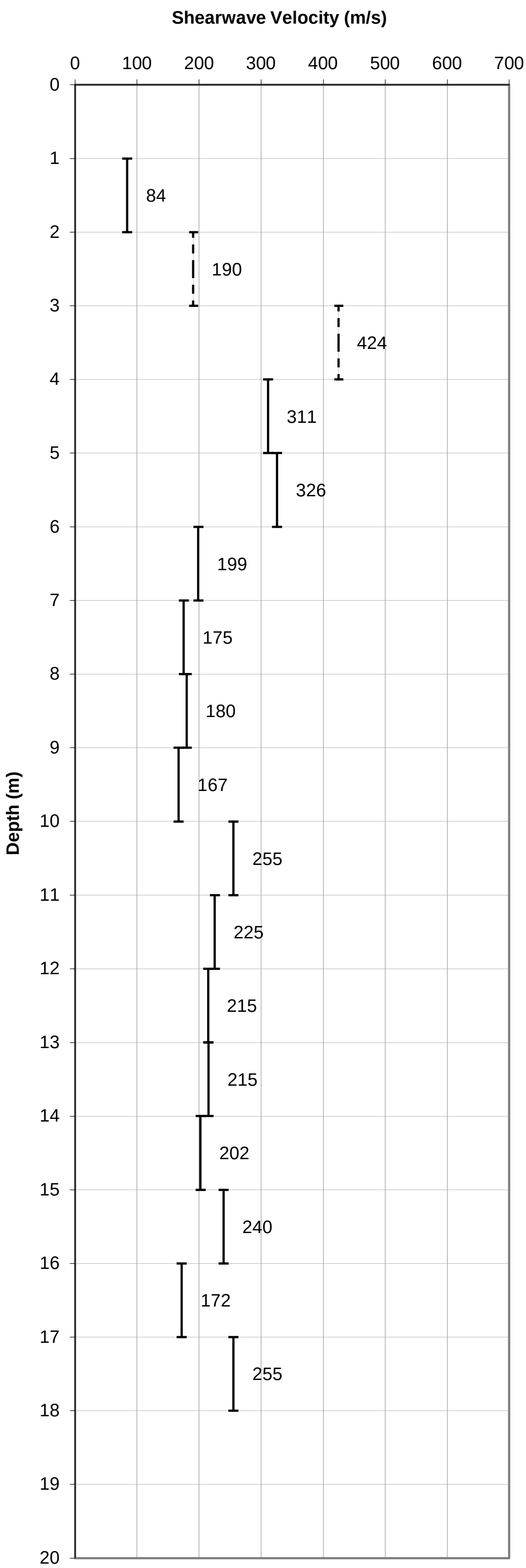


Seismic CPT Test Results

OPUS

Project:	**Opawa Bridge SH1**		
Location:	Blenheim	Date:	7/07/2015
		Cone no:	C14267
Project no:	**5-MB982.03**	CPT no:	**2**





OPUS

Seismic CPT Test Results

Project: **Opawa Bridge SH1**

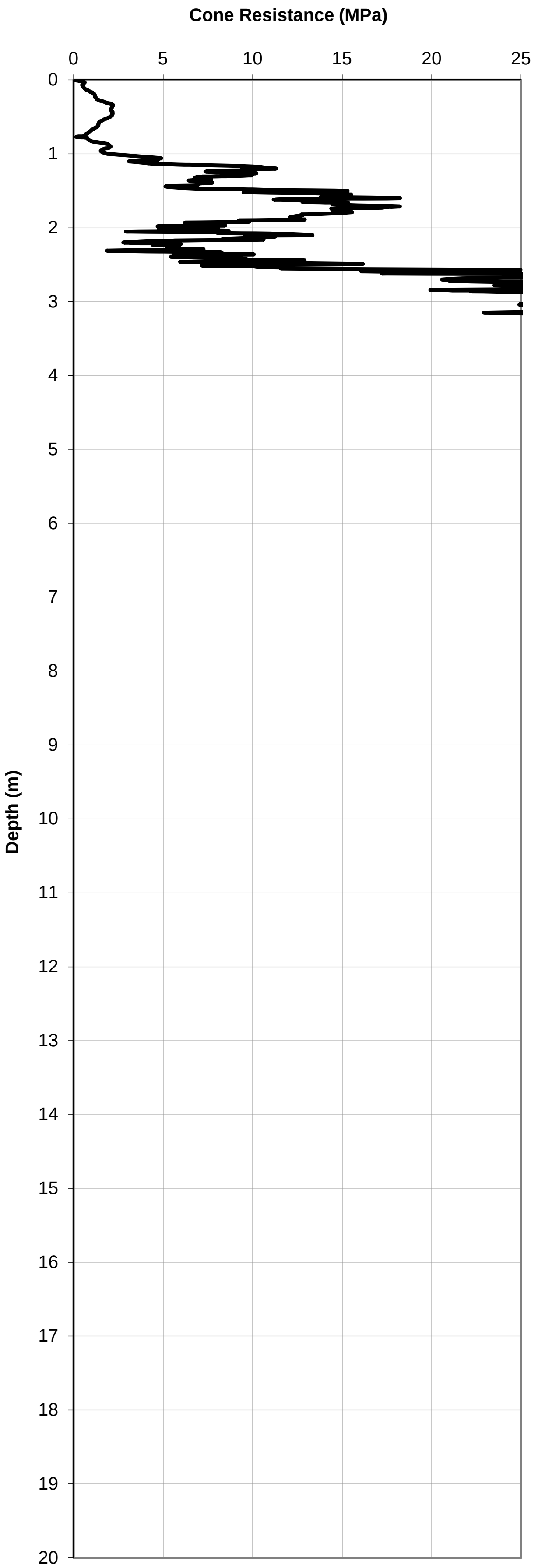
Location: Blenheim

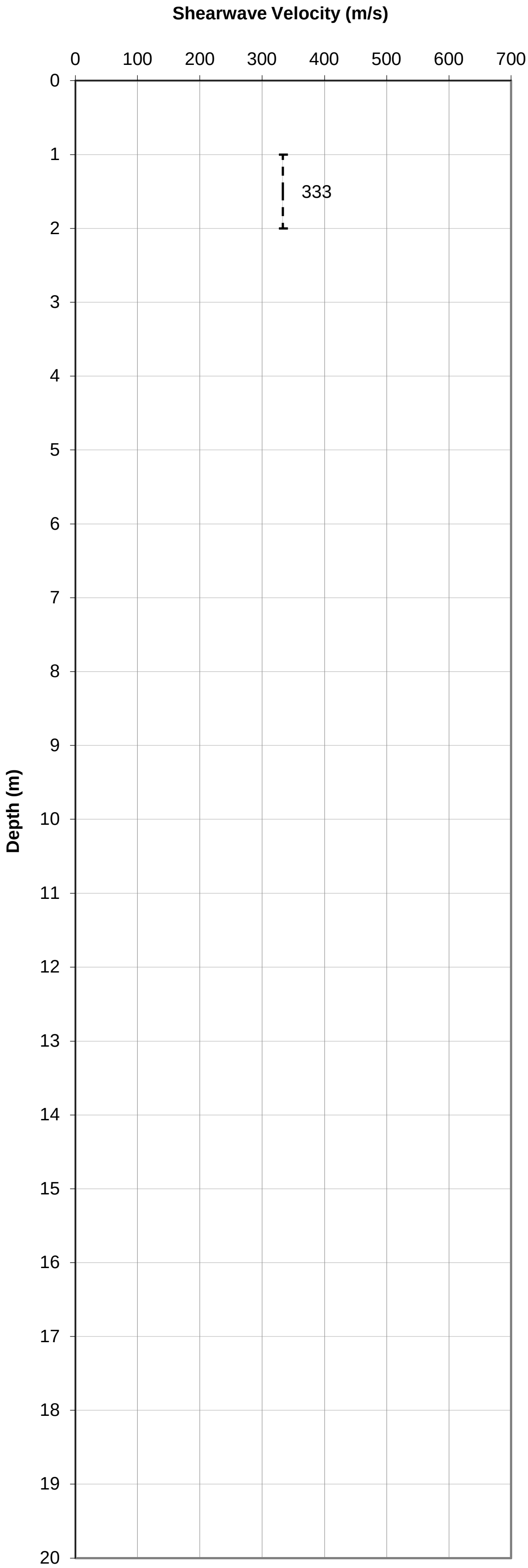
Date: 7/07/2015

Cone no: C14267

Project no: **5-MB982.03**

CPT no: **3**





OPUS

Seismic CPT Test Results

Project: **Opawa Bridge SH1**

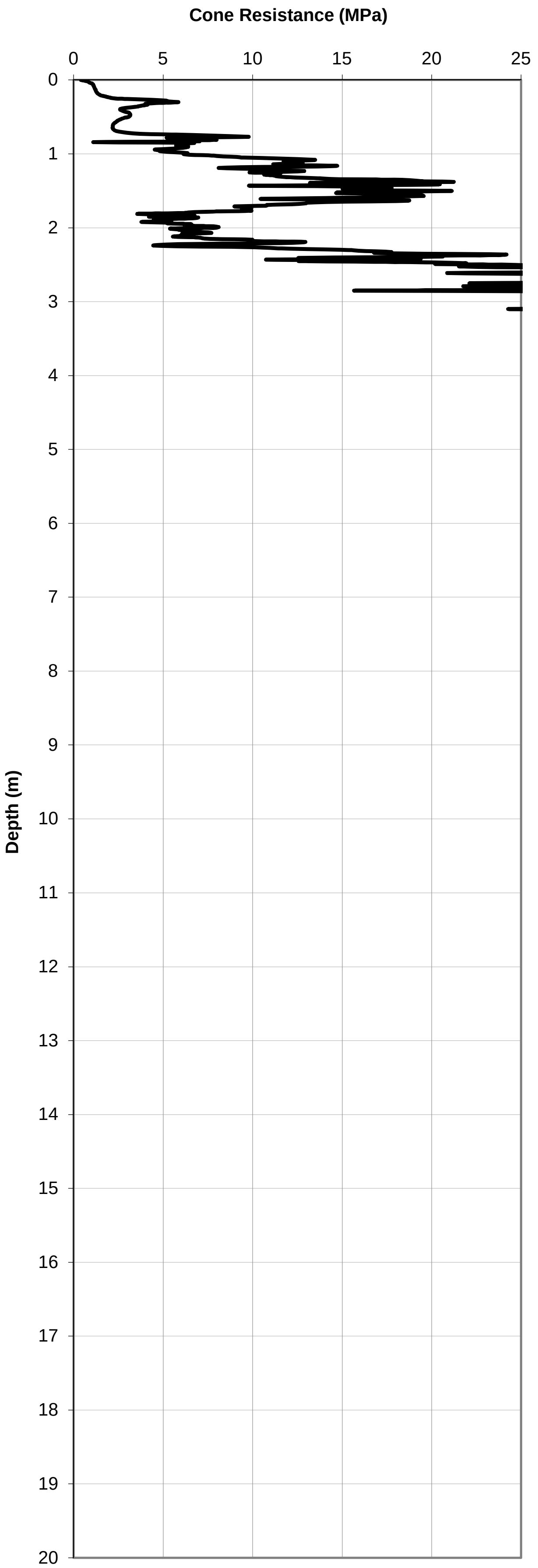
Location: Blenheim

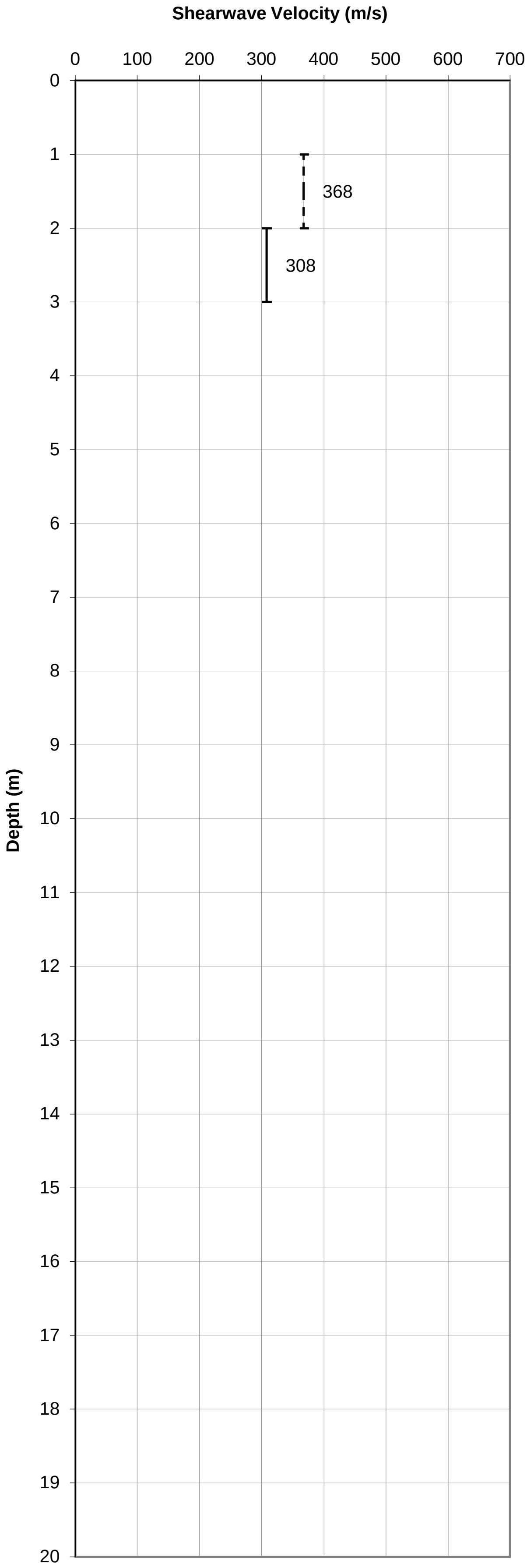
Date: 7/07/2015

Cone no: C14267

Project no: **5-MB982.03**

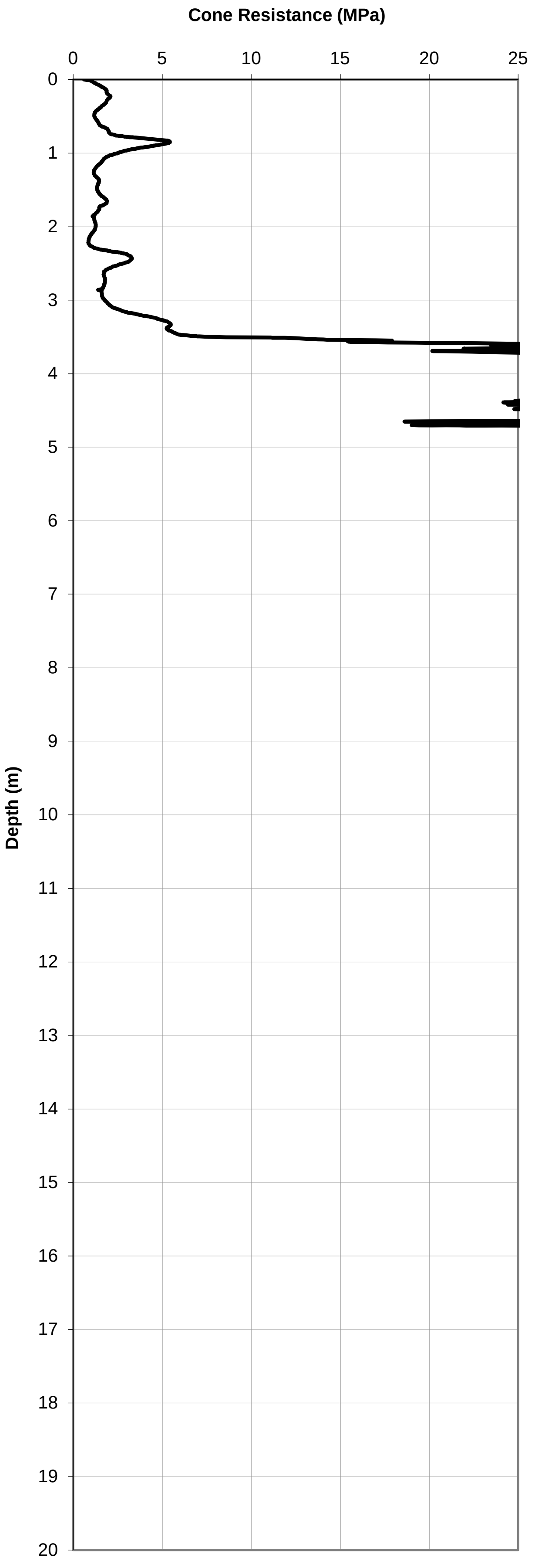
CPT no: **4**

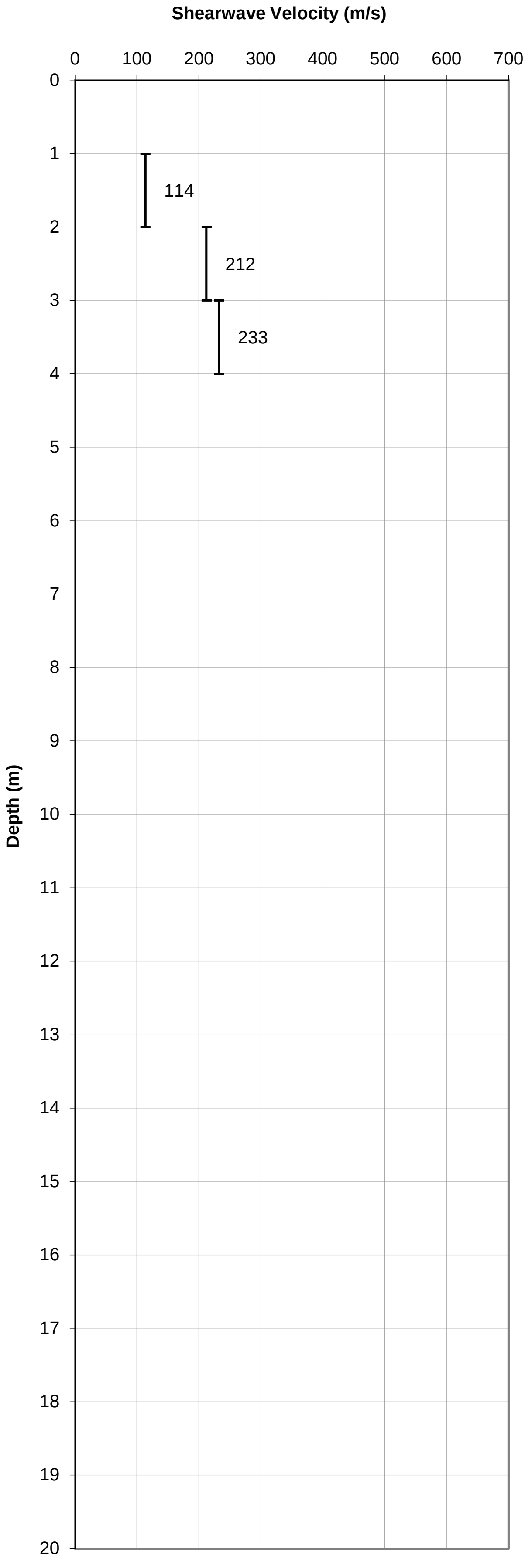




Seismic CPT Test Results

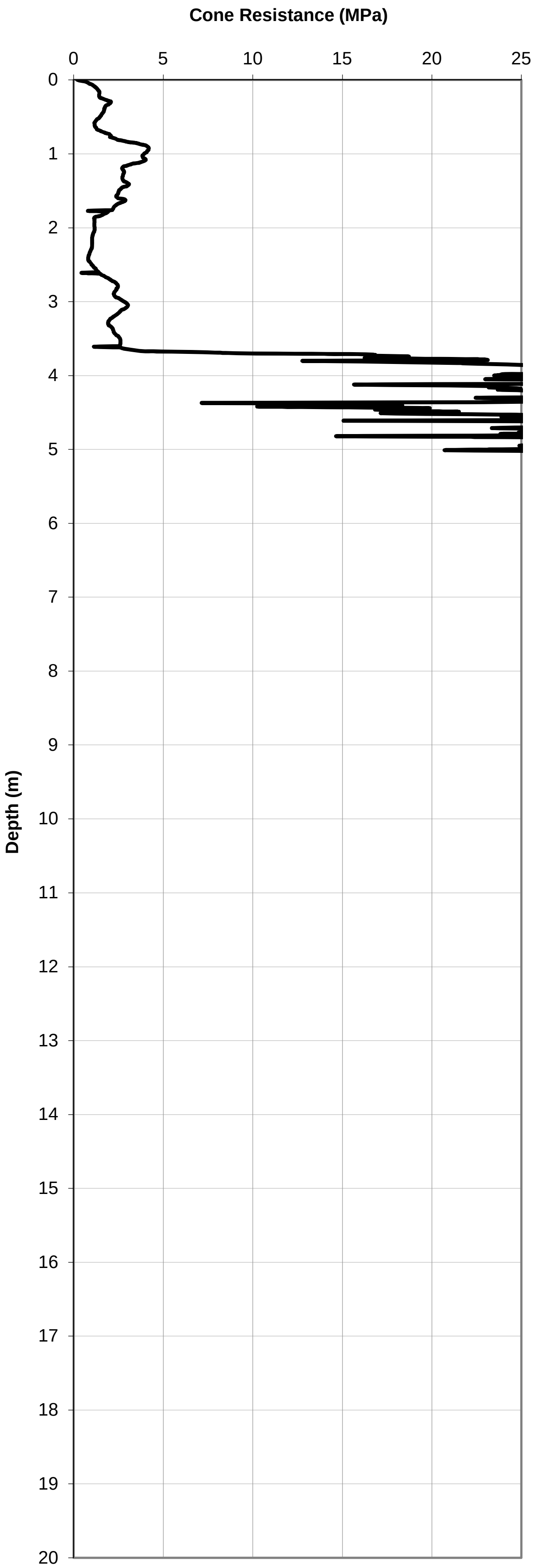
Project:	**Opawa Bridge SH1**		
Location:	Blenheim	Date:	7/07/2015
		Cone no:	C14267
Project no:	**5-MB982.03**	CPT no:	**4A**

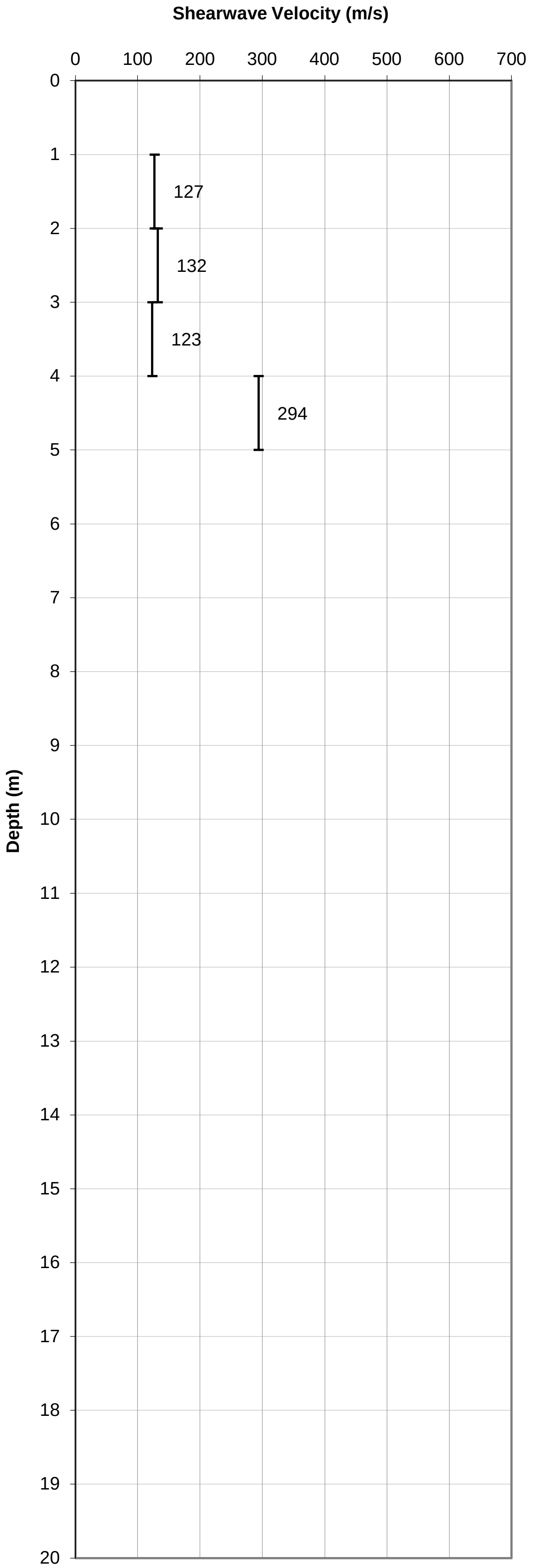




Seismic CPT Test Results

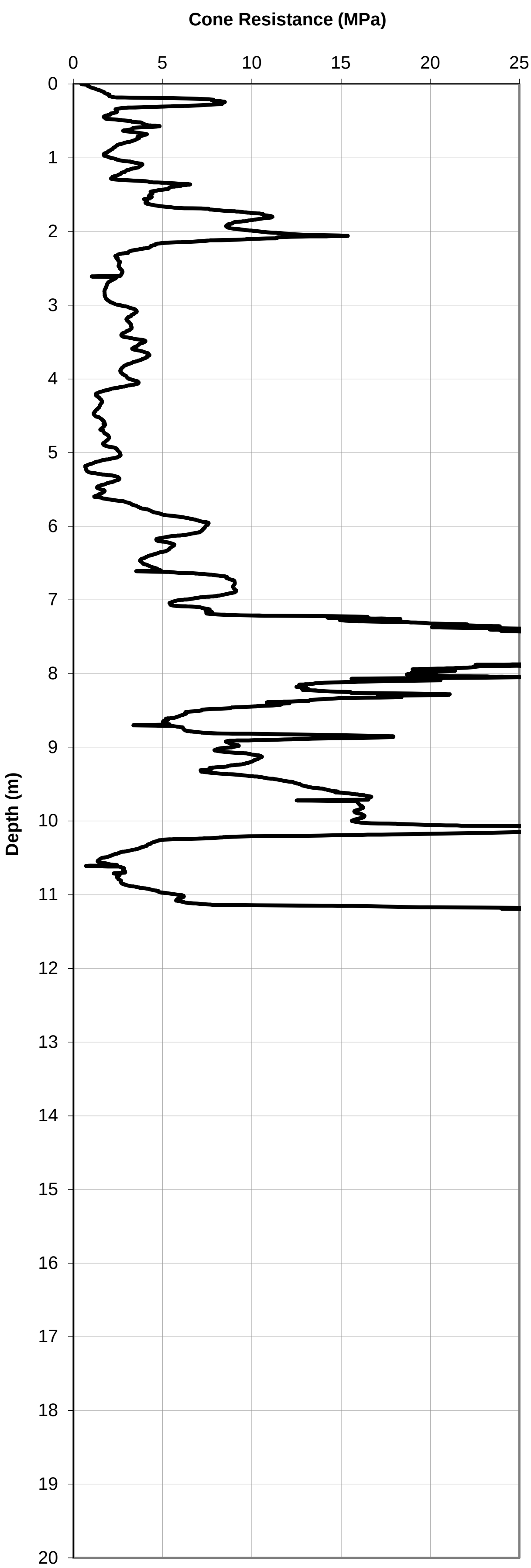
Project:	**Opawa Bridge SH1**		
Location:	Blenheim	Date:	7/07/2015
		Cone no:	C14267
Project no:	**5-MB982.03**	CPT no:	**5**

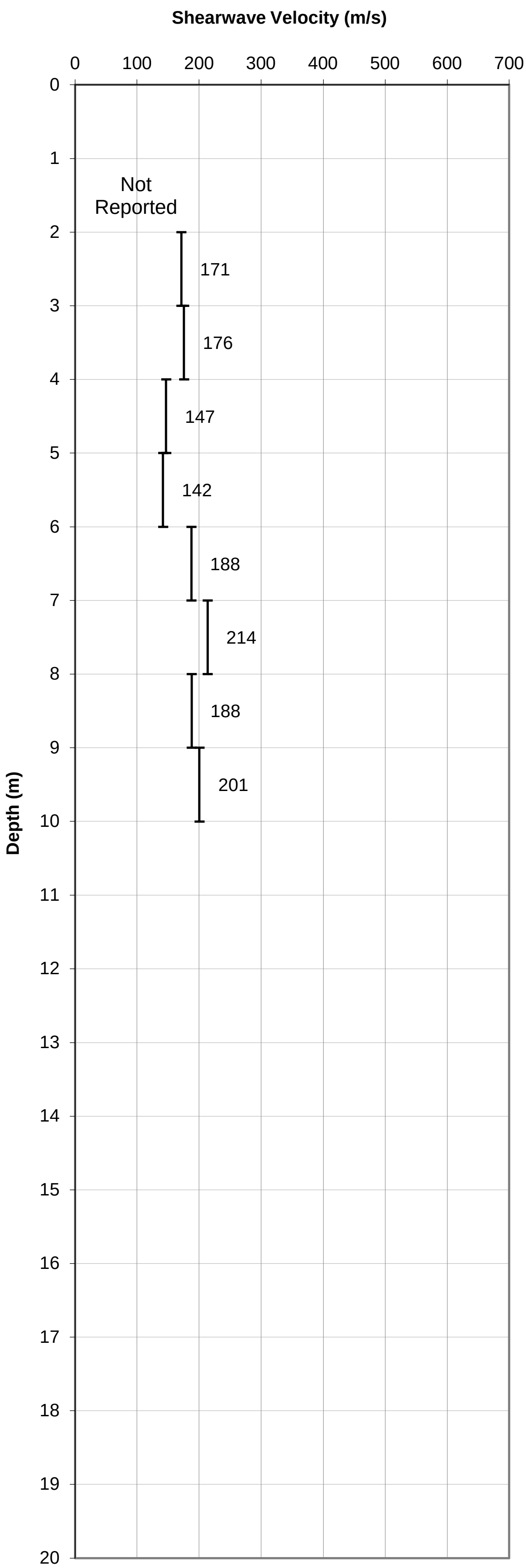




Seismic CPT Test Results

Project:	**Opawa Bridge SH1**		
Location:	Blenheim	Date:	7/07/2015
		Cone no:	C14267
Project no:	**5-MB982.03**	CPT no:	**5A**





Seismic CPT Test Results

Project:	**Opawa Bridge SH1**		
Location:	Blenheim	Date:	7/07/2015
		Cone no:	C14267
Project no:	**5-MB982.03**	CPT no:	**6**

Appendix D

Laboratory Test Results

PARTICLE SIZE ANALYSIS
TEST REPORT

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.06.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH1 3.5-4.0m**
Sample description:	**Silty SAND with minor clay**
Sample condition:	**As received**
Solid density (fines)	**2.65** t/m^3 **Assumed**
Water content as rec'd	**37.8** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/158**
Client ref:	

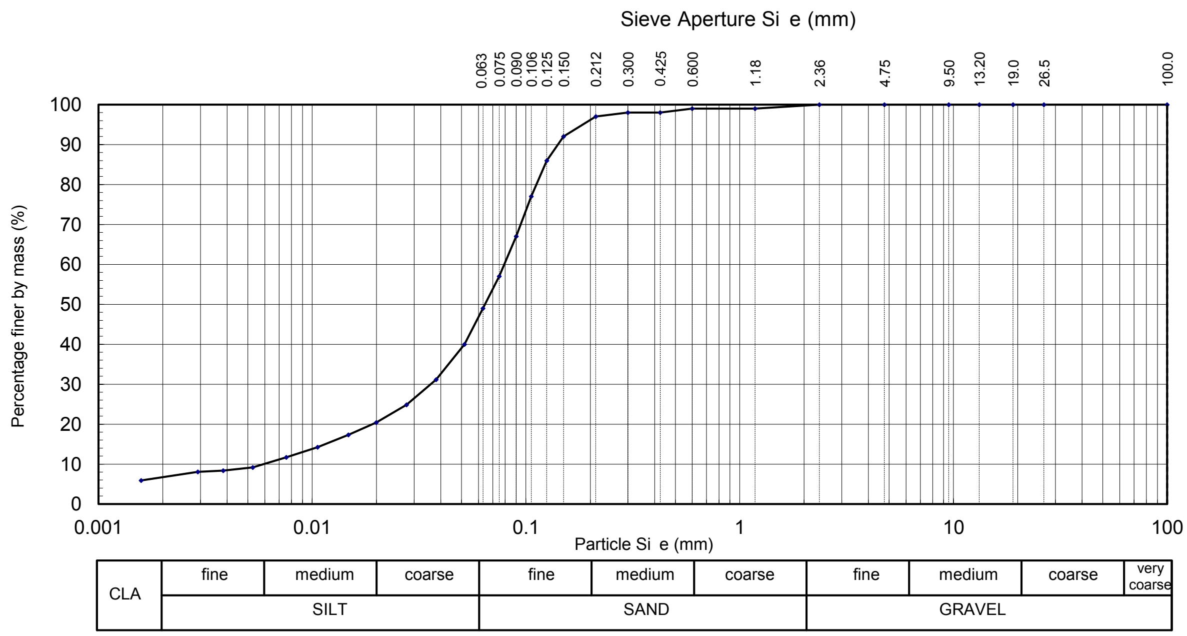
Sieve Analysis

Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)
100.0	**100**	2.36	**100**	0.150	**92**
26.5	**100**	1.18	**99**	0.125	**86**
19.0	**100**	0.600	**99**	0.106	**77**
13.20	**100**	0.425	**98**	0.090	**67**
9.50	**100**	0.300	**98**	0.075	**57**
4.75	**100**	0.212	**97**	0.063	**49**

Percent passing the finest sieve is obtained by difference

Hydrometer Analysis

Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
0.0515	**40**	0.0076	**12**
0.0380	**31**	0.0053	**9**
0.0277	**25**	0.0038	**8**
0.0199	**20**	0.0029	**8**
0.0148	**17**	0.0016	**6**
0.0106	**14**		



Test Methods	**Notes**
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried
Particle Size Analysis: NZS 4402 1986 Test 2.8.4 (Hydrometer)	Uncalibrated sieve sizes 0.090, 0.106, 0.125,0.180 & 0.212mm

Date Tested: 16-29.07.15
Date Reported: 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

IANZ ACCREDITED LABORATORY All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

PLASTICITY INDEX FOR SOILS
TEST REPORT

OPUS

Project :	**New Opawa Bridge**
Location :	**Grove Road, SH1, Blenheim**
Client :	**NZTA**
Contractor :	**DCN Drilling**
Sampled by :	**DCN Drilling**
Date sampled :	**23-26.06.15**
Sampling method :	**Sonic drilling**
Sample condition :	**As received**

Report No:	**522900/1128**
Sample No:	**see table**
Client Ref:	

Test Results

Sample no:	**2-15/158**	-	-	-	-	-
Sample source:	**BH1 3.5-4m**	-	-	-	-	-
Sample description	**Silty SAND with minor clay**	-	-	-	-	-
Liquid Limit (LL):	-	-	-	-	-	-
Cone Pen. Limit (CPL):	**33 ± 1**	-	-	-	-	-
Plastic Limit (PL):	**NP**	-	-	-	-	-
Plasticity Index (PI):	**NP**	-	-	-	-	-
Natural Water Content (%) : Whole soil	**37.8**	-	-	-	-	-
Fraction tested	-0.425mm	-	-	-	-	-
Number of LL or CPL points	8	-	-	-	-	-

Test Methods		**Notes**
Liquid Limit	N S 4402 : 1986, Test 2.2	Alternative 0.01g accuracy balance used. N S 4402:1986 requires the reporting of a range of values.
Plastic Limit	N S 4402 : 1986, Test 2.3	
Plasticity Index	N S 4402 : 1986, Test 2.4	History: Air dried Liquefaction potential
Cone Penetration Limit	N S 4402 : 1986, Test 2.5	Early determinations sho rapid drop in CPL, therefore only single measurements could be taken at 6 7 moisture contents

Date tested : 29-31.07.15
Date reported : 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001

33 The Esplanade, Petone 5012
PO Box 30 845, Lower Hutt 5040
New Zealand

Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

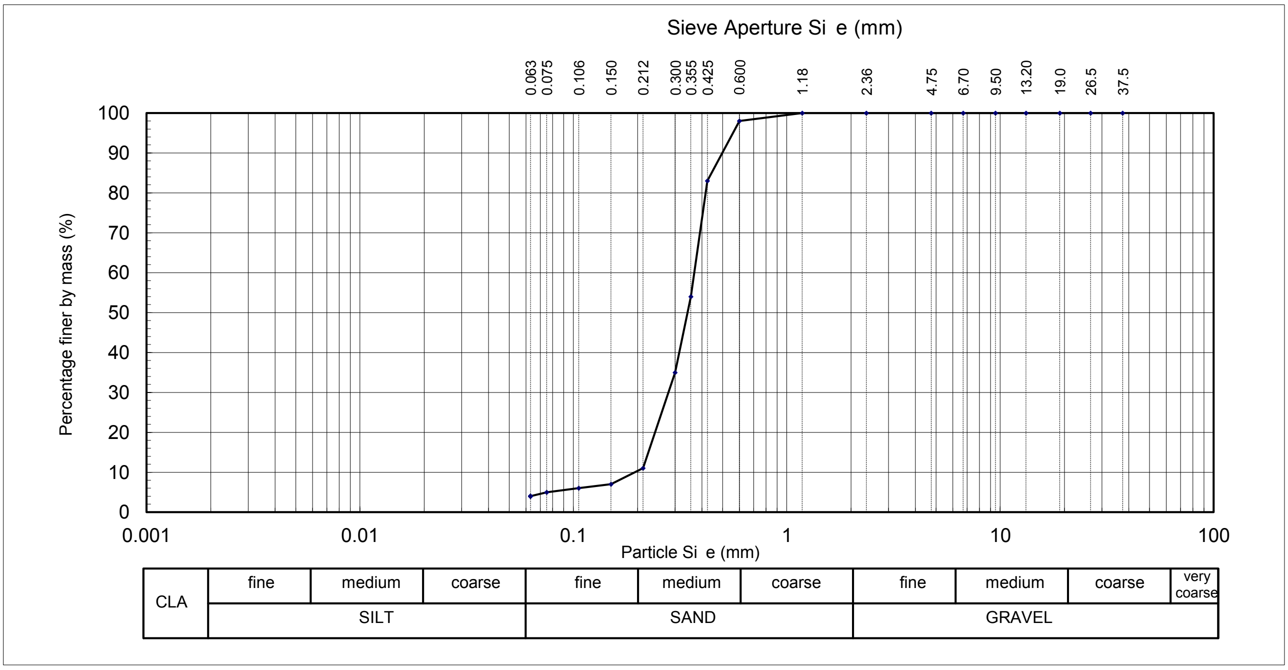
PARTICLE SIZE ANALYSIS
TEST REPORT

OPUS

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.6.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH1 4.5-5.0m**
Sample description:	**SAND with minor clay-silt**
Sample condition:	**As received**
Solid density (fines)	**N/a** t m^3
Water content as rec d	**25.4** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/159**
Client ref:	

Sieve Analysis						**Hydrometer Analysis**			
Sieve Si e (mm)	Passing (%)	Sieve Si e (mm)	Passing (%)	Sieve Si e (mm)	Passing (%)	Particle Si e (mm)	Passing (%)	Particle Si e (mm)	Passing (%)
37.5	**100**	4.75	**100**	0.300	**35**				
26.5	**100**	2.36	**100**	0.212	**11**				
19.0	**100**	1.18	**100**	0.150	**7**				
13.20	**100**	0.600	**98**	0.106	**6**				
9.50	**100**	0.425	**83**	0.075	**5**				
6.70	**100**	0.355	**54**	0.063	**4**				



Test Methods	**Notes**
Particle Si e Analysis: N S 4402 1986 Test 2.8.1 (Wet Sieve)	History: Oven dried
Particle Si e Analysis: N S 4402 1986 Test 2.8.4 (Hydrometer)	ncalibrated sieve si es 0.355, 0.212, 0.106mm

Date Tested: 16.7.15
Date Reported: 23.7.15

Testing only is covered by IANZ Accreditation
This report may only be reproduced in full

IANZ Approved Signatory
Designatior *Technical Officer (MJ Mclachlan)*
Date : 23.7.15

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

PF-LAB-100 (30 05 2013)

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

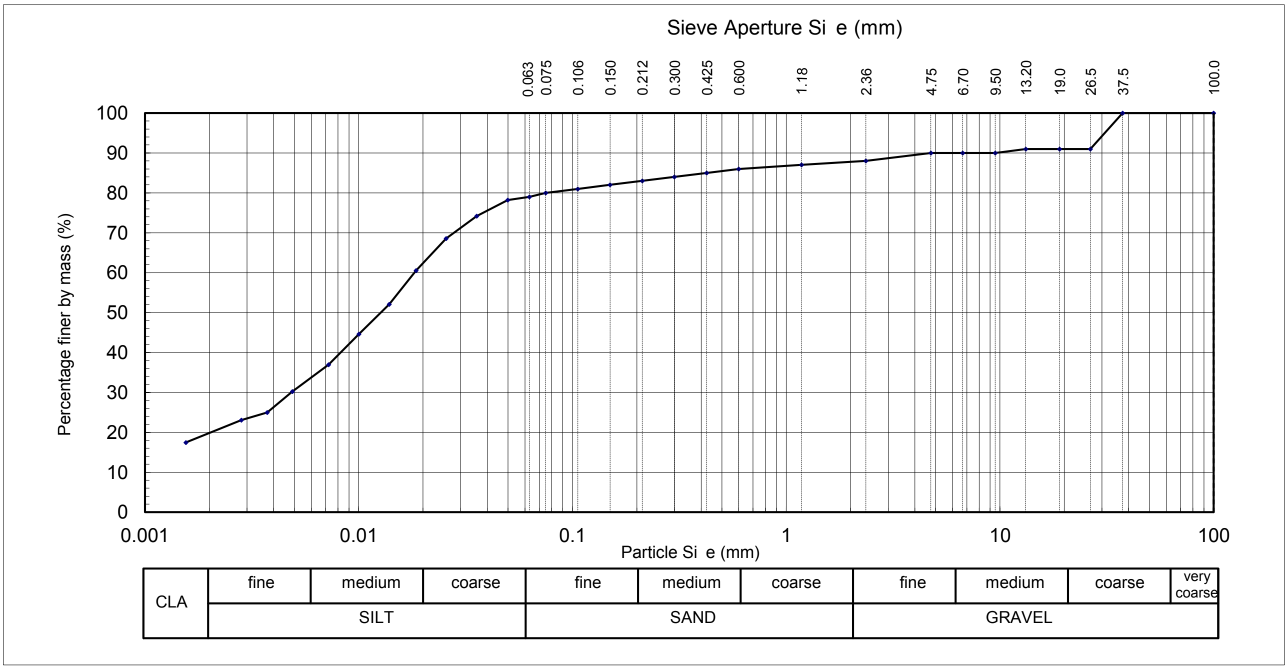
PARTICLE SIZE ANALYSIS
TEST REPORT

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.06.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH1 10-10.45**
Sample description:	**Clayey SILT with minor sand/gravel, contains organics**
Sample condition:	**As received**
Solid density (fines)	**2.65** t/m^3 **Assumed**
Water content as rec'd	**42.6** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/160**
Client ref:	

Sieve Analysis						Hydrometer Analysis			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
100.0	**100**	6.70	**90**	0.300	**84**	0.0498	**78**	0.0072	**37**
37.5	**100**	4.75	**90**	0.212	**83**	0.0357	**74**	0.0049	**30**
26.5	**91**	2.36	**88**	0.150	**82**	0.0257	**69**	0.0037	**25**
19.0	**91**	1.18	**87**	0.106	**81**	0.0186	**61**	0.0028	**23**
13.20	**91**	0.600	**86**	0.075	**80**	0.0139	**52**	0.0016	**17**
9.50	**90**	0.425	**85**	0.063	**79**	0.0100	**45**		

Percent passing the finest sieve is obtained by difference



Test Methods	Notes
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried
Particle Size Analysis: NZS 4402 1986 Test 2.8.4 (Hydrometer)	Uncalibrated sieve sizes 0.106 & 0.212mm

Date Tested: 16-29.07.15
Date Reported: 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

IANZ ACCREDITED LABORATORY — All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

PLASTICITY INDEX FOR SOILS
TEST REPORT

Project :	**New Opawa Bridge**
Location :	**Grove Road, SH1, Blenheim**
Client :	**NZTA**
Contractor :	**DCN Drilling**
Sampled by :	**DCN Drilling**
Date sampled :	**23-26.06.15**
Sampling method :	**SPT**
Sample condition :	**As received**

Report No:	**522900/1128**
Sample No:	**see table**
Client Ref:	

Test Results

Sample no:	**2-15/160**	-	-	-	-	-
Sample source:	**BH1 10-10.45m**	-	-	-	-	-
Sample description	**Clayey SILT with minor sand/gravel, contains organics**	-	-	-	-	-
Liquid Limit (LL):	**50 ± 1**	-	-	-	-	-
Cone Pen. Limit (CPL):	-	-	-	-	-	-
Plastic Limit (PL):	**28 ± 1**	-	-	-	-	-
Plasticity Index (PI):	**22 ± 2**	-	-	-	-	-
Natural Water Content (%) : Whole soil	**42.6**	-	-	-	-	-
Fraction tested	-0.425mm	-	-	-	-	-
Number of LL or CPL points	5	-	-	-	-	-

Test Methods		**Notes**
Liquid Limit	N S 4402 : 1986, Test 2.2	Alternative 0.01g accuracy balance used. N S 4402:1986 requires the reporting of a range of values.
Plastic Limit	N S 4402 : 1986, Test 2.3	History: Air dried
Plasticity Index	N S 4402 : 1986, Test 2.4	
Cone Penetration Limit	N S 4402 : 1986, Test 2.5	

Date tested : 29-31.07.15
Date reported : 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 31.07.15

IANZ ACCREDITED LABORATORY — All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone 5012
PO Box 30 845, Lower Hutt 5040
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

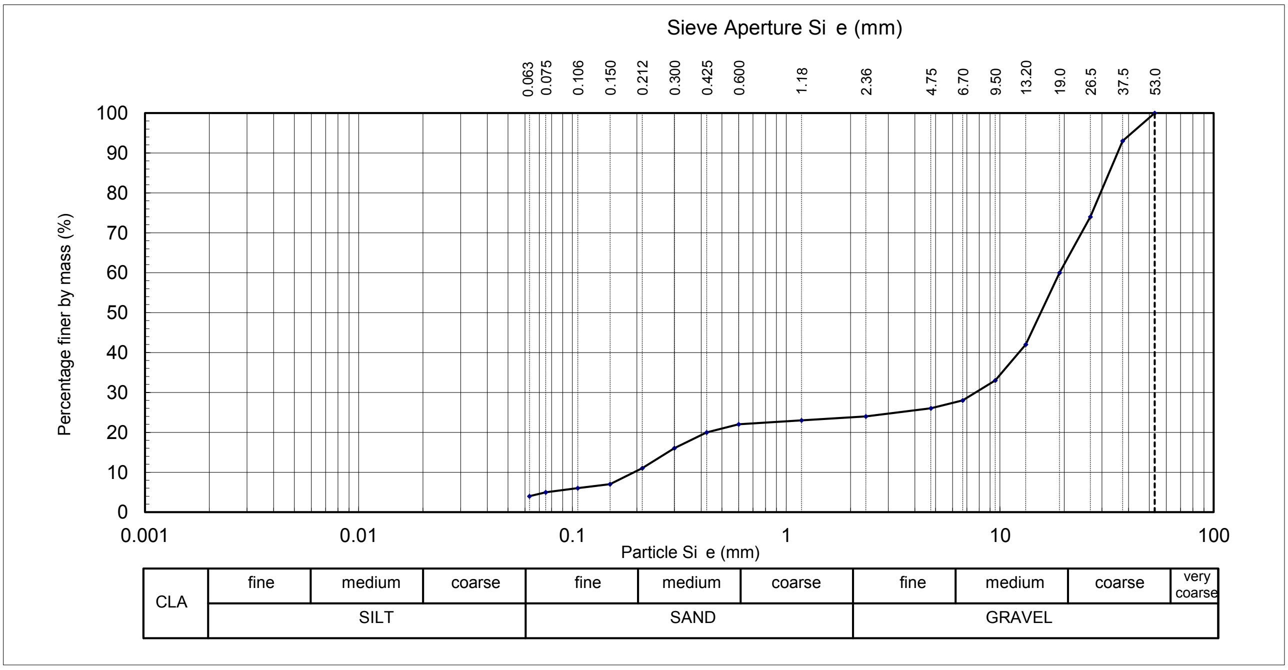
PARTICLE SIZE ANALYSIS
TEST REPORT

OPUS

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.6.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH1 12.45-13m**
Sample description:	**Sandy GRAVEL**
Sample condition:	**As received**
Solid density (fines)	**na** t/m^3 **Assumed**
Water content as rec'd	**5.6** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/161**
Client ref:	

Sieve Analysis						Hydrometer Analysis(not performed)			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
53.0	**100**	6.70	**28**	0.300	**16**				
37.5	**93**	4.75	**26**	0.212	**11**				
26.5	**74**	2.36	**24**	0.150	**7**				
19.0	**60**	1.18	**23**	0.106	**6**				
13.20	**42**	0.600	**22**	0.075	**5**				
9.50	**33**	0.425	**20**	0.063	**4**				
Percent passing the finest sieve is obtained by difference									



Test Methods	**Notes**
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried Uncalibrated sieve sizes 0.106 & 0.212mm

Date Tested: 16-29.07.15
Date Reported: 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

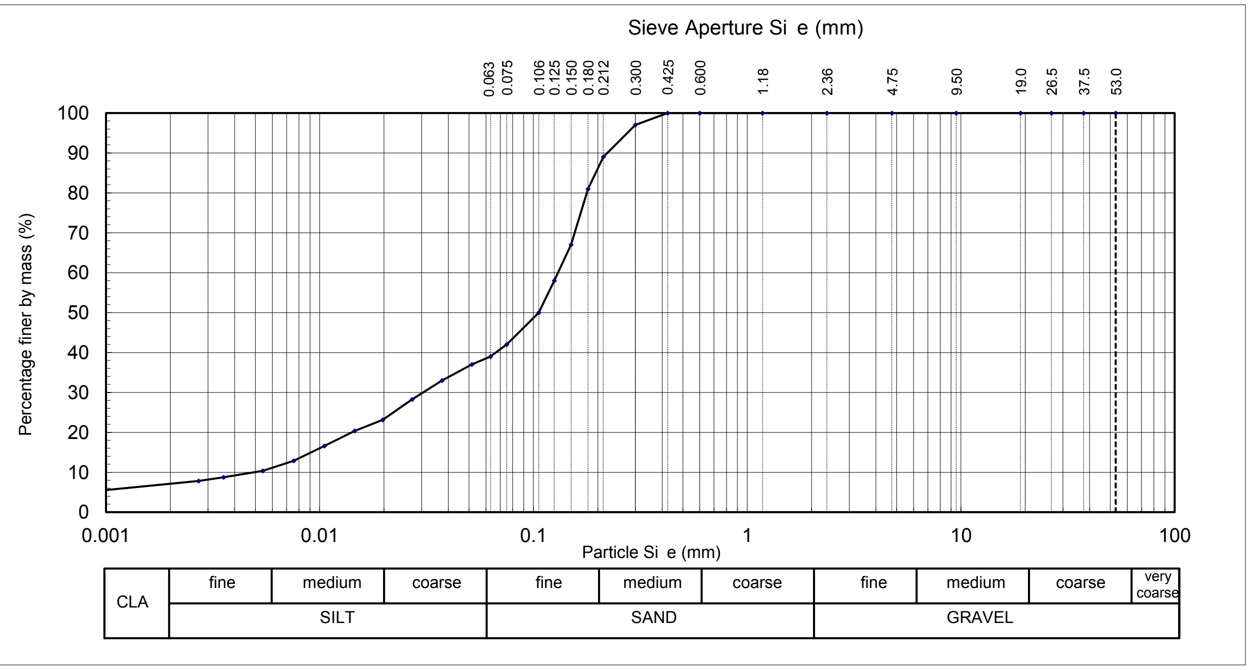
PARTICLE SIZE ANALYSIS
TEST REPORT

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.6.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH1 15.5-16m**
Sample description:	**Silty SAND: trace clay**
Sample condition:	**As received**
Solid density (fines)	**na** t/m^3 **Assumed**
Water content as rec'd	**5.2** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/162**
Client ref:	

Sieve Analysis						Hydrometer Analysis			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
53.0	**100**	2.36	**100**	0.180	**81**	0.0516	**37**	0.0076	**13**
37.5	**100**	1.18	**100**	0.150	**67**	0.0374	**33**	0.0054	**10**
26.5	**100**	0.600	**100**	0.125	**58**	0.0271	**28**	0.0035	**9**
19.0	**100**	0.425	**100**	0.106	**50**	0.0197	**23**	0.0027	**8**
9.50	**100**	0.300	**97**	0.075	**42**	0.0146	**20**	0.0009	**5**
4.75	**100**	0.212	**89**	0.063	**39**	0.0105	**17**		

Percent passing the finest sieve is obtained by difference



Test Methods	Notes
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried
Particle Size Analysis: NZS 4402 1986 Test 2.8.4 (Hydrometer)	Uncalibrated sieve sizes 0.106 ,0.125, 0.180 & 0.212mm

Date Tested: 16-29.07.15
Date Reported: 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

IANZ ACCREDITED LABORATORY — All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

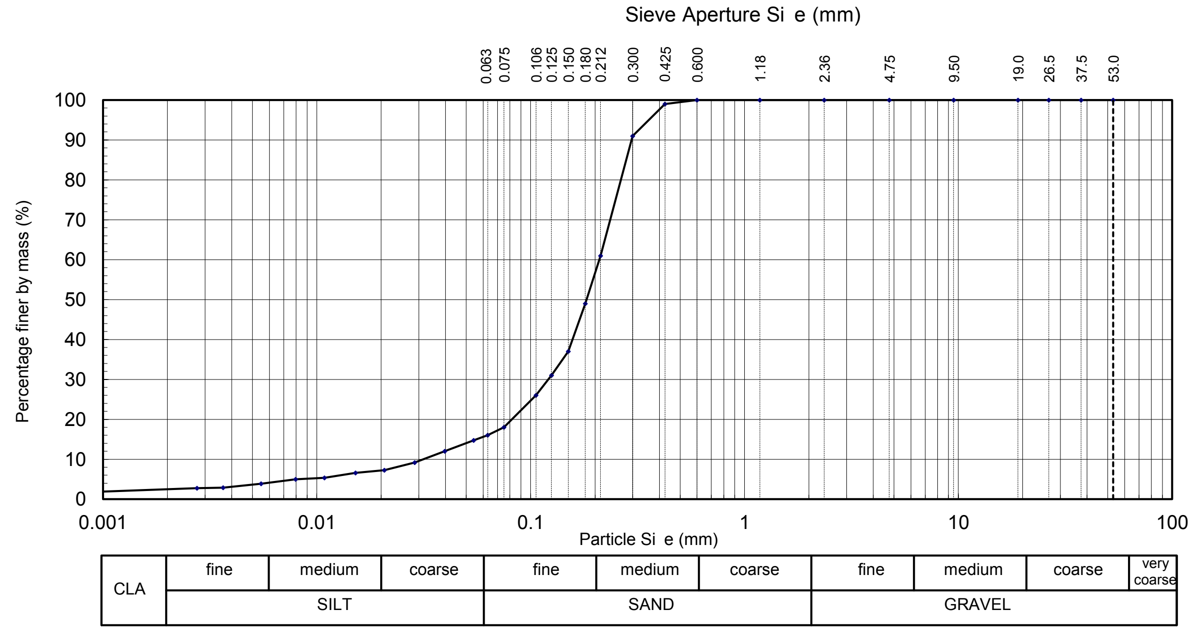
PARTICLE SIZE ANALYSIS
TEST REPORT

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.6.15**
Sampling method:	**SPT sample**
Sample source:	**BH2 3-3.45m**
Sample description:	**SAND:f-m some silt and trace clay**
Sample condition:	**As received**
Solid density (fines)	**2.65** t/m^3 **Assumed**
Water content as rec'd	**25.3** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/163**
Client ref:	

Sieve Analysis						Hydrometer Analysis			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
53.0	**100**	2.36	**100**	0.180	**49**	0.0541	**15**	0.0080	**5**
37.5	**100**	1.18	**100**	0.150	**37**	0.0396	**12**	0.0055	**4**
26.5	**100**	0.600	**100**	0.125	**31**	0.0287	**9**	0.0036	**3**
19.0	**100**	0.425	**99**	0.106	**26**	0.0207	**7**	0.0027	**3**
9.50	**100**	0.300	**91**	0.075	**18**	0.0152	**7**	0.0009	**2**
4.75	**100**	0.212	**61**	0.063	**16**	0.0108	**5**		

Percent passing the finest sieve is obtained by difference



Test Methods	Notes
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried
Particle Size Analysis: NZS 4402 1986 Test 2.8.4 (Hydrometer)	Uncalibrated sieve sizes 0.106 ,0.125, 0.180 & 0.212mm

Date Tested: 16-29.07.15
Date Reported: 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

PARTICLE SIZE ANALYSIS
TEST REPORT

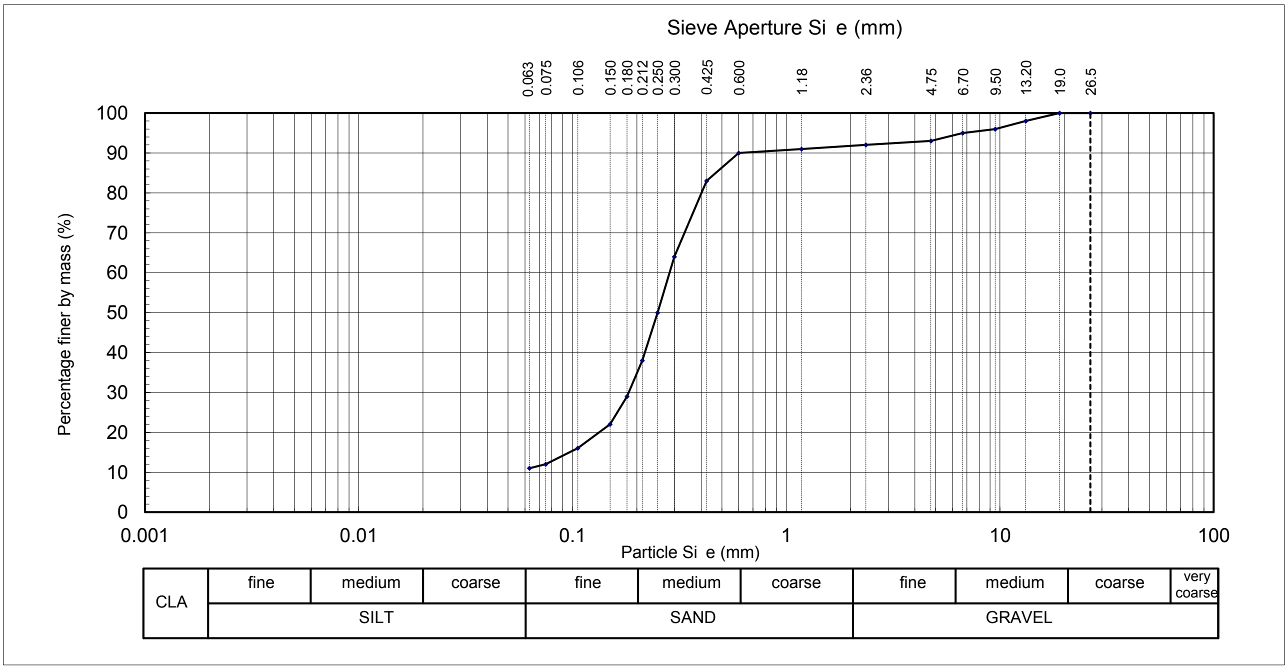
Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.6.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH2 8.5-9.0m**
Sample description:	**SAND:f-m some silt and gravel**
Sample condition:	**As received**

Report No:	**522900/1128**
Sample No:	**2-15/164**
Client ref:	

Solid density (fines)	**na**	t/m^3	**Assumed**
Water content as rec'd	**27.1**	%	**whole**

Sieve Analysis						Hydrometer Analysis(not performed)			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
26.5	**100**	2.36	**92**	0.212	**38**				
19.0	**100**	1.18	**91**	0.180	**29**				
13.2	**98**	0.600	**90**	0.150	**22**				
9.5	**96**	0.425	**83**	0.106	**16**				
6.70	**95**	0.300	**64**	0.075	**12**				
4.75	**93**	0.250	**50**	0.063	**11**				

Percent passing the finest sieve is obtained by difference



Test Methods	**Notes**
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried Uncalibrated sieve sizes 0.106, 0.180, 0.212 & 0.250mm

Date Tested: 20-27.07.15
Date Reported: 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

IANZ ACCREDITED LABORATORY — All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

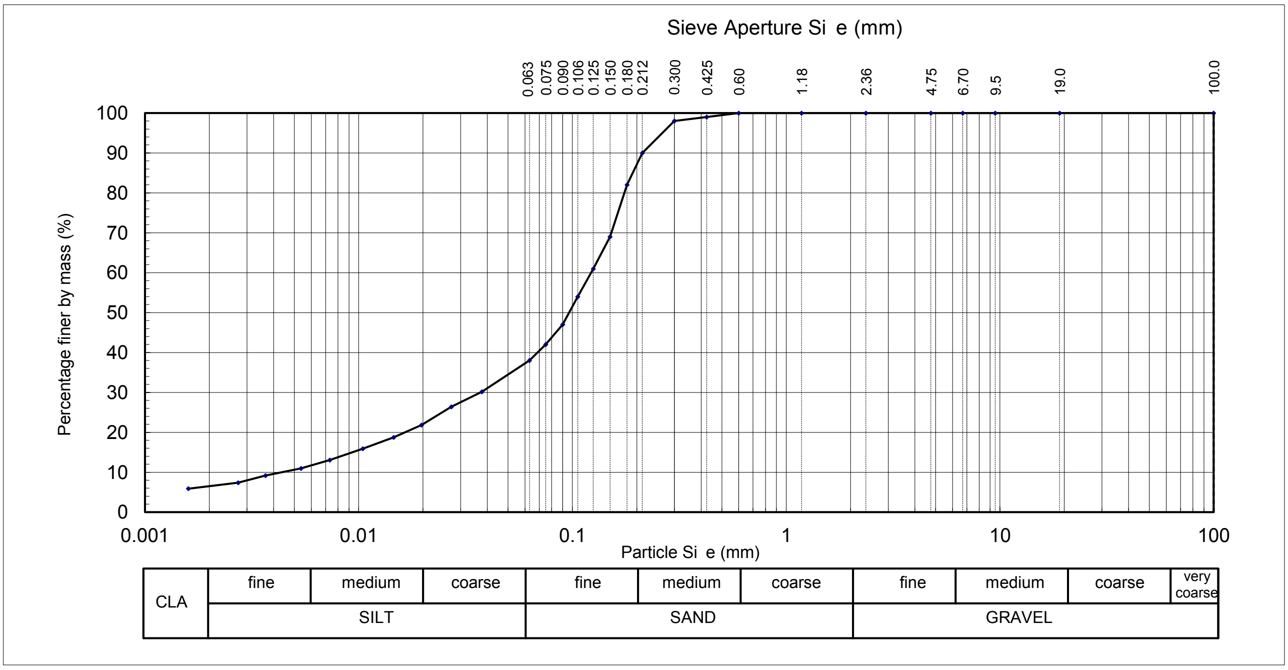
PARTICLE SIZE ANALYSIS
TEST REPORT

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.06.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH2 11.7-11.9m**
Sample description:	**Silty SAND:f-m with minor clay**
Sample condition:	**As received**
Solid density (fines)	**2.65** t/m^3 **Assumed**
Water content as rec'd	**22.7** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/165**
Client ref:	

Sieve Analysis						Hydrometer Analysis			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
100.0	**100**	1.18	**100**	0.150	**69**	0.0377	**30**	0.0054	**11**
19.0	**100**	0.600	**100**	0.125	**61**	0.0271	**26**	0.0037	**9**
9.50	**100**	0.425	**99**	0.106	**54**	0.0197	**22**	0.0027	**7**
6.70	**100**	0.300	**98**	0.090	**47**	0.0146	**19**	0.0016	**6**
4.75	**100**	0.212	**90**	0.075	**42**	0.0105	**16**		
2.36	**100**	0.180	**82**	0.063	**38**	0.0073	**13**		

Percent passing the finest sieve is obtained by difference



Test Methods	**Notes**
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried
Particle Size Analysis: NZS 4402 1986 Test 2.8.4 (Hydrometer)	Uncalibrated sieve sizes 0.090, 0.106, 0.125,0.180 & 0.212mm

Date Tested: 22-31.07.15
Date Reported: 7.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 7.08.15

IANZ ACCREDITED LABORATORY — All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

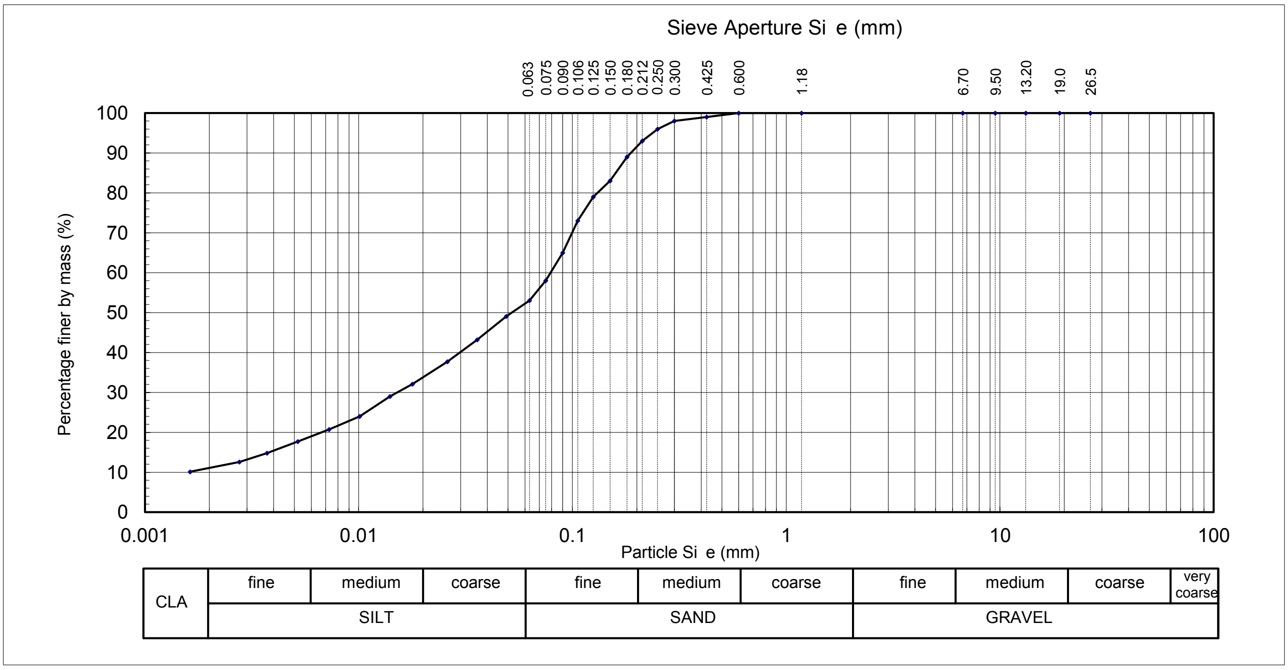
Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

PARTICLE SIZE ANALYSIS
TEST REPORT

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.6.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH2 18.5-19.0m**
Sample description:	**SAND:f-m some silt and gravel, contain shell and organics**
Sample condition:	**As received**
Solid density (fines)	**2.65** t/m^3 **Assumed**
Water content as rec'd	**24.4** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/166**
Client ref:	

Sieve Analysis						Hydrometer Analysis			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
26.5	**100**	0.600	**100**	0.150	**83**	0.0491	**49**	0.0073	**21**
19.0	**100**	0.425	**99**	0.125	**79**	0.0358	**43**	0.0052	**18**
13.20	**100**	0.300	**98**	0.106	**73**	0.0260	**38**	0.0037	**15**
9.50	**100**	0.250	**96**	0.090	**65**	0.0178	**32**	0.0028	**13**
6.70	**100**	0.212	**93**	0.075	**58**	0.0140	**29**	0.0016	**10**
1.18	**100**	0.180	**89**	0.063	**53**	0.0101	**24**		
Percent passing the finest sieve is obtained by difference									



Test Methods	Notes
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried
Particle Size Analysis: NZS 4402 1986 Test 2.8.4 (Hydrometer)	Uncalibrated sieve sizes 0.090, 0.106, 0.125, 0.180, 0.212 & 0.250mm

Date Tested: 22-29.07.15
Date Reported: 7.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 7.08.15

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

PLASTICITY INDEX FOR SOILS
TEST REPORT

OPUS

Project :	**New Opawa Bridge**
Location :	**Grove Road, SH1, Blenheim**
Client :	**NZTA**
Contractor :	**DCN Drilling**
Sampled by :	**DCN Drilling**
Date sampled :	**23-26.06.15**
Sampling method :	**Sonic drilling**
Sample condition :	**As received**

Report No:	**522900/1128**
Sample No:	**see table**
Client Ref:	

Test Results

Sample no:	**2-15/166**	-	-	-	-	-
Sample source:	**BH2 18.5-19m**	-	-	-	-	-
Sample description	**SAND:f-m some silt and gravel, contain shell and organics**	-	-	-	-	-
Liquid Limit (LL):	-	-	-	-	-	-
Cone Pen. Limit (CPL):	**27 ± 1**	-	-	-	-	-
Plastic Limit (PL):	**20 ± 1**	-	-	-	-	-
Plasticity Index (PI):	**7 ± 2**	-	-	-	-	-
Natural Water Content (%) : Whole soil	**24.4**	-	-	-	-	-
Fraction tested	-0.425mm	-	-	-	-	-
Number of LL or CPL points	7	-	-	-	-	-

Test Methods		**Notes**
Liquid Limit	N S 4402 : 1986, Test 2.2	Alternative 0.01g accuracy balance used. N S 4402:1986 requires the reporting of a range of values.
Plastic Limit	N S 4402 : 1986, Test 2.3	History: Air dried
Plasticity Index	N S 4402 : 1986, Test 2.4	Early determinations sho rapid drop in CPL, therefore only single measurements could be taken at 5 7 moisture contents
Cone Penetration Limit	N S 4402 : 1986, Test 2.5	

Date tested : 29-31.07.15
Date reported : 3.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 3.08.15

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001

33 The Esplanade, Petone 5012
PO Box 30 845, Lower Hutt 5040
New Zealand

Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

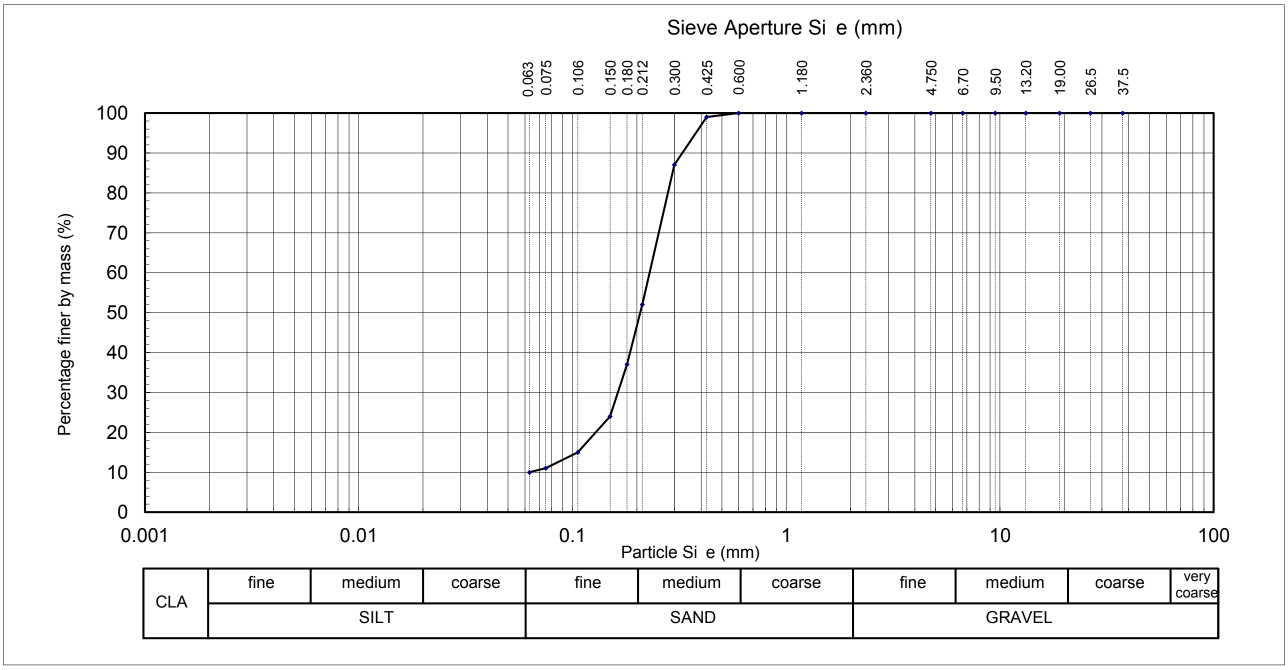
PARTICLE SIZE ANALYSIS
TEST REPORT

Project:	**New Opawa Bridge**
Location:	**Grove Road, SH1, Blenheim**
Client:	**NZTA**
Contractor:	**DCN Drilling**
Sampled by:	**DCN Drilling**
Date sampled:	**23-26.6.15**
Sampling method:	**Sonic drilling**
Sample source:	**BH2 19.5-19.9m**
Sample description:	**SAND:f-m some silt**
Sample condition:	**As received**
Solid density (fines)	**n/a** t/m^3 **Assumed**
Water content as rec'd	**24.1** % **whole**

Report No:	**522900/1128**
Sample No:	**2-15/167**
Client ref:	

Sieve Analysis						Hydrometer Analysis (not performed)			
Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Sieve Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)	Particle Size (mm)	Passing (%)
37.5	**100**	4.75	**100**	0.212	**52**				
26.5	**100**	2.36	**100**	0.180	**37**				
19.0	**100**	1.18	**100**	0.150	**24**				
13.20	**100**	0.600	**100**	0.106	**15**				
9.50	**100**	0.425	**99**	0.075	**11**				
6.70	**100**	0.300	**87**	0.063	**10**				

Percent passing the finest sieve is obtained by difference



Test Methods	**Notes**
Particle Size Analysis: NZS 4402 1986 Test 2.8.1 (Wet Sieve)	History: Air dried Uncalibrated sieve sizes 0.106, 0.180 & 0.212mm

Date Tested: 22-28.07.15
Date Reported: 7.08.15

Testing only is covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.

IANZ Approved Signatory
Designation : *Engineering Technician (DW Pollard)*
Date : 7.08.15

IANZ ACCREDITED LABORATORY — All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Opus International Consultants Limited
Opus Research
Quality Management Systems Certified to ISO 9001
33 The Esplanade, Petone
PO Box 30 845, Lower Hutt
New Zealand
Telephone +64 4 587 0600
Facsimile +64 4 587 0604
Website www.opus.co.nz

Opus International Consultants Ltd
L7, Majestic Centre, 100 Willis St
PO Box 12 003, Wellington 6144
New Zealand

t: +64 4 471 7000
f: +64 4 471 1397
w: www.opus.co.nz

APPENDIX S – GEOTECHNICAL INTERPRETIVE REPORT

OPUS

New Zealand Transport Agency

New Opawa Bridge

Geotechnical Interpretative Report

OPUS

New Zealand Transport Agency

New Opawa Bridge

Geotechnical Interpretative Report

Prepared by

Janet Duxfield
Senior Geotechnical Engineer

Brad Peterson
Graduate Civil Engineer

Opus International Consultants Ltd
Wellington Civil
L7, Majestic Centre, 100 Willis St
PO Box 12 003, Wellington 6144
New Zealand

Reviewed & Approved for Release by

Technical Principal, Geotechnical/Earthquake Engineering & Resilience

Telephone: +64 4 471 7000
Facsimile: +64 4 471 1397

Reference: 5MB982.03

Report No. GER2015-35
Status: Issue 1

Date: August 2015

Contents

Figures

1 Introduction

The Opawa Bridge is a heritage structure, is on a poor geometric alignment, has very narrow lane widths and has been assessed to be vulnerable to flood scour and earthquakes. The New Zealand Transport Agency is considering a new two lane state highway bridge alongside the existing bridge, with the existing bridge providing access for pedestrians and cyclists, see Illustration 1.

Opus International Consultants (Opus) has been engaged by NZTA to develop an Indicative business case and detailed business case for replacement of the Opawa River Bridge. A geotechnical issues paper was prepared for the replacement of the Opawa Bridge by Opus (2015a) in March 2015.

Geotechnical investigations and assessment has been carried out to provide information for development of the bridge preliminary designs, including consideration of the foundation and abutment design options. The geotechnical investigations included the drilling and logging of boreholes, Seismic cone penetration tests and laboratory tests, the results of which are presented in a Geotechnical (Factual) report by Opus (2015b) in August 2015.

This report presents the results of geotechnical assessment including ground conditions and liquefaction assessment and provides recommendations on bridge abutment and foundation design.

Illustration 1: Bridge Location

2 Site Description

The Opawa Bridge is located on Stage Highway 1, Grove Road, at the northern edge of the Blenheim township. The new Opawa Bridge is planned to be located adjacent to the west of the current Opawa bridge location. The bridge location is shown in Illustration 1.

2.1 Geomorphology

The Blenheim area is located on the Wairau Plains, which is an extensive alluvial plain formed by the Wairau River and its southern tributaries. In the Blenheim area the geomorphology of the plains consists of flat to undulating terraces and the floodplains of the Opawa River.

At the Opawa Bridge site, the bridge traverses both the river and lower lying designated flood plain zones on either side, which are bound by stop banks. The stop banks have been constructed along the river to provide flood protection. There is a significant terrace along the northern edge of the river at the bridge location, see Illustration 2.

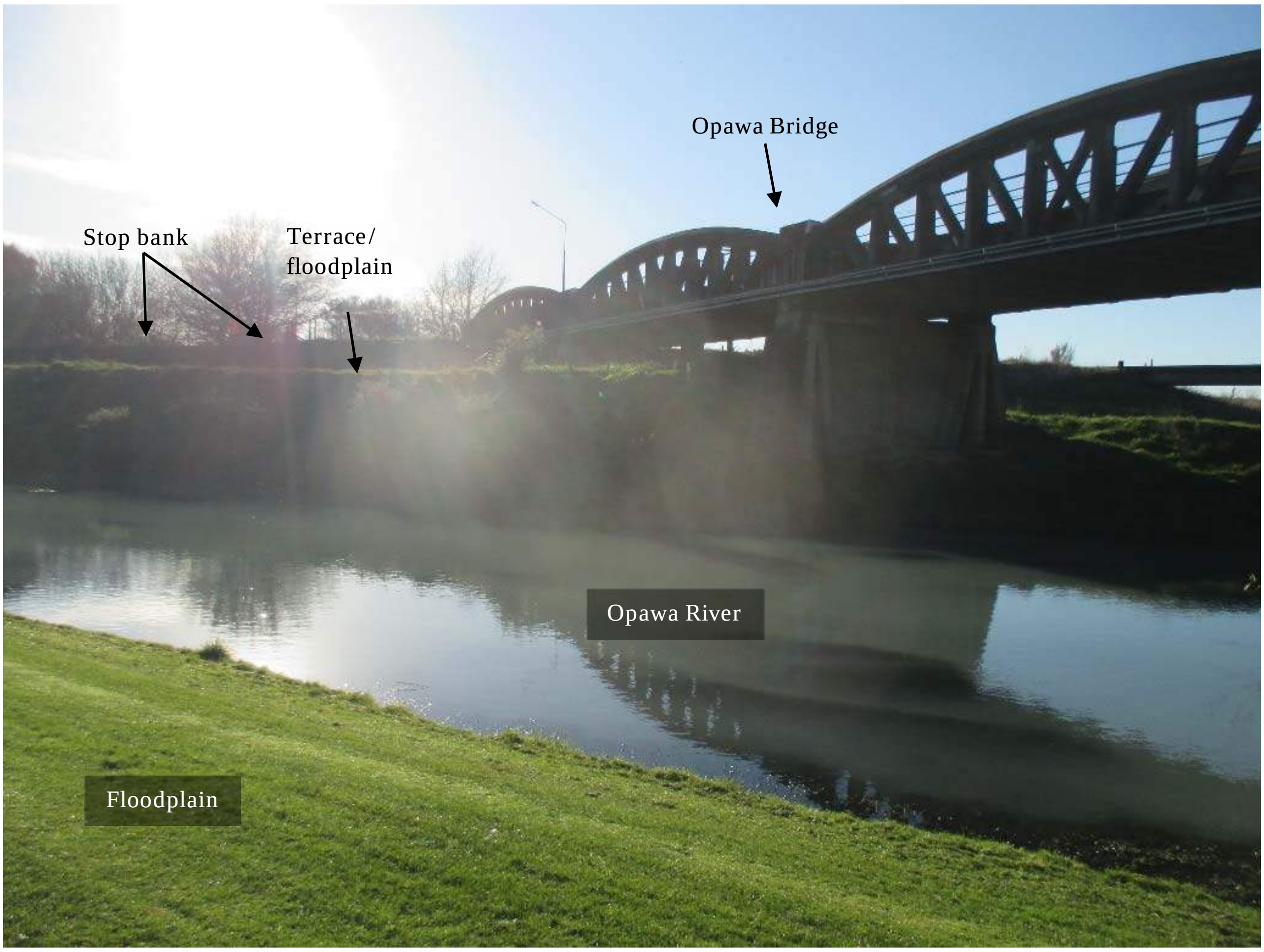


Illustration 2: Opawa Bridge - Geomorphology

2.2 Geology & Hydrogeology

The geology of the Marlborough Area has been mapped at 1:25,000 scale by the New Zealand Geological Survey (NZGS, 1981) and at 1:250,000 scale by the Institute of Geological and Nuclear Sciences (IGNS, 2000). The mapping shows the Blenheim area to be underlain by Holocene age marine/estuarine silts and sands of the Dillons Point Formation and alluvial gravels and sands of the Rapaura Formation. These strata are underlain by older, clay-bound alluvial gravels of the Speargrass Formation.

The site is located on the eastern boundary of the Springs Sector of the Wairau Aquifer. This aquifer supplies municipal water for Blenheim as well as the towns of Renwick and Woodbourne (Davidson and Wilson, 2011). The site location is inferred to feature a shallow sub-artesian water layer to approximately 20 m depth.

2.3 Site Seismic Hazard

The plate boundary between the Pacific and Australian plates passes through Marlborough, and consequently this region is an area of high seismicity. Relative motion between the tectonic plates is accommodated across a zone of active strike-slip faults (the Marlborough fault system), which links the Alpine fault transform plate boundary to the south with the westward-directed Hikurangi subduction margin to the north. The Marlborough fault system comprises four principal strike-slip faults and a number of smaller faults. Those within 15 km of the bridge are summarised in Table 1.

Table 1 – Active Fault Summary

Fault	Characteristic event magnitude	Recurrence interval (years)	Distance from site (km)	Direction
Wairau Fault	7.8	2490	3	Northwest
Vernon Fault	8.4	4210	11	Southeast
Awatere Fault	7.6	3200	15	Southeast

3 Geotechnical Investigations

Geotechnical site investigations comprising 2 boreholes were carried out in June 2015 under the direction of Opus. Standard Penetration Tests (SPTs) were carried out at 1 m intervals in both boreholes. Opus also carried out 6 seismic Cone Penetration Tests (sCPTs) in July 2015.

Laboratory testing including particle size distribution and Atterberg Limits were carried out on selected soil samples collected in the boreholes.

The locations of the boreholes and sCPTs are shown in Illustration 3.

The borehole logs, sCPTs results, shear wave velocity analysis based on sCPTs and laboratory testing results are presented in the Geotechnical (Factual) Report (Opus, 2015b).

Illustration 3: Location of site investigations

4 Geotechnical Assessment

4.1 Ground Conditions

From the borehole and CPT results, the soil stratigraphy of the bridge site has been assessed.

The ground conditions at the bridge site as indicated by the site investigation results are generally summarised in Table 2. A geological long section showing the sub-soil strata is shown in Figure 1.

Table 2 – General Ground Conditions

Soil unit	Reduced level (RLm)		Soil description	SPT "N" values	Prone to liquefaction or cyclic softening
	North abutment BH2	South abutment BH1			
1	6.3 to 2.5	5.1 to -1	SILT, very soft & moderately to non-plastic; Silty SAND / SAND, very loose to loose	1 to 4	Yes
2	2.5 to -10	-1 to -11	Gravelly SAND / SAND, dense to very dense	Varies; 15 to 50+	Yes. Liquefaction likely only in lenses with SPT "N" <24
3	-10 to -15.5	-11 to -13.5	Interbedded SILT (stiff to very stiff and moderately to non-plastic) and SAND (medium dense to dense)	13 - 37	Yes. Liquefaction likely only in some weak lenses
4	Below -15.5	Below -13.5	Sandy GRAVEL; very dense	50+	No

4.2 Groundwater Conditions

Groundwater levels at the site are governed primarily by the fluctuation of the river levels.

Regular monitoring of the groundwater level has been carried out subsequent to the installation of piezometers in boreholes BH1 and BH2. The groundwater measurements show that the groundwater level is at about 2 m (3.1 mRL) and 3.4 m (2.8 mRL) depth below ground level at BH1 and BH2 respectively.

One of the dual piezometers installed at BH1 shows a sub-artesian head of 0.8 m below ground level at depth. The response zone of this piezometer is between 19 m and 23 m depth (-13.9 m RL and -17.9 m RL) below ground level, in the very dense sandy gravel layer (soil unit 4 in Table 2).

4.3 Geotechnical Strength Parameters

The strength parameters of the site soils have been determined based on the results of the site investigations and are shown in Table 3.

Table 3 – Soil Strength Parameters

Soil Unit	Layer Name	Unit Weight, γ (kN/m³)	Cohesion, c' (kPa)	Angle of Internal Friction, ϕ' (deg)	Post Liquefaction Residual Strength, Sr (kPa)
1	SILT, very soft & moderately to non-plastic; Silty SAND / SAND, very loose to loose	16	1 – 3	26 - 29	2 - 10
2	Gravelly SAND / SAND, dense to very dense	18 - 19	0 - 2	30 - 37	30 – 35 (Some interbeded liquefiable layers only)
3	Interbedded SILT (medium stiff to very stiff and moderately to non-plastic) and SAND (medium dense to dense)	16	2 - 4	26 -29	30 – 35 (Some interbeded liquefiable layers only)
4	Sandy GRAVEL; very dense	18	0 - 2	34 - 38	-

4.4 Earthquake Design Loadings

The Opawa River Bridge has been categorised as an Importance Level 3 structure (as per Bridge Manual, Table 2.1) with an annual probability of exceedance of 1/2500 for the ultimate limit state design for earthquake actions.

Intrusive investigations in the surrounding area of the bridge provide evidence of a significant thickness of soil deposits of at least 25 m thickness. In addition to this, published geological maps indicate that these surficial soil formations extend beyond 50 m depth (NZGS, 1981). Given this information, the subsoil site class at the bridge site is considered to be Class D (deep or soft soil site) according to NZS1170.5. The site has a zone factor of 0.33.

Based on these categorisations and classifications, the Bridge Manual provides an unweighted peak ground acceleration (PGA) for ultimate limit state geotechnical design of 0.62g.

4.5 Liquefaction Hazard

4.5.1 Laboratory Testing

Laboratory testing was carried out on soil samples recovered from the boreholes to provide information for the assessment of liquefaction potential based on the New Zealand Geotechnical Society Guidelines (NZGS, 2010).

The laboratory testing shows that the silt / silty sand materials in soil unit 1 has a plasticity index of less than seven (7).

Additionally, grading tests were carried out on selected soil samples including the silt / silty sand / sand within soil unit 1 and the sand within soil unit 2. The grading curves of the tested materials predominantly fits within the grading envelope for liquefiable materials provided in the guideline (NZGS, 2010), indicating the presence of liquefiable materials at these depths.

4.5.2 Liquefaction Potential

The liquefaction potential was also assessed based on Standard Penetration Test (SPT) results, seismic CPT test data and shear wave velocities, which were derived from the seismic CPT test data.

Liquefaction potential at the two borehole locations has been assessed using the software LiquefyPro, which evaluates the liquefaction potential using the methods recommended by the NCEER workshop (Youd & Idriss, 2001).

The CPT results were assessed using the software Cliq which calculated the liquefaction potential based on the methodology proposed by Boulanger and Idriss (2014).

The shear wave velocities derived from seismic CPTs were also used to determine liquefaction potential based on the method stated in Youd & Idriss (2001).

Table 3 summarises the results of our analysis of liquefaction potential. The liquefaction potential at the borehole and CPT locations is also presented in Figure 1.

Analysis shows that liquefaction would predominantly occur in the top silty sand layer (soil unit 1) beneath the water table. Liquefaction is also expected to occur in some of the gravelly sand / sand layers in soil unit 2, in particular in areas closer to the river where weaker soils are present.

The onset PGA to trigger liquefaction was found to be as low as 0.06g in some layers and generally greater than 0.12g in the other layers.

Table 3 – Summary of liquefiable layers based on analysis results

Location	Soil unit	Soil description	Layers that are Assessed to Liquefy in an Ultimate Limit State Earthquake Event — Depth below ground surface level (m): Using CPTs and SPTs	Layers that are Assessed to Liquefy in an Ultimate Limit State Earthquake Event — Depth below ground surface level (m): Using Shear Wave Velocity	Ground subsidence (mm)	Onset PGA (g)
BH 1	1	SILT / Silty SAND / SAND	2.0 – 4.4	-	170	0.06
BH 2	2 3	Gravelly SAND / SAND SILT and SAND	7.8 – 10.8 17 - 20	-	140	0.22
CPT 1	1	SILT / Silty SAND / SAND	2.8 – 5.2	1.0 – 5.0	90	0.12
CPT 2	1 2	SILT / Silty SAND / SAND Gravelly SAND / SAND	2.0 – 4.0 7.0 – 8.0	1.0 – 3.0	100	0.12
CPT 3	1 2 3	SILT / Silty SAND / SAND Gravelly SAND / SAND SILT and SAND	1.4 – 5.0 5.0 – 16.0 16.0 – 17.5	1.0 – 2.0 6.0 – 10.0 16.0 – 17.0	380	0.09
CPT 4A	1	SILT / Silty SAND / SAND	1.7 – 2.3	-	20	0.16
CPT 5A	1	SILT / Silty SAND / SAND	3.2 – 3.8	1.0 – 4.0	30	0.16
CPT 6	1 2	SILT / Silty SAND / SAND Gravelly SAND / SAND	6.2 – 7.2 8.2 – 11.2	6.2 – 7.0 8.0 – 10.0	120	0.16

4.5.3 Ground Subsidence

Based on the liquefaction analysis results, liquefaction will induce ground subsidence of about 20 mm to 400 mm and will also cause down drag on piles.

4.5.4 Lateral Spreading

Lateral spreading displacements at the river banks as well as at various locations away from the banks has been evaluated using different methods:

1. Using empirical charts and methods published by Tokimatsu and Asaka (1998) and Zhang (2004). The calculation of lateral spreading displacement were based on calibrated SPT and CPT results obtained from the site investigations. These methods allow the lateral spreading displacements to be calculated over the depth of the liquefiable soil profile and interpolated toward or away from the river to calculate the extent of displacement as a function of distance from the river.

2. Newmark method. Permanent lateral displacements have also been estimated using the methods developed by Ambraseys and Srbulov (1995) and Jibson (2007), based on the Newmark's procedure for displacement of a rigid body subjected to base accelerations.

   Several cross sections throughout the site have been analysed. These cross sections represent locations where lateral spreading would have significant effects to the bridge abutments and piers in the event of liquefaction. The critical acceleration (i.e. the acceleration that results in a factor of safety of 1 against failure) was then determined and used to estimate the ground displacement using the methodologies proposed by Ambraseys and Srbulov (1995) and Jibson (2007). A typical cross section used for the analysis is shown in Illustration 4.

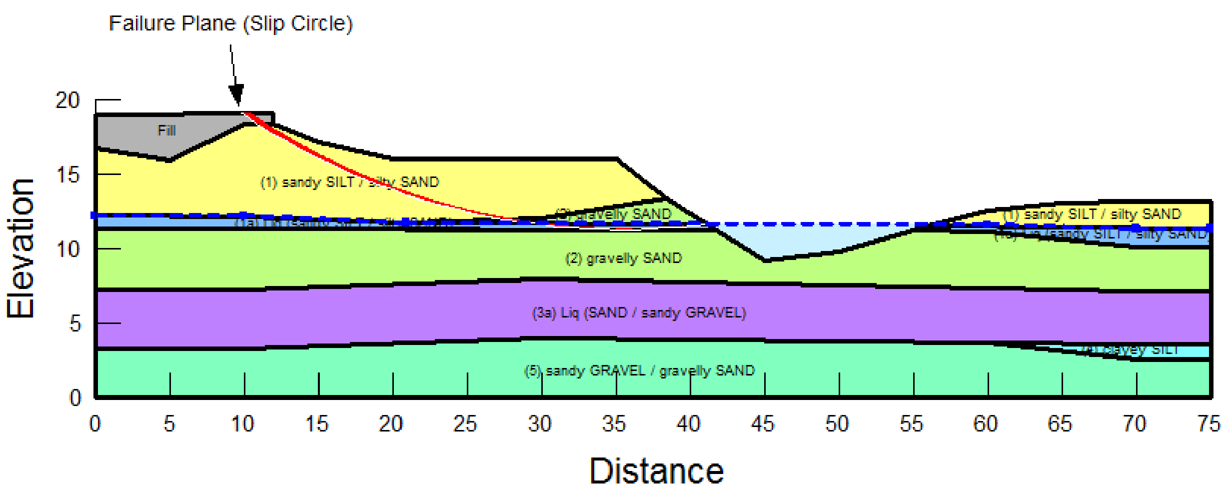


Illustration 4: Typical analysis of critical acceleration and lateral spreading displacements

The analysis concluded that the maximum displacement would occur near the river bank (free face) and that the displacement would decrease with distance from the river. The maximum displacement was found to be in the order of 1 m to 2 m at the river banks. The displacement would reduce to about 0.2 m to 0.4 m at a distance of 30 m away from the banks. For the southern abutment located approximately 60 m from the river bank the displacement was found to be about 0.1 m to 0.2 m based on the Zhang (2004) approach.

Observations in the Christchurch earthquake (Robinson, Bradley, & Cubrinovski, 2012) indicated that lateral spreading displacements due to liquefaction could, on average, range from 0.85 m to 1.5 m near the river banks and from 0.25 m to 0.75 m about 50 m away from the river the bank.

Lateral displacements could impose large lateral displacements and loads on the pier foundations and substructure, as well as at the abutments. Mitigation measures should be developed to protect the bridge structure against liquefaction and associated lateral spreading.

4.5.5 Abutment Stability

In addition to displacements associated with lateral spreading towards the river, liquefaction of the ground at the abutments during a design earthquake events could also lead to slope instability of the bridge abutments and approach embankments. A localised failure near the abutment, indicated by the analysis, is shown in Illustration 5.

The movement induced by lateral spreading downslope will cause displacements near the abutment in the order of 100 mm to 200 mm. Additionally, similar amount of vertical settlement due to liquefaction could be expected. The movement of abutments will impose lateral loads on the abutment piles. Therefore, we recommend that ground improvement work is carried out at the abutment locations.

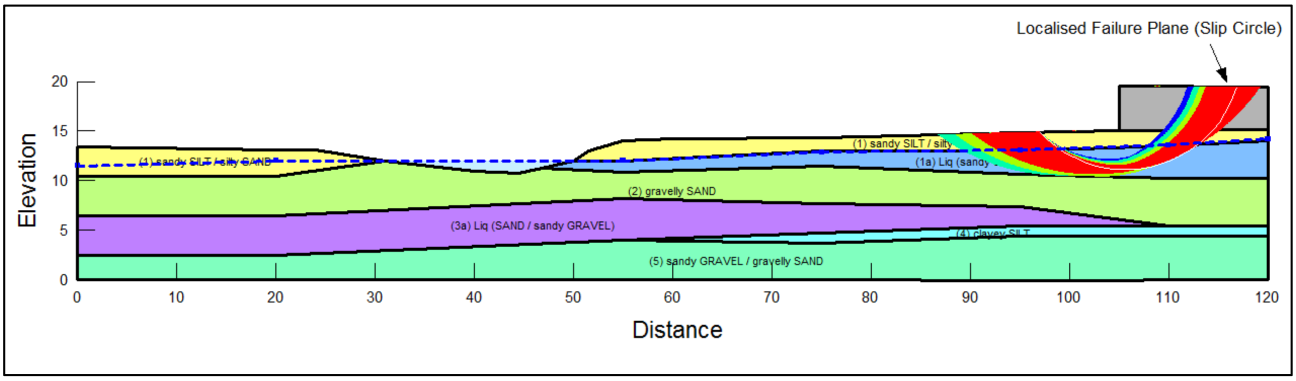


Illustration 5: Typical analysis of stability at abutments

4.6 Bridge Foundations

The Opawa Bridge site is underlain by very weak soils (see Section 4.1) and liquefiable deposits (see Section 4.5.2). Therefore, the bridge cannot be founded on shallow foundations, as this would cause bearing capacity failure and unacceptably large foundation settlements, as well as foundation failure in the design earthquake event.

Deep piled foundations are therefore appropriate for the new Opawa River Bridge. The piles should have adequate embedment into the dense gravels and cobbles to counteract scour effects and to resist down drag from the liquefiable soils. In addition, the pile founding depths should be three to five times the pile diameter below any overlying liquefiable layers and at least five times the pile diameter above any underlying liquefiable layers.

Due to the variable nature of the ground, the pile founding depths will vary along the bridge and will need to be assessed during design when the loading demand is better defined. Ideally, the Bridge should be founded in the very dense gravel layer (soil unit 4) below RL -13.5 m to RL -15.5 m.

Depending on the depth of penetration, the piles may be founded at about RL -19.5 m to RL -21.5 m, i.e. at a depth of about 20 m to 25 m. At some locations where there are no deeper seated liquefiable or low strength soils, the piles may possibly be able to be founded within the dense gravel in soil unit 2 (below -5 m RL), depending on the settlement tolerance of the structure, lateral capacity required and the scour estimates.

Given the presence of intermediate dense gravels, and the likely presence of cobbles and possibly boulders, driven piles are not likely to be suitable to achieve the required penetrations to provide adequate vertical and lateral capacity for the piles. Also driven piles will be a noisy operation close to the Blenheim town centre and the holiday park. Therefore bored piles are likely to be the most suitable option for this bridge. Given the variable ground conditions, river environment and presence of cohesionless very loose sand and dense gravel deposits, permanently cased bored piles are likely to be required to provide construction ground support as well as long term resilience in earthquakes.

4.7 Liquefaction Mitigation

4.7.1 Need for Liquefaction Mitigation

The lateral spreading analysis concluded that free-field ground displacement would occur across the site. The calculated free field displacements are of a magnitude greater than the allowable limits specified by the Bridge Manual. The liquefaction hazard at the site and the consequent subsidence and lateral spreading is likely to require mitigation measures for the bridge. The actual measures adopted will depend on the design considerations and bridge form.

The measures that could be considered to provide resistance to liquefaction are discussed below.

4.7.2 Bridge Form

Consideration should be given to the bridge form and span layout given the potential for liquefaction and lateral spreading effects.

Our analysis shows that the bridge will be subject to significant loads from liquefaction induced lateral spreading. In particular, special attention should be given in the design of bridge abutments and piers close the river banks will also be prone to liquefaction and lateral spreading.

Various approaches may be adopted to mitigate the risk of liquefaction and lateral spreading. Ground improvement can be effective in reducing lateral spreading displacement. Another approach is to design robust structures to resist the loads due to liquefaction and lateral spreading. A combination of both may be considered.

Given the likely skew of the bridge the lateral spreading may not be able to be resisted by the superstructure, as the lateral spread loads on the abutments will not be along the alignment of the bridge. Damage to the bridge abutments and piers were observed in the Canterbury earthquakes of 2010-2011.

The bridge piers should be located away from the river bank as far as possible. This may include locating the bridge pier in the centre of the river (away from either bank), and using larger spans to locate the flood plain piers away from the river bank, and reduce the number of piers on the river flood plain. This will need to be a balance between longer bridge span costs and the cost of ground improvements to protect the bridge piers.

The bridge substructure could also be designed to resist some lateral spreading loads on the bridge.

4.7.3 Ground Improvement

Our assessment also shows that improvement of the upper layer of liquefiable soils (unit 1) to about 5 m depth will greatly reduce the effect of liquefaction and lateral spreading to the bridge abutments and piers. Ground improvement will be required at the bridge abutments to ensure overall stability of the abutments and minimise lateral displacement and settlement. Additionally, ground improvement along the river banks will reduce the liquefaction-induced lateral spread loads on the pier piles, where lateral spreading is significant.

Stone Columns

Ground improvement in the form of stone columns has been proven to be a satisfactory technique in a river environment. For example this approach was used to enhance the seismic performance of the SH3 Cobham Bridge in Wanganui as part of the seismic strengthening measures. Stone columns can improve soil strength and soil stiffness, as well as providing drainage to help dissipating the groundwater pressures developed during earthquakes, and therefore reducing the potential for liquefaction, or at least helping to reduce the duration of liquefaction following earthquakes.

Vibroflotation stone columns are expected to be unsuitable given the predominantly silty soils and the need for robust protection to the bridge. Stone columns which are excavated using a temporary casing for support, with the stone being subsequently compacted or rammed into place during withdrawal of the temporary casing may be suitable for the bridge. This approach has previously been used for some sites including the SH3 Cobham Bridge in Wanganui (Brabhaharan, 1992 and Brabhaharan et al, 2011).

Stone columns may be installed to a depth of about 7 m, with subsidence associated with the deeper liquefiable layers being accepted and the structure designed to accommodate associated settlements.

Our preliminary analyses suggest that stone columns at a triangular spacing of about 1.5 m, with a diameter of 750 mm to 900 mm and to a depth of about 7 m may be appropriate. This should be further developed during design.

Other Deep Improvement Techniques

Other options of ground improvement such as soil replacement, deep soil mixing and continuous flight auger (CFA) piles can also be considered. Factors such as performance, cost, buildability and existing underground utilities will need to be considered in selecting the type of ground improvement.

Ground Replacement

Ground replacement or partial replacement could be considered given the relatively shallow 5 m to 6 m depth of shallow liquefiable layers at the abutments. This could however, be difficult given the shallow groundwater level, and the urban environment making excavation difficult or costly and require sheet piling to protect the surrounding land.

5 Conclusions and Recommendations

5.1 Resilience

The new Opawa Bridge will be a key lifeline arterial route that provides national north south access from Picton to Christchurch and beyond, as well as local access in the Marlborough and Blenheim township. Therefore, the resilience of this route is important, and careful consideration should be given in the selection of bridge form and design concepts to provide resilience.

5.2 Geotechnical Conditions

The bridge will be located in an area with very loose sandy silt deposits with poor bearing capacity, potential for large settlements and prone to liquefaction and lateral spreading in design earthquakes. This could give rise to foundation failure and large displacements if adequate foundations and mitigation measures are not adopted.

5.3 Bridge Form

It is important to develop a suitable bridge form taking into consideration the geotechnical and earthquake hazards. This may include consideration of:

- Larger spans to reduce the number of piers in the flood plain prone to liquefaction and lateral spreading.
- Locating the river bridge pier in the centre of the river, away from the river banks prone to lateral spreading in earthquakes.
- Designing and detailing the sub-structure and bridge superstructure to be tolerant of ground displacements.

5.4 Bridge Abutments

It is considered that, abutments in the form of vertical reinforced soil walls with steel strip reinforcement and structural facing panels will be appropriate for this bridge. Due to the flexible nature of the reinforced soil walls, they are excellent in tolerating residual differential settlement and lateral movements due to liquefaction and lateral spreading after ground improvement.

Ground improvement will likely be required at the bridge abutments to mitigate the risk of liquefaction and lateral spreading.

5.5 Bridge Foundation

We recommend the bridge be founded on piles, in the form of concrete bored piles. Permanently cased piles are suitable given the variable liquefaction potential and potential ground displacements over depth, and to provide stability during piling in the cohesionless loose sand, silt and gravel materials encountered. The piles should be ideally founded in the very dense sandy gravel unit at a depth greater than 20 m to 25 m.

5.6 Ground Improvement

Ground improvement is likely to be required to protect against liquefaction subsidence and lateral spreading. A variety of methods could be considered. Compacted or rammed stone columns are likely to be suitable given the silty ground conditions, and are likely to be installed to a minimum depth of about 7 m. The deeper liquefaction may be able to be managed by designing the structure to be tolerant of some ground subsidence / displacements.

Ground replacement to 5 m to 6 m depth may be considered, but may be difficult given the high groundwater conditions and the urban environment.

6 References

Ambraseys N., Srbulov M. (1995) "Earthquake-induced displacements of slopes", Soil Mechanics & Earthquake Engineering, vol.14, pp.59-72.

Boulanger, R. W., and Idriss, I. M. (2014). “CPT and SPT based liquefaction triggering procedures.” Report No. UCD/CGM-14/01, Center for Geotechnical Modelling, Department of Civil and Environmental Engineering, University of California, Davis, CA, 134 pp.

Brabhaharan, P (1992). Ground improvement to reduce geotechnical risk: Waingake final water treatment plant. 6th ANZ Conference, Christchurch, NZ, February 1992.

Brabhaharan, P, Duxfield, J, Arumugam, S and Gregg, G (2011). Retrofit to Improve Earthquake Performance of Bridge Abutment Slopes. 9th Pacific Conference on Earthquake Engineering, Auckland. 14-16 April 2011.

Davidson, P.; Wilson, S. (2011). Groundwaters of Marlborough. Marlborough District Council.

Institute of Geological and Nuclear Sciences (2000). *Geology of the Wellington area, scale 1:250,000*. Institute of Geological and Nuclear Sciences 1:250 000 geological map 10. Institute of Geological and Nuclear Sciences, Lower Hutt. Compiled by Begg, J.G., and Johnston, M.R.

Landcare Research (1995). *Geomorphology of the Wairau Plains: implications for floodplain management planning.* Landcare Research Sciences Series No.11. Manaaki Whenua Press, Lincoln. Prepared by Basher, L.R.; Lynn, I.H.; Whitehouse, I.E.

Marlborough Catchment & Regional Water Board (1987). *Water and soil resources of the Wairau, Volume 1.* Marlborough Catchment and Regional Water Board, Blenheim.

New Zealand Geological Survey (1981). *Water well data – northern Marlborough. Part sheet P28 – Wairau Plain (geology and water wells) 1:25,000*. Report No NZGS 93. Department of Scientific and Industrial Research, Lower Hutt. Prepared by Brown, L.J.

New Zealand Geotechnical Society Inc. (2005). *Field Description of Soil and Rock; Guideline for* the Field Classification and Description of Soil and Rock for Engineering Purposes.

New Zealand Geotechnical Society Inc. (2010). *Geotechnical earthquake engineering practice Module 1 - Guidelines for the identification, assessment and mitigation of liquefaction hazards.* New Zealand Geotechnical Society.

NZ Transport Agency (2013). Bridge Manual, Third Edition (effective from May 2013) and Amendment 1 in Section 6 (effective from September 2014).

Opus International Consultants (2015a). Opawa River Bridge Indicative Business Case. Geotechnical Issues Paper. Prepared by P Brabhaharan. File 5MB982.03. 17 March 2015.

Opus International Consultants (2015b). New Opawa Bridge. Site Investigations Factual Report. GER2015-28. August 2015.

Robinson, K., Bradley, B., & Cubrinovski, M. (2012). Analysis of Liquefaction-Induced Lateral Spreading Data from the 2010 Darfield and 2011 Christchurch Earthquakes. *2012 New Zealand Society of Earthquake Engineering Conference*, 1-8.

Standards New Zealand (2004). NZS 1170.5:2004 Structural Design Actions Part 5. Earthquake Actions - New Zealand. New Zealand.

Stirling, M., McVerry, G., Gerstenberger, M., Litchfield, N., Van Dissen, R., Berryman, K., Barnes, P., Wallace, L., Villamor, P., Langridge, R., Lamarche, G., Nodder, S., Reyners, M., Bradley, B., Rhoades, D., Smith, W., Nicol, A., Pettinga, J., Clark, K. and Jacobs, K. (2010). *National Seismic Hazard Model for New Zealand: 2010 Update*. Bulletin of Seismological Society of America, Vol. 102, No. 4, pp/ 1514-1542, August, 2012.

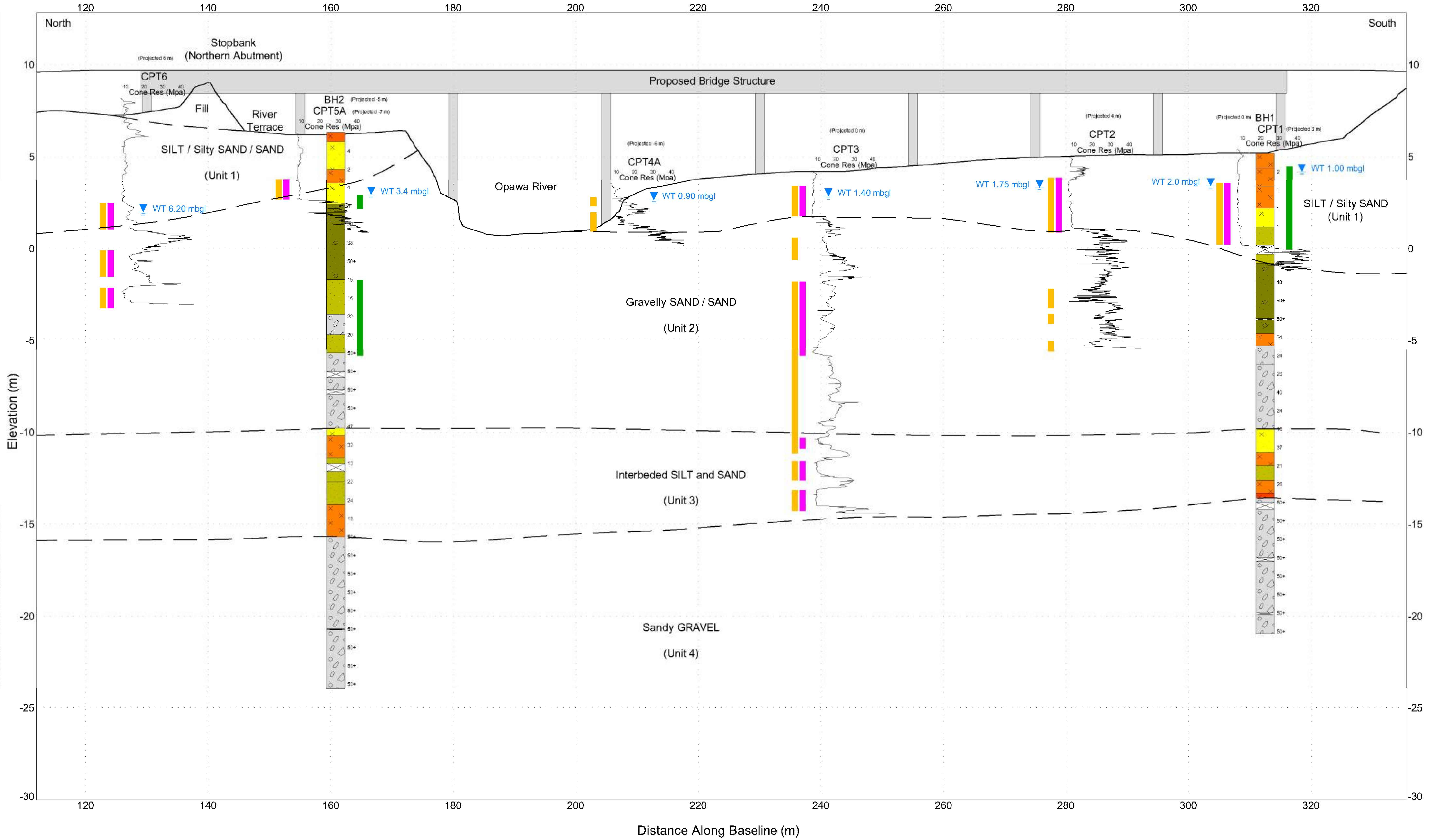
Tokimatsu, K., & Asaka, Y. (September 1998). Effects of Liquefaction-Induced Ground Displacement on Pile Performance in the 1995 Hyogoken-Nambu Earthquake. *Special Issue of Soils and Foundations* , 163-177.

Youd, T. L., & Idriss, I. M. (2001). Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils. *Journal of Geotechnical and Geoenvironmental Engineering*, 297-313.

Zhang, G., Robertson, P. K., & Brachman, R. W. (August 2004). Estimating Liquefaction-Induced Lateral Displacements Using the Standard Penetration Test or Cone Penetration Test. *Journal of Geotechnical and Geoenvironmental Engineering*, 861-871.

Figure 1

Geological Long Section



Prepared for: NZ TRANSPORT AGENCY WAKA KOTAHI

Prepared by: OPUS GEOTECHNICAL

Legend:

- Water table measured in CPT/BH
- Existing Ground Profile
- Inferred Geological Boundary

Liquefaction Potential Based On:

- SPT 'N' Values
- CPT Results
- Shear Wave Velocity, Vs

Lithological Graphics

- BSI Silt
- BSI Silty Sand
- BSI Sand
- Zone of no core recovery
- BSI Gravelly Sand
- BSI Sandy Gravel
- BSI Gravelly Silt
- BSI Sandy Silt

Title:	Engineering Geology Long-Section
Project:	New Opawa River Bridge

Vertical Scale:	Horizontal Scale:	Project:	Figure:
1:200	1:600	5MB982.03	1

BOREHOLE & CPT LONG SECTION 5MB982.03 OPAWA RIVER BRIDGE.GPJ OPUS_DATA_TEMPLATE_MARCH2015.GDT 18/8/15

Opus International Consultants Ltd
L7, Majestic Centre, 100 Willis St
PO Box 12 003, Wellington 6144
New Zealand

t: +64 4 471 7000
f: +64 4 471 1397
w: www.opus.co.nz