Otaki to North of Levin
Taylors Road to Ohau River Four Laning
Preliminary Options Report and Addendum

Prepared for NZ Transport Agency

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QUALITY STATEMENT

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NZ Transport Agency

Otaki to North of Levin

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Preliminary Options Report

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1 Introduction

The New Zealand Transport Agency (the Agency) has been investigating a package of improvements to the existing state highways between Ōtaki and north of Levin as part of its strategic approach to achieving safety and efficiency benefits in the short to medium term, while retaining a long-term option to achieve a four lane highway in the project area.

Since 2011 the project has proceeded through investigation of the opportunities and constraints of an expressway within the wider project area, to investigations to identify feasible targeted improvement projects, and through several stages of consultation. Some of the specific projects have required further consideration following consultation in 2013.

In developing some of these projects, it became clear that further analysis and consideration was needed to ensure that the projects would be compatible with a long term route for the highway (particularly as a four-lane highway), between the Peka Peka to Otaki project at Taylors Road and the Ohau River.

This analysis does not detract from the safety improvement projects that are proposed for some areas (e.g. through Manakau and Ohau villages), as these provide much needed short term safety benefits, but it may affect some of the larger project components that are still under development.

This report explains the basis and outcomes of the analyses undertaken into the different potential alignments identified between Taylors Road and the Ohau River. The work undertaken includes:

- A multi-criteria analysis (MCA), which is an accepted method when a number of options with a wide range of impacts, benefits and costs need to be evaluated. The methodology follows a series of process steps which are fully explained in this report.
- Consideration of how such a long term strategy could be staged.
- An economic evaluation of a long term corridor.

The identification and consideration of options is an important component of the necessary investigations before notices of requirement for designations under the Resource Management Act (the RMA) can be lodged. The processes set out in this report, and its findings, will contribute to future statutory processes to secure the preferred route and gain RMA approvals.

This report will become an appendix to the SH1-SH57 Connection Detailed Business Case. The structure of the remainder of this report is as follows:

- a description of the area and the options for evaluation (section 2)
- the multi-criteria process and outcomes (section 3)
- a discussion around staging (section 4)
- economic analysis (section 5)
- conclusions (section 6).

It is important to note that the work undertaken to date has not been to a level of detail that enables an exact route to be confirmed. However, there has been enough analysis to remove some routes from further consideration and to determine whether or not the SH1-SH57 Connection and Forest Lakes projects that are being developed would be consistent or inconsistent with potential long term routes.

Following completion of this report, further information was obtained from two cultural impact reports which had subsequently been commissioned. A further MCA process was undertaken to incorporate this material. The process and outcomes of this process are reported in the Addendum, attached at Appendix E.

1.1 Project Objectives

The objectives of the Wellington Northern Corridor RoNS, which runs from Wellington Airport to north of Levin, are:

- To enhance inter regional and national economic growth and productivity;
- To improve access to Wellington's CBD, key industrial and employment centres, port, airport and hospital;

- To provide relief from severe congestion on the state highway and local road networks;
- To improve the journey time reliability of travel on the section of SH1 between Levin and the Wellington Airport; and
- To improve the safety of travel on state highways.

For the Ōtaki to north of Levin section; the objectives are:

- To provide best value solutions which will progressively meet (via a staged approach) the long term RoNS goals for this corridor of achieving a high quality four lane route;
- To provide better Levels of Service, particularly for journey time and safety, between north of Ōtaki and north of Levin;
- To remove or improve at-grade intersections between north of Ōtaki and north of Levin;
- To engage effectively with key stakeholders; and
- To lodge Notices of Requirement and resource consents as appropriate with the relevant consent authorities for the first individual project by the 2013/14 financial year.

1.2 Location

The plan below outlines the projects that have been investigated in the Project Feasibility Report stage of the project and the area to which this report applies.

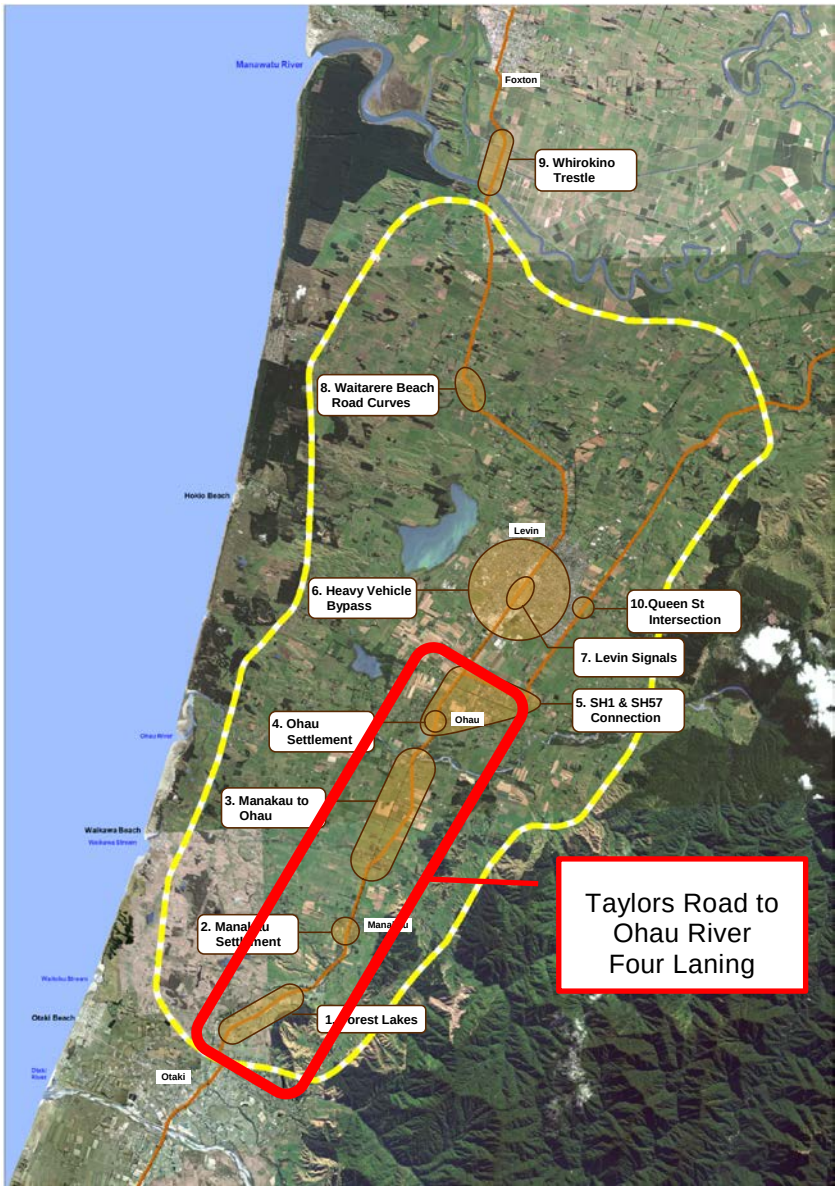


Figure 1-1: Location Plan

2 Options for Analysis

2.1 Introduction

The area for evaluation encompasses land that lies between Otaki in the south and Ohau in the north. The present state highway system within this area incorporates various features and characteristics which require improvement or alternative resolution. The problems have been fully documented in earlier reports[1] and various options considered for each section.

Between February and April 2014, further work was done on the connectivity details for the SH1 and SH57 Connection, taking into account additional design considerations and the findings of Stage 4 consultation.

This resulted in concern in regards to the location and design of a connection point south of the SH1-SH57 interchange. Specifically, the difficulty in fitting a grade separated solution in or around the Kuku Beach Road area due to the proximity of the railway line, the presence of Maori land and the proximity to the SH1-SH57 interchange.

It was clear that there are no other obvious connection points that could be located within the SH1-SH57 Connection project in this vicinity, and that retaining connectivity at Kuku Beach Road is important for the community and for businesses.

It was agreed that if significant expense was to be incurred on this connection point, then it needs to be suitable and adaptable for any future four lane alignment.

Accordingly, MWH were tasked to investigate alignment options for a potential future four lane route between Taylors Road and the Ohau River, including appropriate connection points.

The southern connection point was assumed to be the intersection of Taylors Road and SH1 (the northern extent of the approved Peka Peka to Otaki RoNS project). The northern connection point was assumed to be the crossing of the Ohau River as part of the preferred SH1-SH57 Connection option (Option 5A).

2.2 Constraints

Initially a number of no-go areas were confirmed from site visits and previous work[2]. These comprised:

- Manakau Township, including both sides of the highway and as far east as (and including) the Manakau Reserve on Waikawa Beach Road. This obviously excluded any option of the highway utilising the existing state highway. This is considered appropriate as a four lane expressway through this area would directly affect the significant number of residential and commercial properties on the west of the highway, including an historic church. In many cases buildings would need to be demolished or relocated and access to the remainder would need to be via parallel service road which would require even more land.
- A small grouping of houses including a new subdivision extending along the southern side of Waikawa Beach Road. The development of housing in this area has proceeded during the duration of the O2L project and some are currently under construction.
- Two stands of native bush between Waikawa Stream and Kuku Beach Road west of the railway line.

2.3 Quantm and refinement of options

The software programme Quantm was used to undertake route identification (horizontal and vertical alignment) by generating 3D corridors and alignments. Its route identification technology can generate numerous potential alternative alignments and returns the lowest cost options as preferred routes.

Contour data and the constraint data above were input into the software along with the eastern and western boundaries, unit cost data and design parameters commensurate with the assumptions reported

[1] E.g. Scoping Report for Otaki to North of Levin in July 2012, Project Feasibility Reports for NZTA early 2013 addressing Forest Lakes (Report 1), Manakau Settlement (Report 2), Manakau Ohau Bridge (Report 3), Ohau Settlement (Report 4), and SH1-SH57 & Arapaepae Curve (Report 5),.and also SH1-SH57 Scoping Report November 2013. All MWH NZ Ltd.
[2] See footnote 1.

in the Scoping Report Preliminary Design Philosophy Statement and typical construction costs. These data were used to generate alignments and return the optimum route alignment options based on the limited data that were available at this stage.

These routes were then collated and refined into a number of generic routes for evaluation though the MCA process.

2.4 Description of Options

Please refer to Appendix A for a plan of the options.

All but one of the options pass through two points at Waikawa Beach Road (due to the existing constraints). Hence to reduce the number of options evaluated and reduce repetition the options were split into northern options and southern options with Waikawa Road the dividing point. The preferred options from each group would then be merged after the initial MCA evaluation to create overall route options.

In addition there were a number of potential interchange locations. The approach adopted was to assess the three interchange locations separately, regardless of which option they would end up supporting i.e. they could move east or west onto the options without being significantly different in terms of their evaluation. This is discussed in more detail later in the report.

It is important to note that these options have not been developed to any stage of design. They are purely lines on aerial photographs at this stage.

2.4.1 Southern Options

The table below outlines the key characteristics of the route options from Taylors Road to Waikawa Beach Road.

Table 2-1: Description of Southern Options

Route Option	Description and Key Features (from south to north)
Brown	This option traverses east of the current alignment running roughly parallel to the existing highway from Taylors Road to past Pukehou Railway Overbridge. It then stays on the eastern side of the railway line and progresses past the eastern side of the Manakau Township.
Green (east)	This option also traverses east of the current highway before crossing the highway north of the existing rest area south of Pukehou Rail Overbridge. From this point it crosses the railway line and Atkins Road and runs roughly parallel to the existing highway before crossing Waikawa Beach Road immediately west of the Manakau Domain.
Green (west)	Similar to the Green (east) option, the difference with this option is that it utilises the existing SH1 corridor before diverting off at the rest area.
Light Blue	This option starts on the eastern side of SH1 similar to Brown and Green (east) but crosses earlier in the vicinity of Forest Lakes Road. It then stays further west of the current State Highway 1 and crosses Waikawa Beach Road approximately 1.3km west of the small residentially developed area.
Light Purple	Starting at Taylors Road, this option leaves the current highway to travel west of the current alignment and heads in a straight north-west line towards Waikawa Beach Road immediately west of the Manakau Domain,
Light Blue / Light Purple	This is a combination of the above two options; Light blue at the southern end and Light Purple at the northern end.
Yellow	This is the westernmost option. Similar to Light Purple it deviates to the west immediately from Taylors Road. It then stays west to cross Waikawa

Route Option	Description and Key Features (from south to north)
	Beach Road west of the residential development.

2.4.2 Northern Options

The table below outlines the key characteristics of the route options from Waikawa Beach Road to Ohau River.

Table 2-2: Description of Northern Options

Route Option	Description and Key Features (from south to north)
Brown (via 7A)	This option continues on from the Brown (southern) option, staying east of the highway and tying into Option 7A from the SH1-SH57 Connection project[3].
Grey (via 7A)	This option continues on from the Green and Purple southern options. It heads east to cross the existing highway just north of North Manakau Road then crosses the Waikawa Stream before joining into the existing highway and Option 7A from the SH1-SH57 Connection project.
Red	The Red option also continues north from the Green and Purple southern options. It starts adjacent to the Manakau Domain before angling towards the railway line and it stays adjacent to the railway line all the way to the Ohau River.
Magenta	This option (and the subsequent three options) extends from Waikawa Beach Road, approximately 1.3km west of SH1. The Magenta alignment cuts quickly back towards the railway line passing on the eastern side of the native bush area before continuing adjacent to the railway line to the river.
Dark Blue	This option is similar to the Magenta option but traverses west of the native bush area before meeting the railway line.
Orange	The Orange alignment again starts west of the residentially developed land west of Manakau and stays approximately 350m west of the railway line before crossing the Ohau River at the same location envisaged by SH1-SH57 Option 5A.
Dashed Orange	This option is similar to the Orange alignment but stays almost 600m away from the railway line. This additional distance requires the bridge over the Ohau River to be further west than under SH1-SH57 Option 5A.

2.4.3 Interchange Options

The table below outlines the options for interchange locations.

Interchange locations were determined based on site knowledge, connectivity and ideal interchange spacing (from Austroads).

In addition to the three general locations below, it has been assumed that there will be improved connectivity at the southern end of the project regardless of which interchange location is pursued. This

[3] Originally, the Brown option crossed back over the highway to join into Option 5A as per the scope of this stage. However it was considered that if the Brown alignment was going to be progressed, it would sensibly be coupled with Option 7A to provide route efficiencies. Accordingly, the MCA workshop assumed that the Brown option included Option 7A, at least south of the Ohau River.

would be to provide local access for Taylors Road and Forest Lakes Road traffic into Otaki as well as the interchange at Otaki. The current Peka Peka to Otaki drawings do not provide for this, meaning that any trip originating north of Otaki would have to travel even further north to the next interchange before travelling south. There are a number of options for improving access and these need to be developed in conjunction with the Peka Peka to Otaki project team.

At this stage, it has been assumed that a spread diamond interchange is the preferred interchange type in accordance with the rural environment and Austroads guidelines. It was recognised that this would involve a substantial area of land, but can be refined at a later stage if necessary.

Table 2-3: Description of Interchange Options

Interchange Option	Location and Key Features
U	This option comprises an interchange on or around Gleesons Road. It is noted that this option would not be compatible with the Brown alignment because it would have a significant effect on the Manakau Heights area. If this option were progressed it would need to be coupled with the ½ interchange option at SH1-SH57 (rather than the pure Y intersection) due to the additional distance between the two interchanges.
V	This option comprises an interchange between Waikawa Beach Road and Whakahoro Road. It is noted that this option would not be compatible with the Red alignment due to its proximity to the current state highway coupled with the need to connect back into it. If this option were progressed it would need to be coupled with the ½ interchange option at SH1-SH57 (rather than the pure Y intersection) due to the additional distance between the two interchanges.
W	This option comprises an interchange between Whakahoro Road and Kuku Beach Road. As previously determined, an interchange adjacent to the railway line causes many issues therefore this option is incompatible with Red, Magenta or Dark Blue. There is a possibility that another interchange would be required if W were constructed as there would be more than 10km between this and the Otaki North interchange. However, as this is uncertain it was not included as part of the analysis.

3 Multi-Criteria Analysis

3.1 Background and Methodology

Figure 3-1 sets out a schematic representation of the context within which multi-criteria analysis is applied, particularly in relation to significant infrastructure projects.

In the circumstances of the Taylors Road to Ohau River options, Steps 1 and 2 in Figure 1 had been developed as discussed in Section 2 above, producing options that were considered able to contribute to the achievement of NZTA's objectives for the Ōtaki to North of Levin RoNS project. With the addition of a step which involved collection of more detailed environmental material, these two steps set the scene for the remainder of the steps set out in Figure 1.

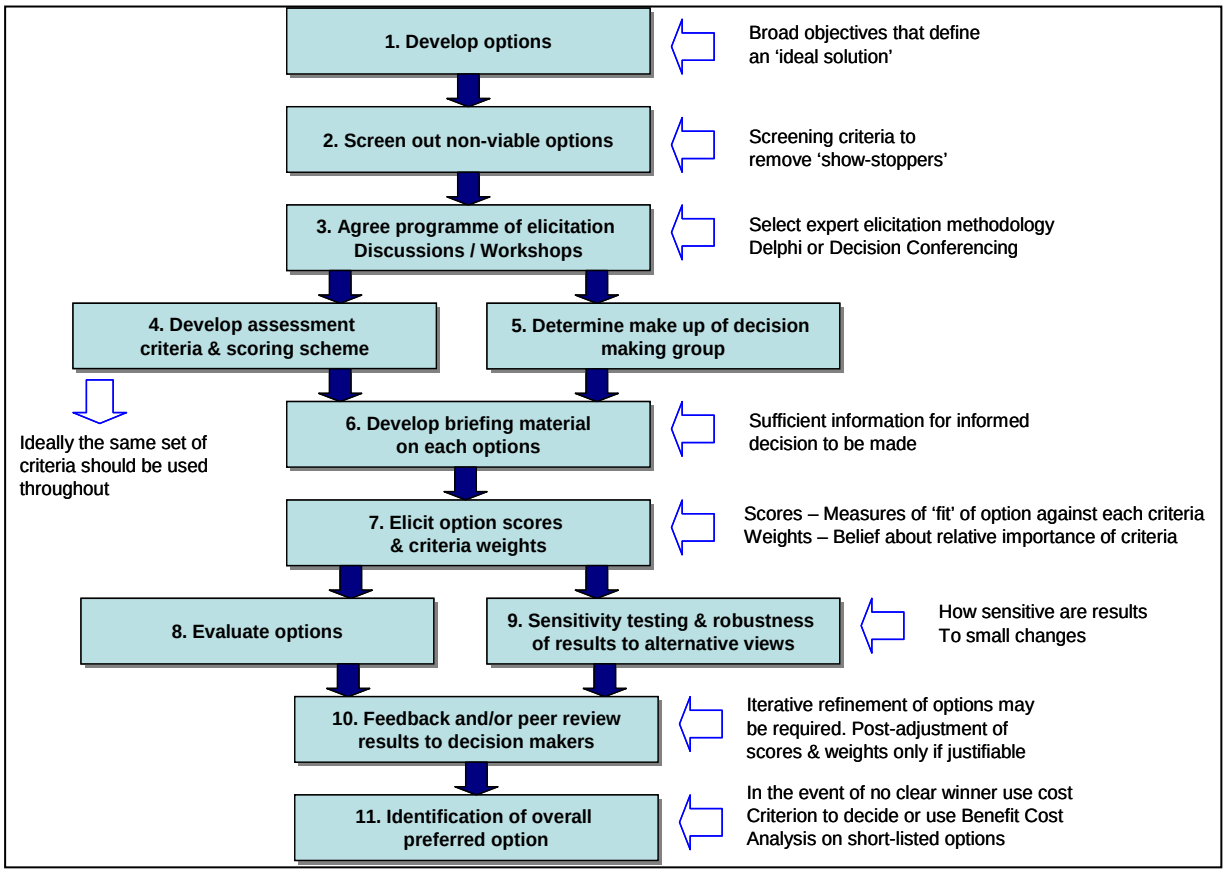


Figure 3-1: MCA Process

The multi-criteria analysis methodology is a key element of analysis, and a useful aid to decision-making. Multi-criteria analysis is particularly applicable when there are several options to choose between, and where there are numerous complex considerations involved. Multi-criteria analysis is thus commonly used in assessments of options for infrastructure. It is a useful tool for evaluations, including those under the RMA and Local Government Act (LGA), to compare and assess alternative proposals where there are multiple objectives, and where there are a range of diverse potential adverse and beneficial effects affecting different areas and/or communities[4]. The range of attributes that are relevant to a decision between options can be numerous and varied, and it is necessary in such circumstances to bring together the information in a reliable and credible way.

Figure 3-2 shows how multi-criteria analysis is applied. Key aspects to be taken into account in the decision making process are identified, defined, and scored on a consistent basis. Once scored, they

[4] The use of multi-criteria analysis is recommended by the NAMS (the New Zealand National Asset Managers Support organisation) and is a key element of the Optimised Decision Making Guidelines promoted by that organisation. It also finds favour (used in conjunction with CBA) in "Decision-making on Mega-projects: Cost-benefit Analysis, Planning and Innovation", Priemus, H; Flybrjerg, B and van Wee, I, Eds – 2008.

can then be weighted as appropriate and combined into a single option score. In multi-criteria analysis processes, the scores can be seen as surrogates for measures of value for an aspect (allowing for the effects of diverse criteria, with different units, to be combined). The weights represent beliefs or assumptions about what is important in a particular situation or to a particular group of decision makers.

It is possible to strengthen the analysis by applying a range of different weightings to see whether the preference changes due to weighting systems. It is also appropriate to test the sensitivity of the process by carefully reviewing the scoring and identifying the extent to which scoring would need to change to result in a difference preference.

3.1.1 Decision-making in the Multi-criteria Framework

Decisions on criteria, scoring and weighting are ideally made by a group of informed people through a process that allows for testing through discussion, questions and answers.

When the criteria are diverse and areas of specialist judgment are called-for, the preferred method is through a "decision conference" or facilitated workshop session, at which a participating group of specialists and generalists share information and work through the issues, finally deciding on the score for each criterion[5]. Ideally consensus is reached on the scores. This reduces individual bias and keeps the process transparent.

An alternative method which can be used is the Delphi method, where criteria are scored by individual technical and specialist experts and combined by an individual generalist who, at the same time, checks the robustness of the assessment. The Delphi method is an accepted method, but lacks some of the benefits of the decision conference method.

These benefits include drawing out the detail of the various assessments through discussion and questioning, and the involvement of project leaders who are particularly familiar with the project and the area, as well as examination and testing of the information through the shared scoring process.

In practice, both decision methods were applied in the multi-criteria analysis undertaken for this project.

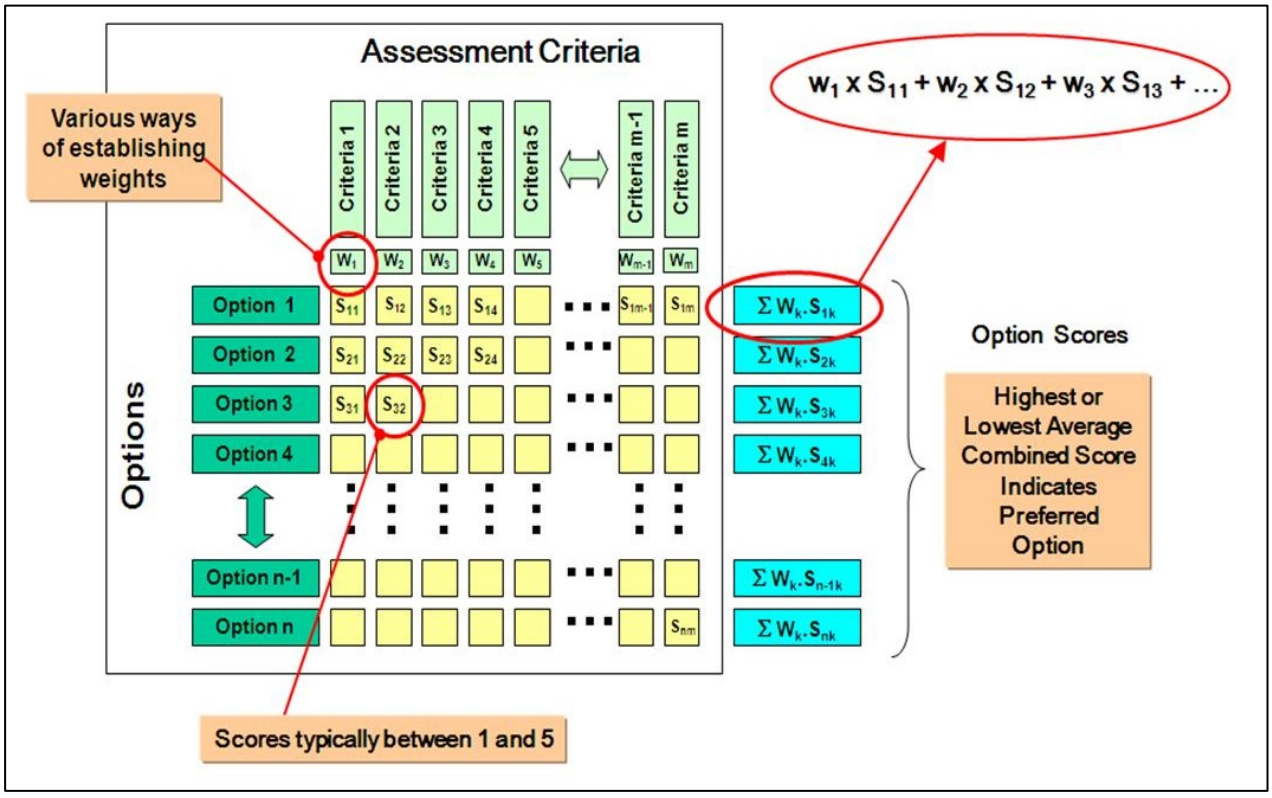


Figure 3-2: Multi-criteria Analysis Scoring and Weighting

[5] The method is based on the demonstrated hypothesis (from international research in the early 1990s on roading projects) that groups of people, given the same information and the opportunity to test the information, will make similar decisions on preferences, regardless of their backgrounds.

3.2 Application of the Multi-Criteria Analysis

3.2.1 Background Information

No additional information was sought to undertake this MCA process; it was progressed based on previous investigations undertaken for this project and with the knowledge and experience of the project team.

Background information referred to included:

- Otaki to North of Levin Scoping Report, MWH, July 2012
  - Particular consideration was given to the constraint maps as Appendix D to the Scoping Report
- Landscape and Urban Design Baseline Report, Isthmus, April 2011.
- Otaki to North of Levin PFRs (Reports 1 to 12), MWH, February 2013
- Otaki to North of Levin SH1 - SH57 Connection Scoping Report, MWH, November 2013
  - Particular consideration was given to the MCA Report including specialist reports as Appendix J to the Scoping Report
- Manakau Bypass Constraint Maps, MWH, 12-05-2014, based on constraints identified during previous phases.

3.2.2 Choice of Attributes or Criteria

The attributes for assessment, or assessment criteria, are based on the aspects identified for investigation at earlier stages of the project, and were discussed amongst the project team. The criteria are relatively broadly-based, as is appropriate for the stage of project development, the scale of the project and the nature of the route options being evaluated.

The assessment criteria need to reflect matters that are important within the RMA, and the Land Transport Management Act 2003 and its amendments[6], taking into account the decision criteria that will eventually be brought to bear through RMA processes. They should also be able to be categorized across all of the "four well-being" considerations – social, environmental, cultural and economic, which are part of the sustainable development principles in the Local Government Act 2002. This assessment is shown in Table 5-1. A brief description of the scope of each of the criteria follows in section 5.2.

Table 3-1: Assignment of Criteria to Generic Evaluation Frameworks

Criterion	NZTS Objective*, and GPS** Priorities, Impacts and Principles	Examples of relevant RMA Aspects	LGA Sustainable Development Principle (S14)
1. Landscape/Visual Impacts	Reducing Adverse Environmental Effects	S5, S6(b), S7(c) and (f)	Environmental
2. Ecology	Reducing Adverse Environmental Effects	S5, S6(a) and (c), S7(d)	Environmental
3. Archaeology/Heritage	Reducing Adverse Environmental Effects	S5, S6(f)	Cultural
4. Tāngata Whenua Values	All Objectives	S5, S6(e) and (g), S7(a), S8	Cultural
5. District/Regional Plan Fit/Consentability	Reducing Adverse Environmental Effects/Economic Growth and Productivity/Urban Planning Principles	S5, S104, S171	All aspects

[6] The LTMA includes an overall objective and requires that NZTA exhibits a sense of social and environmental responsibility and acts in a transparent manner (section 96), and incorporates the Crown's responsibility to take appropriate account of the principles of the Treaty of Waitangi (section 4).

Criterion	NZTS Objective*, and GPS** Priorities, Impacts and Principles	Examples of relevant RMA Aspects	LGA Sustainable Development Principle (S14)
6. Fit to Project Objectives	All Impacts and Principles	S5, S7(b), S171	Social/Economic
7. Social/Community Impacts	Reducing Adverse Environmental Effects/Access and Mobility/Positive Health Outcomes/Urban Planning Principles	S5, S7(c)	Social
8. Engineering Degree of Difficulty	Environmental Sustainability/Economic Growth and Productivity	S5	Environmental/ Economic
9. Cost	Economic Growth and Productivity, Value for Money	S5, S7(b)	Economic

* New Zealand Transport Strategy (current version, 2008).

**Government Policy Statement on Land Transport Funding 2012. The focus is on strategic priorities of economic growth and productivity, value for money, and road safety, but alongside these strategic goals are set out a series of "short to medium term impacts" to be achieved.

Consideration was given to a criterion around staging as emphasis has been placed on this attribute for this project by the Agency; however this was considered to be adequately included in the project objectives category.

Other criteria used previously, productive land use and specific landowner effects, were not included as specific criteria due to the general similarity of the land uses in the areas potentially affected and to simplify the decision making process. Effects in the former category were considered under Criterion 5 and the latter were considered under Criterion 7.

3.2.3 Description of Criteria

The scope and extent of each criterion was initially determined by the specialist, or person who had investigated the aspect, and fully discussed and confirmed at the workshop. A brief description follows.

1. **Landscape/Visual** – This took into account existing landscape character (including degree of modification and presence of structures), route length and presence of dwellings nearby, any outstanding landscape or natural character components, and important landscape/natural features.

2. **Ecology** – This criterion focused on terrestrial ecology values[7], particularly those relating to patches of indigenous vegetation which are nationally, regionally or locally significant in terms of habitat values and presence of known species.

3. **Archaeology/Heritage** – This criterion took into account presence of known archaeological and heritage sites and features, and also archaeological risks (i.e. the likelihood of encountering archaeological sites).

4. **Tāngata Whenua Values** – This took into account Maori owned land and the range of cultural values including values relating to the natural environment (waterways and wetlands, areas of indigenous vegetation), key areas of settlement (marae, papakainga) and use (food gathering areas), and known wāhi tapu.

[7] While aquatic ecological values were considered, it was determined that effects would be localised and similar between all options. They would be largely mitigated through design and managed through the construction stage.

5. **District and Regional Plans and Consentability** – This criterion includes consideration of both zoning and plan objectives and policies, and any major impediments through the plans to a route location.

6. **Fit to Project Objectives** – This criterion covered levels of service, and efficiency and effectiveness (in terms of best value solutions). The assessment took into account the local network and the various state highway components including the ability to stage development over time.

7. **Social/Community Impacts** – This incorporated a range of considerations including severance effects, access to and from settlement areas and townships, general urban amenity, connectivity to community services and facilities, recreational effects, and construction impacts. Also considered were direct effects on land including dwellings.

8. **Engineering Degree of Difficulty** – This was assessed on the basis of physical components such as volume and balance of earthworks (cut and fill suitability / issues with materials), structures, temporary works, access management, risks around "unknowns", additional provisions to address natural hazards such as hydrological impact, flooding, geology and general degree of difficulty in construction.

9. **Costs** – Based on $ per km plus an allowance for interchanges and local road connectivity.

In assessing options, reasonable mitigation was taken into account. It was also assumed that all options would include adequate provision for property access and local connectivity (to allow for reasonable continuation of established patterns such as journeys to school and other local services).

There are 9 assessment criteria, which is an acceptable number[8]. The number and scope of the criteria were confirmed by the workshop.

It was noted at the workshop that there was some potential for double counting, particularly with constructability and cost, aspects of social assessment (e.g. visual impact and social impacts), and archaeology/heritage and tāngata whenua values. It was decided that these issues could best be handled during the scoring and weighting discussions. It was also noted that in some cases, the same aspects could justifiably be assessed under two criteria (such as the separate heritage and cultural values associated with some marae and urupa, and the separate ecological and cultural values of streams, waterways and bush). The possibility of removing cost from the analysis and considering it as a separate item was also raised.

It was also noted that, in general terms, there were likely to be benefits in aligning separate transport mode routes into a corridor through this area; i.e. co-locating the main road and rail routes. This would limit the spread of effects such as noise, local air quality and severance and was therefore most likely to be addressed under Criterion 7.

3.2.4 Scoring System

For the multi-criteria analysis, the scoring system moved from the provisional assessment provided by the specialists, to a five-point numerical system, as set out in Table 3 on the following page.

[8] Eight to twelve criteria is the ideal. With an increasing number of criteria, each criterion reduces in importance and it can become difficult to distinguish between options.

Table 3-2: Basis for Scoring Used in the Multi-criteria Analysis

Score	Description
1	The corridor option presents few difficulties on the basis of the criterion being evaluated, taking into account reasonable mitigation proposals. There may be significant benefits in terms of the attribute.
2	The corridor option presents only minor areas of difficulties on the basis of the criterion being evaluated, taking into account reasonable mitigation proposals. There may be some benefits in terms of the attribute.
3	The corridor option presents some areas of reasonable difficulty in terms of the criterion being evaluated. Effects cannot be completely avoided. Mitigation is not readily achievable at reasonable cost, and there are few or no apparent benefits.
4	The corridor option includes extensive areas of difficulty in terms of the criterion being evaluated, which outweigh perceived benefits. Mitigation is not readily achievable.
5	The corridor option includes extreme difficulties in terms of achieving the project on the basis of the criterion being evaluated.

3.2.5 Decision Process

The structured workshop proceeded in accordance with the process set out in in this report and the background information provided in Appendix B. The workshop results and analysis are further outlined in section 6 of this report.

The Grey alignment was identified after the workshop as a result of consideration of options that did not tie into the preferred SH1-SH57 Connection. The Delphi technique was used to add this option to the assessment. This involved asking workshop participants by email to score the additional route. The workshop participants responsible for criteria provided scores for all the criteria. The scoring was undertaken in accordance with the process in section 3.3 of this report, and is incorporated in the discussion of the analysis in the next section.

3.3 Analysis and Outcomes

3.3.1 Scoring Process

The scoring process was done on the basis of a structured workshop involving six participants:

- Phil Peet, MWH, Team Leader
- Marten Oppenhuis, MWH, Design Manager
- Sylvia Allan, sub-consultant to MWH, Planning and Consultation Leader
- Steve Kerr, MWH, Planner
- Maggie Buttle, NZTA, Project Manager (standing in for Jo Draper)
- Susan Rawles, NZTA, Planner

The necessary protocols were followed to ensure that the outcome would be as reliable as possible.

Following preliminary discussion[9], the interchanges were scored first, followed by the northern options then the southern options. For every set of options, each criterion was described and discussed by the presenter, identifying issues relating to each option. This was followed by questions and discussion.

The workshop then proceeded to the evaluation stage, giving each option a specific score for each aspect. Each aspect was evaluated for all options in turn. This was to encourage a balanced view of the relative merits of each option for each aspect before moving to the next aspect. To avoid patterning, the order of scoring options was varied each time a new aspect was evaluated.

Morrie Love attended a later meeting to review the cultural and archaeological scores, which resulted in a small number of minor changes in initial scores for those criteria.

The outcomes are presented in Tables 6-1 to 6-3 with key points from the discussions outlined after each table.

Table 3-3: Scoring of Options – Interchange Options

Option	Landscape/ Visual	Ecology	Archaeology/ Heritage	Tangata Whenua	District Plan/ Consentability	Project Objectives	Social/ Community	Eng. Degree of Difficulty	Cost
U – South of Waikawa Beach Rd	4*	3	2	2	2[&]	2	2	3	3
V – South of Whakahoro Rd	3	2	2	4[%]	2	2	2	2	2
W – South of Kuku Beach Rd	3[#]	2	2	2	2	1	3	2	2

* Would be 5 if on Brown alignment due to impact on Manakau
[#] If on Brown would force a new alignment to be considered as it couldn't fit in the proposed location.
[%] Would be 2 if on Brown alignment due to avoiding some Maori land.
[&] Would be 4 if on Green alignment as it would impact on Manakau

Landscape. Option U passes through a higher quality environment (refer Isthmus Landscape maps).
Ecology. U scored worse as the link road from the interchange to Takapu Road has significant impact on the existing stream network.
Archaeology/Heritage. No specific sites identified. A low to medium risk of sites being accidentally discovered.
Tangata Whenua Values. V has the greatest impacts on Maori owned land. This would revert back to a 2 if this was located on the Brown alignment.
District and Regional Plan and Consentability. No difference between options. If U was located on the Green alignment then score would be 4 due to greater proximity to Manakau.
Fit to Project Objectives. There was found to be little difference between options. Staging only likely to be possible with W - hence this option scores best.
Social/Community Impacts. W results in the greatest distance between interchanges and therefore the greatest travel time impacts for local traffic. If U was located on the Green alignment then score would be 4 due to greater proximity to Manakau.
Engineering Degree of Difficulty. U is likely to be more difficult as it is in an area of undulating land and waterways.
Cost. U is likely to be more costly as it is in an area of undulating land and waterways.

[9] This included an outline of the options proposed, a presentation on the multi-criteria analysis methodology to be applied, and a discussion which confirmed the appropriateness and content of the various criteria.

Based on the scores above, the major differentiator between options is Tangata Whenua values.

As mentioned earlier, there is a possibility that if an interchange is progressed at location W, then another interchange could be required between W and Otaki at some point in the future to service Manakau and the surrounding area. The distance between those two locations is over 10km.

Table 3-4: Scoring of Options – Northern Alignment Options

Option	Landscape/ Visual	Ecology	Archaeology/ Heritage	Tangata Whenua	District Plan/ Consentability	Project Objectives	Social/ Community	Eng. Degree of Difficulty	Cost
Brown (with Option 7A at SH1-SH57)	4	3	2	4	3	2	2	3	4
Grey (with Option 7A at SH1-SH57)	3	3	2	4	3	2	2	3	4
Red	3	3	3	3	3	2	2	2	2
Magenta	2	3	3	3	3	2	2	2	3
Blue	2	3	3	3	3	2	2	2	3
Orange	3	3	2	3	3	2	3	2	3
Dashed Orange	3	3	2	4	3	2	2	2	3

Landscape. Alignments that run parallel to the rail scored better as they fit better within the existing landscape. Red scores well except at the southern end where it dissects two parts of the Manakau community.
Ecology. All routes cross the Waikawa Stream and avoid significant areas of bush.
Archaeology/Heritage. Slight differences in likelihood of impacting on unknown sites (refer Archaeology report for SH1-SH57 interchange).
Tangata Whenua Values. Orange alignment minimises the effect on Maori land near Kuku Beach Road. Red has less impact on Maori land but is closer to Wehi Wehi Marae.
District and Regional Plan and Consentability. Mostly based on Ecology. All routes cross the Waikawa Stream and avoid significant areas of bush.
Fit to Project Objectives. Brown and Orange enable staging, but it is noted that safety is impacted if staging occurs. Length will be considered once northern and southern aspects considered together.
Social/Community Impacts. Orange scores worse because of its effects on houses on Kuku Beach Road.
Engineering Degree of Difficulty. Little difference between options. Brown scores worse due to the multiple crossings of the Ohau River, with the southern one being in a difficult location.
Cost. Brown most costly due to two river bridges and increased length of highway and local road required. Red is the cheapest due to it being the shortest route.

Table 3-5: Scoring of Options – Southern Alignment Options

Option	Landscape/ Visual	Ecology	Archaeology/ Heritage	Tangata Whenua	District Plan/ Consentability	Project Objectives	Social/ Community	Eng. Degree of Difficulty	Cost
Brown	5	3	3	2	3	2	4	3	5
Green East	5	3	4	2	3	2	4	3	4
Green West	4	3	4	2	3	2	4	3	4
Purple	3	4	2	3	4	2	3	3	4
Purple/Light Blue	3	4	2	2	4	2	3	3	4
Light Blue	3	3*	2	2	3*	2	1	3	2
Yellow	3	3*	2	3	3*	2	2	3	3

*This could increase to 4 depending on the extent of the impact on the wetlands.

Landscape. Area east of highway has significant natural character. Green routes cut across sensitive area at Atkins Road.
Ecology. Brown route is close to Pukehou Hill. Both green routes cross wetlands near Gleesons Road. Purple crosses middle of wetland. Yellow and Light Blue may substantially avoid wetland but this needs to be confirmed.
Archaeology/Heritage. Green routes cross through sensitive Atkins Road area. Light Blue is near an old homestead. Some routes also pass close to Pukehou Hill.
Tangata Whenua Values. Purple and Yellow affect two Maori owned land parcels.
District and Regional Plan and Consentability. Similar to Ecology as no other issues identified.
Fit to Project Objectives. All routes similar as there are no significant staging opportunities at this location. Length will be considered once northern and southern aspects considered together.
Social/Community Impacts. Eastern options have significant effect on Manakau township.
Engineering Degree of Difficulty. Little difference as all options traverse undulating terrain and wetlands.
Cost. Light Blue and Yellow score best mostly due to shortest length.

With the above scoring it has been assumed that the Light Blue alignment can be altered to the east to avoid the bush area at Forest Lakes Road. Also that the Brown, Green and Light Blue alignments at the southern end would be moved slightly east to enable one row of properties to continue to access the current state highway.

3.3.2 Weighting

After reviewing the scoring, the workshop discussed the weighting system to apply. The weights arrived at are presented in the table below. This can be regarded as the agreed view of the key technical and specialist advisors involved in the project. The workshop was aware that additional analyses would be undertaken as a later stage, along with sensitivity analysis applying the different scores elicited at the workshop.

Table 3-6: Weighting of aspects

Landscape/ Visual	Ecology	Archaeology/ Heritage	Tangata Whenua	District Plan/ Consentability	Project Objectives	Social/ Community	Eng. Degree of Difficulty	Cost
5	6	5	7	6	10	7	8	8

All criteria were considered important enough to be given substantial weight. The most important aspects were considered to be the alignment with the project objectives as this is critical in progressing the project. The next highest weightings were given to engineering degree of difficulty and cost.

Weighting systems are usually much more challengeable than scoring, as they can be readily developed from a range of different perspectives. Thus a single result is always vulnerable to criticism that the weighting system is wrong. An alternative means of investigating the robustness of a preference is to subject the scoring to a range of weightings and review the outcomes in terms of their consistency and range of differences.

To analyse the route option preferences, a range of weighting systems was developed subsequently. These are shown in Appendix C and are described in general terms below. Note that the first weighting system is the only one subject to discussion by a group. The other five systems have been developed by Allan Planning and Research on the basis of understanding a range of possible relevant considerations[10].

- **Workshop Weighting** – this weighting was developed in discussion and agreement at the workshop and could be described as the technical view of the Agency's project advisors. See above.
- **RMA Section 6 Emphasis Weighting** – this places maximum weight on three of the four section 6 RMA aspects potentially at play in respect of the project (ecology, heritage and tāngata whenua values). Landscape values have not been elevated to the same level in this analysis, as "outstanding" qualities and elements were not identified in the area affected by the route options by the specialist involved, and it would thus be inappropriate to elevate them to a very high weight. Some weight is placed on the district plan analysis in this case, as reflective of section 6 matters, but other criteria are left at low levels.

The remaining weighting systems are related to quadruple bottom line considerations. The analysis on this basis is relevant to matters to be taken into account under the LTMA and other national infrastructure policy approaches. It is also pertinent to RMA and LGA considerations.

- **Social** – all criteria have a social component, so all are given some weight. The highest weighting is given to social and community impacts, followed by tāngata whenua and archaeological risk aspects which have a high social component in this area, ownership effects and district plan considerations. All other criteria have some social relevance in this productive rural area, with engineering aspects least relevant.

[10] This type of process has been applied in similar analyses for major infrastructure in the past, to ensure robustness in analysis.

- **Environment** – this places the highest weight on the physical environmental element of ecology, with other criteria which integrate physical environmental considerations with social/community values also given some weighting. Criteria without a physical environment component are omitted.
- **Cultural** – this highly weights tāngata whenua cultural values and archaeology/heritage, followed by ecological and social/community impacts but also acknowledged cultural significance in the established rural landscape and its settlement pattern, and its remaining ecological values, which have a cultural dimension through their protected status.
- **Economic** – this excludes a number of criteria which have little or no direct economic bearing on the project or the local economy. It emphasises cost and productive land uses, but applies some weighting to other criteria with an economic component[11].

3.3.3 Analysis

The six weighting systems have been applied to the workshop scores set out in Section 3.3.1, and are shown tabulated in Tables 3-7 to 3-9 below. Lowest weighted scores indicate the preferred option. The results can be seen graphically in Appendix C.

The same analysis was performed without the cost scores included. This did not change the preferences in the tables below. Results are also shown graphically in Appendix C.

Table 3-7: Analysis of Interchange Options (scores x weights for different weighting systems)

Option	Workshop	RMA S6	Social	Environmental	Cultural	Economic
U – South of Waikawa Beach Rd	2.52	2.52	2.40	2.95	2.39	2.60
V – South of Whakahoro Rd	2.31	2.52	2.37	2.52	2.76	2.00
W – South of Kuku Beach Rd	2.03	2.14	2.18	2.24	2.30	2.00

The analysis shows that Option W is the preferred option.

However, it is noted that difference in scores between V and W is almost purely due to Tangata Whenua values. Hence consideration should be given to further development of Option V to reduce impact on Maori land.

One of the major benefits of Option V that wasn't taken into account in the MCA analysis is the overall layout of the roading network between Otaki and Levin. Option V provides better separation of interchanges and better access to Manakau. Hence if an alternative to Option V is developed which avoids the majority of Maori land, this is likely to be considered preferable to Option W.

[11] This quadruple bottom-line weighting is a different type of evaluation from the Benefit Cost Ratio (BCR) evaluation normally undertaken by NZTA.

Table 3-8: Analysis of Northern Options (scores x weights for different weighting systems)

Option	Workshop	RMA S6	Social	Environmental	Cultural	Economic
Brown (with Option 7A at SH1-SH57)	2.97	3.06	2.91	3.24	3.00	3.00
Grey (with Option 7A at SH1-SH57)	2.89	2.94	2.82	3.00	2.85	3.00
Red	2.47	2.82	2.60	3.00	2.85	2.00
Magenta	2.52	2.74	2.60	2.76	2.70	2.40
Blue	2.52	2.74	2.60	2.76	2.70	2.40
Orange	2.63	2.72	2.72	2.86	2.70	2.60
Dashed Orange	2.63	2.86	2.68	3.00	2.85	2.40

Magenta and Blue are very similar alignments and this is reflected in the scores which indicate these are equal and preferred under four of the six weighting systems. These options consistently scored best or second best. The Magenta alignment was taken through to the next stage of optioneering as it keeps the alignment closer to the railway and this provides a better outcome in terms of landscape / urban design and the potential for staging.

The Red alignment also scored well under three of the six weighting systems and is worthy of further consideration as it provides an alternative linking point at Waikawa Beach Road. This is particularly important if the preferred southern options connect at this location.

Table 3-9: Analysis of Southern Options (scores x weights for different weighting systems)

Option	Workshop	RMA S6	Social	Environmental	Cultural	Economic
Brown	3.26	3.14	3.30	3.33	3.15	3.80
Green East	3.21	3.30	3.35	3.48	3.45	3.40
Green West	3.13	3.18	3.26	3.24	3.30	3.40
Purple	3.08	3.10	3.09	3.33	2.79	3.20
Purple/Light Blue	2.97	2.90	2.95	3.19	2.48	3.20
Light Blue	2.29	2.40	2.19	2.71	2.09	2.00
Yellow	2.65	2.70	2.60	2.86	2.55	2.60

The Light Blue alignment scored consistently best under all weighting systems as it avoids all major impacts. Yellow also scored well but had a greater impact on Maori land and hence Tangata Whenua values.

A sensitivity test was undertaken to determine if the impacts of the Light Blue and Yellow options on the wetland result in the scores for these options increasing. This didn't change the overall result of Light Blue being the preferred option overall; it still ranked first under each rating weighting system.

Light Blue, Yellow and Purple/Light Blue were carried forward for further analysis as these provide the best scoring routes and connections to both crossing points on Waikawa Beach Road.

3.3.4 Combined Route Analysis

Based on the above, northern and southern alignments were brought together to form continuous routes. Magenta and Red were brought forward from the northern section and Light Blue, Yellow and Purple/Light Blue were brought forward from the southern section to provide three potential alignments.

The analysis was undertaken independently of the location of the main interchange, analysed earlier (see Table 6-5 and associated discussion). It is noted that the W interchange location would be extremely difficult to create on the Magenta and Red alignments due to the proximity of the rail line in this location; this re-enforces the need to consider an alternative to Option V that avoids the majority of Maori land.

The MCA scores in the table below are the northern and southern scores combined. The Workshop weighting is shown as a representative outcome and is presented alongside the overall length of the respective route for both SH1 and SH57 traffic. This is a very important consideration as it impacts on the overall cost of the project, the likely benefits that could be achieved and the overall fit with the overall RoNS and project objectives. While these considerations were all embedded within the MCA process, the Agency wished to be sure that the analysis had sufficiently reflected the aspects directly associated with project length.

The SH1 length is taken as the distance from Taylors Road to the Ohau River via SH1. The SH57 length is taken as the distance from Taylors Road to Muhunoa East Road via SH1 and SH57.

Table 3-10: Analysis of Combined Options

Option	**MCA Score** (Workshop weighting)	**SH1 Length** (existing 12.6km)	**SH57 Length** (existing 14.3km)
Magenta & Light Blue	4.81	12.2	13.1
Magenta & Yellow	5.17	11.9	12.9
Red & Purple/Light Blue	5.44	12.0	13.0
Grey & Purple	*5.97*	*12.2*	*12.3*

The table above shows that the three preferred routes from the MCA analysis process have similar lengths for both the SH1 and SH57 routes.

Although not preferred in the MCA process, the Red & Purple/Light Blue alignment was brought forward as being the best route that goes through Waikawa Beach Road closer to Manakau. The length analysis shows this as being longer as well as scoring slightly worse under the MCA process than the Magenta & Yellow route.

For comparison purposes, the shortest route - Grey & Purple - is also included in the table above. Whilst the length is similar for SH1 traffic, it is substantially shorter for SH57 traffic, which is a particular benefit if this route was to become a Levin Bypass at some point in the future.

As a sensitivity test, the Project Objectives scores were back calculated to determine what differential of score this route would need to obtain in order for it to be the preferred route under the MCA analysis.

It was determined that even if the Grey route scored a one in the northern section and the Magenta route scored a four, the Magenta would still be preferred in three of the seven weighting scenarios (the Grey would be preferred in three and they would be tied in one). This scoring differential could not be achieved, and therefore there is no basis for the Grey route to be progressed further.

3.3.5 Findings from Analysis

The overall conclusion from the multi-criteria and subsequent analysis is that the Magenta & Light Blue and Magenta & Yellow routes are preferred in terms of the range of matters that contribute to decisions on route preferences under various legislative requirements. It is, however, also considered that the Red & Purple/Light Blue route should be retained for further investigation. The Blue route at the northern end also scored well, and will be considered for inclusion in future analyses.

The analysis clearly shows that the Brown and Grey routes at the northern end and the Brown and Green routes at the southern end have a number of factors which means that they can be discarded at this stage of analysis.

The MCA analysis shows that Option W is the preferred interchange location; however the difference in scores between Option W and Option V was predominantly due to Tangata Whenua values and Option V provides better separation of interchanges and better access to Manakau. Hence if an alternative to Option V is developed which avoids the majority of Maori land, this is likely to be considered preferable.

It should be noted that Option W is incompatible with the Magenta and Red alignments due to it needing to be away from the railway line, i.e. placing Option W on either of these alignments would mean that they would shift onto the Orange route.

The outcome of the analysis can assist both the community and the Agency in that it provides an understanding of the range of aspects that need to be taken into account when considering route options, and provides more detailed levels of information about these aspects. For the Agency, recognising that multi-criteria analysis is an aid to decision-making, but does not make the decision on behalf of the NZTA, it will provide assistance in determining the preferred option to proceed with.

3.3.6 Discussion

In finalising the analysis, it was acknowledged that there are two particular areas for which the project team would have preferred to have further information. These were Tangata Whenua values and the level of development east of Manakau.

3.3.6.1 Tangata Whenua Values

In regards to Tangata Whenua values, it is acknowledged that on the SH1-SH57 Connection project, Option 7A is currently preferred over Option 5A by Te Iwi O Ngati Tukorehe. The project team recognises that the method used to determine the Tangata Whenua Values scores under the MCA may not reflect the values of Te Iwi O Ngati Tukorehe.

Accordingly, Cultural Impact Assessments are being commissioned from Te Iwi O Ngati Tukorehe and Te Iwi O Ngati Wehi Wehi. Once these are completed, the MCA will be updated both for the SH1-SH57 Connection and for the Taylors Road to Ohau section and this report will be re-issued.

Details of the analysis and outcomes are provided in an Addendum Report in Appendix E.

3.3.6.2 Development East of Manakau

There have been a number of new residential subdivisions developed in the time since the original MCA on the Otaki to Levin expressway options was undertaken. Accordingly, it was considered that members of the project team should undertake a site visit to determine how much additional housing has been developed, particularly east of Manakau and in the Manakau Heights area.

Margaret Buttle, Sylvia Allan and Phil Peet undertook a site visit on Tuesday 16 September. Aerial photographs were annotated with the location of new dwellings or developments.

In summary, it was determined that there have been a number of new houses built in the already subdivided areas of Manakau Heights (both north and south of South Manakau Road). However, no further building or subdividing was evident immediately east of Manakau. It was considered by those on the site visit that the level of development was not so great as to affect the possibility of a route being constructed in this area, nor would it change the scores agreed to during the MCA workshop.

4 Staged Implementation

The Multi Criteria Analysis has determined the routes that are worthy of further investigation. However, for each of these options, there are different possibilities for how these would be implemented. It was clear from the original work on the Otaki to north of Levin Expressway that there are no significant congestion problems on the network currently, and none are forecast to develop during the 30 year modelling horizon. Accordingly, options for staging the long term route between Taylors Road and Ohau River need to be considered.

There are three overall possibilities for staging as outlined below. All of the possibilities would still include the construction of the Manakau and Ohau Township Safety Improvements in 2014/15.

Four Lanes in Short Term - This comprises building four lanes from Taylors Road to Ohau River on one of the preferred alignments, plus the SH1-SH57 connection in 2019. No further improvements within the 30 year period.

Two Lanes in Short Term - This comprises building two lanes from Taylors Road to Ohau River on one of the preferred alignments, plus the SH1-SH57 connection in 2019. As the route would be only two lanes, at-grade intersections would be constructed rather than at-grade interchanges. The route would be upgraded to four lanes plus grade separation in 2044

Geographically Staged – This comprises building the SH1-SH57 Connection and safety improvements through Forest Lakes in 2019 then the remainder of the Taylors Road to Ohau Four Laning in 2044.

Based on the preferred alignments identified through the MCA process, there is no real opportunity to geographically stage the works other than have the SH1-SH57 Connection as the first stage and the remainder as the second stage. This is because the alignment stays west of the current SH1 between south of Whakahoro Road and Forest Lakes Road and it would not be easy or logical to connect back into the current highway in between these locations.

Further discussion of the impacts of a geographically staged implementation is provided in Appendix D. The two main areas of concern are retaining the existing Pukehou Rail Overbridge, which is narrow and on a sub-standard alignment, and finding a safe and appropriate layout for the SH1/Kuku Beach Road intersection. Geographically staging the works will result in some redundant construction at the southern end of the SH1-SH57 connection and at Forest Lakes, but the latter could be minimised depending on the option progressed.

For either type of staged implementation, it is noted that the northern end of the Peka Peka to Otaki Expressway includes a two lane bridge over the Otaki River. This will need to be duplicated in the future to provide a full four lane route.

5 Economic Evaluation

To help determine the preferred method of implementation, economic analysis was undertaken on the different staging possibilities as presented in the previous section. The economic analysis assumes the Magenta and Light Blue route, however, all of the preferred options would have similar outcomes.

5.1 Traffic Modelling

Traffic modelling was undertaken using the Otaki to north of Levin SATURN model for the morning peak, evening peak and inter-peak periods for the years 2011, 2016, 2021, 2026 and 2041.

No further traffic modelling was undertaken for the Do Minimum and the SH1-SH57 option (i.e. the first stage of the geographically staged possibility) as this was undertaken previously for the SH1-SH57 Connection Scoping Report. It is acknowledged that this did not include the Forest Lakes safety improvements; however the travel time and vehicle operating cost benefits of this project are limited and will therefore have minimal impact on the model outputs.

The model was re-run for the four lane option, based on the modelling philosophies developed through previous stages of the project.

The model was not run specifically for a two-lane option. Based on the lack of congestion on the Do-Minimum network, and results from previous modelling analysis[12], it is considered that a two-lane option will perform similarly to a four lane option.

Further information outlining the SATURN do-minimum network and validation are outlined in the following reports:

- Otaki to North of Levin Scoping Report, MWH, July 2012
- Otaki to North of Levin Validation Report, MWH, September 2013

5.1.1 Model Outputs

The evening peak results for 2016 and 2041 (as the heaviest demands on the network) are presented in the graphs below. Results for 2016 rather than 2011 are presented, because no option runs were undertaken for 2011 as the options are not planned for construction until at least 2016. It is these results for distance travelled and travel times which are key inputs to the economic evaluation, along with other inputs such as crash analyses which also use model results for volumes on various road links.

[12] In fact, the staging assessment at the end of the North of Otaki to North of Levin Scoping Report showed that the two lane option for the entire length of the study area performed better than the four lane option due to its increased connectivity with the local road network.

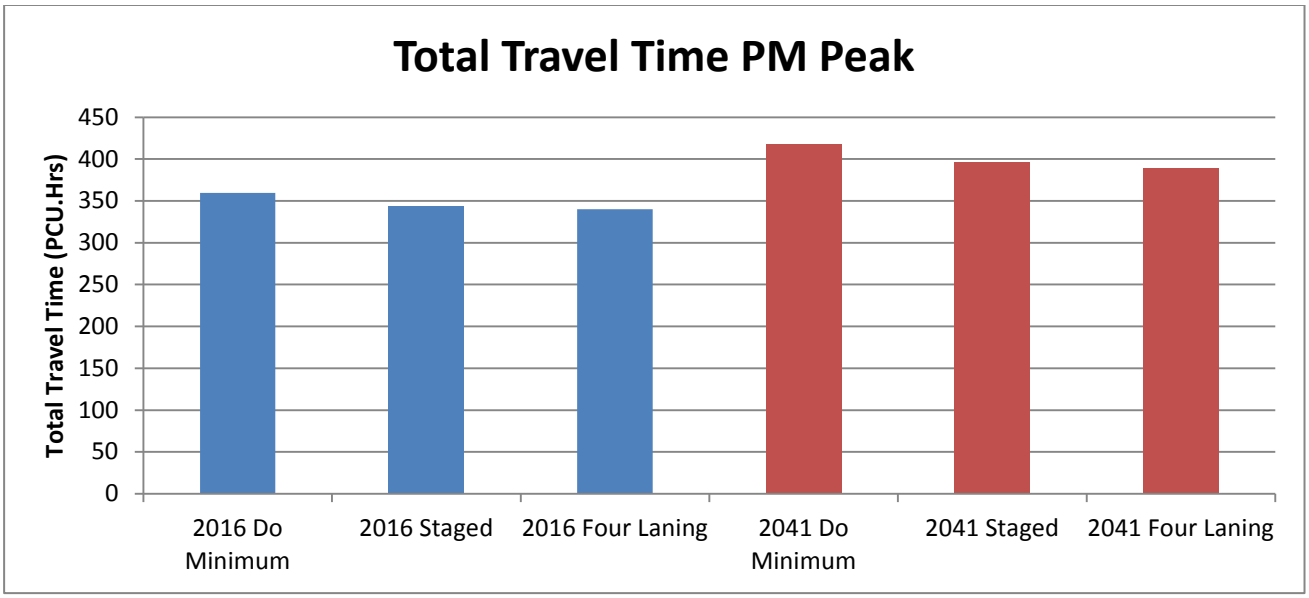


Figure 5-1: Total Travel Time – PM peak

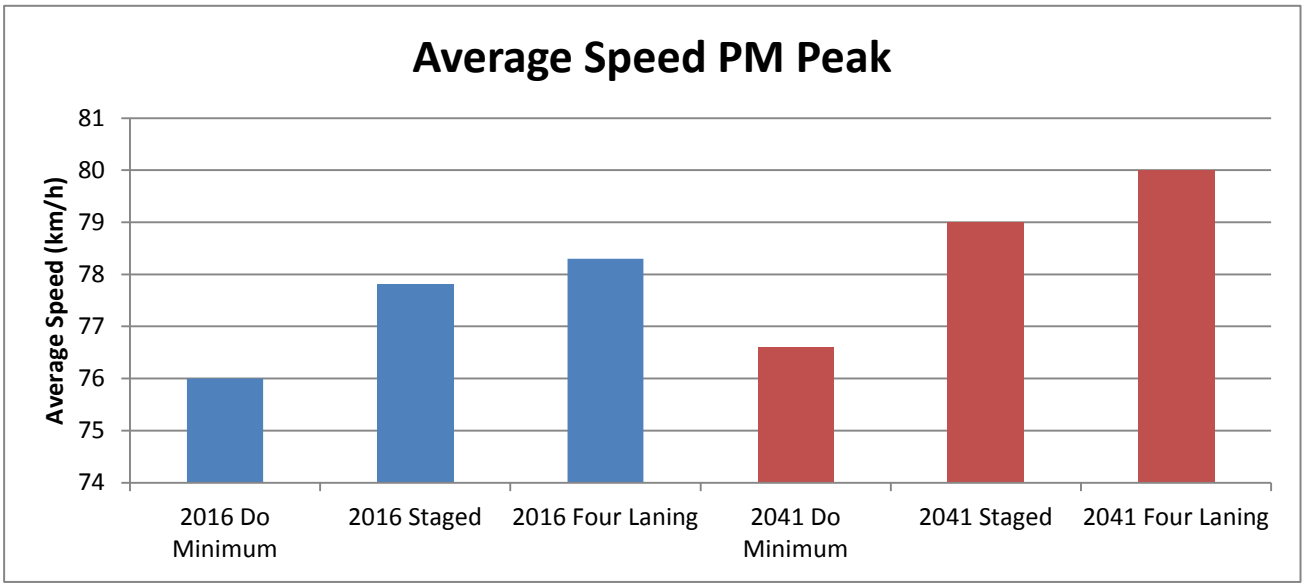


Figure 5-2: Average Speed – PM Peak[13]

[13] The average speed in 2044 is higher than in 2016 as there is predicted to be growth on the state highways but not on the local roads. As the state highways have higher average speeds, and are not predicted to have any level of congestion, this then brings up the average speed for the entire network.

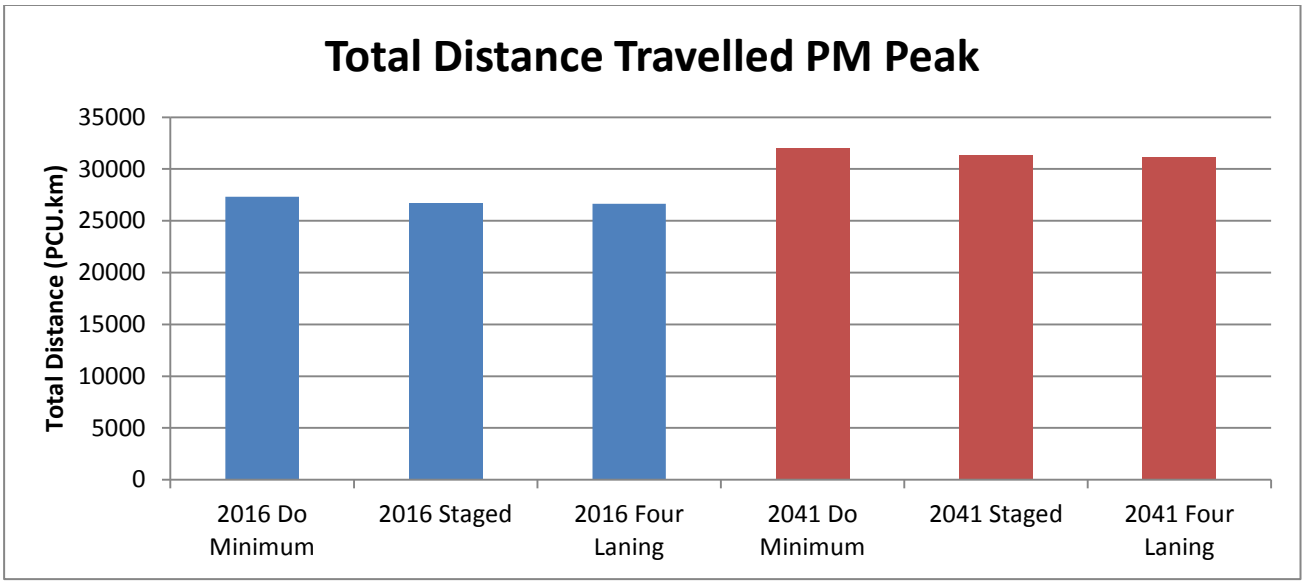


Figure 5-3: Total Distance Travelled – PM Peak

The results from the modelling show some benefits for the four laning over the short to medium term improvements.

The four lane modelling shows a decrease in travel time, an increase in speeds and a small reduction in distance travelled. However, none of these improvements are particularly large, which reflects that there is not an existing capacity concern; the benefits are predominantly from route shortening. The projects also result in some rerouting occurring on the local road network which is dampening the benefits.

5.1.2 Route Travel Times

The model was also interrogated to determine the travel times that would be expected for key trips on the highways once the route was constructed. This is presented in the table below for the Do Minimum and the options. The absolute travel times are shown for the Do Minimum but the difference in travel time between the options and the Do Minimum is shown for each of the options.

Table 5-1: Route Travel Time Differences

			Travel Time or Travel Time Difference (seconds)	
Option	**Route**	**Direction**	**2016 PM**	**2041 PM**
Do Min	Route 1	Northbound	1,381	1,391
	Route 2	Northbound	843	854
	Route 3	Northbound	1,370	1,383
Geographically Staged	Route 1	Northbound	-28	-33
	Route 2	Northbound	-28	-33
	Route 3	Northbound	-338	-344
Four Lane	Route 1	Northbound	-68	-78
	Route 2	Northbound	-68	-78
	Route 3	Northbound	-380	-391

Route 1: Taylors Road (SH1) to Manawatu River (SH1)

Route 2: Taylors Road (SH1) to Queen Street, Levin (SH1)

Route 3: Taylors Road (SH1) to Potts Hill (SH57)

Shaded cells indicate savings in travel times compared to the Do Min network

The table above shows that in 2016 the four laning option has approximately 40 seconds of travel time saving for vehicles using the highways to travel through the study area on SH1 (Route 1 in the table) and SH57 (Route 3), compared to the short term improvements

In 2041, this travel time saving increases, but only by a few seconds, which reflects that the model is not predicting a decrease in travel time either on the Do Minimum network or the short term improvements network in the next 30 years.

5.2 Economic Evaluation

5.2.1 Basis of Economic Analysis

Economic analysis was carried out in accordance with the 2013 version of NZTA's Economic Evaluation Manual (EEM) using the outcomes of the SATURN transportation model.

The following assumptions have been made in the calculation of the Benefit Cost Ratio. They are:

1. Time zero is 2013, with the start of benefits in 2017.
2. A 40 year analysis period and 6% discount rate has been used and reported. Note that this is different from previous analyses so the values in the tables below will differ from previous reports.
3. The crash analysis has been undertaken for the five calendar year period January 2009 – December 2013 and considers the following:
    a. Accident by Accident analysis for the Do-minimum scenario (i.e. Method A). The do-minimum crash cost for the five year period across the study area was calculated as $7.7m annually.
    b. Crash Rate for the Options (Method B) given there will be a fundamental change to the project area.
    c. The AADTs used in the accident analysis were estimated by applying factors of 2, 11.4 and 2 to the AM Peak, Inter-peak and PM Peak hour SATURN movement volumes, respectively. This is consistent with the figures used in the Opus Peka Peka to Otaki model.
4. The travel time and vehicle operating costs have been calculated from the SATURN transportation modelling. The travel time benefits were determined by using the queuing delays and link cruise times, and the vehicle operating cost benefits determined from the fuel use output.
5. As presented earlier in this report, the model was run for the years 2011, 2016, 2021, 2026 and 2041 and for the AM, Interpeak and PM periods. The daily benefits were calculated by using an assessed number of hours per day for each time period. Annual costs were linearly interpolated between modelled years.
6. Travel time benefits have been based on the uncongested and congested (queuing) value of time pertaining to Rural Strategic and Urban Arterial values, with a weighted average applied.
7. The Vehicle Operating Costs (VOC) were derived by applying the ratio of fuel to operating costs as given in the EEM for a Rural Strategic highway. The CO2 costs have been assessed as a percentage of VOC, based on the vehicle traffic composition.
8. As mentioned earlier, the model was not run specifically for a two-lane option. Based on the lack of congestion on the Do-Minimum network, and results from previous modelling analysis, it is considered that a two-lane option will perform similarly to a four lane option.

9. No benefits associated with walking and cycling facilities, congestion reduction or driver frustration has been claimed at this stage. Furthermore, no wider economic benefits have been considered as these are being evaluated on the entire RoNS corridor.

Economic evaluation worksheets are available on request.

5.2.2 Travel Time Analysis

The SATURN model outputs were used to determine the overall travel time values for the Do-Minimum and the options. The travel time benefits for each option, when compared to the Do-Minimum are shown below.

The expected travel time costs are shown in Table 5-2 below.

Table 5-2: Travel Time Benefits

Option	Travel Time Cost (PV)	Travel Time Savings (NPV)
Do Minimum	$442,986,000	–
Geographically Staged	$428,299,000	$14,757,000
New Route (Four Lanes or Two Lanes)	$424,211,000	$18,775,000

The above travel time saving reflects that of the model outputs; namely that the new route provides some, but not significant, additional benefits.

5.2.3 Vehicle Operating Costs

The vehicle operating cost savings for each option, when compared to the Do-Minimum, are shown below. An allowance has also been made for an improvement in roughness as part of the new pavement construction (assumed existing situation has a roughness of 85 NAASRA and the new construction would be 65 NAASRA). Carbon dioxide emission savings are also calculated using the VOC data.

The expected vehicle operation costs savings are presented in Table 5-3.

Table 5-3: Vehicle Operating Cost Benefits

Option	VOC and CO_2 Cost (PV)	VOC and CO_2 Savings (NPV)
Do Minimum	$252,420,000	N/A
Geographically Staged	$243,832,000	$8,588,000
New Route (Four Lanes or Two Lanes)	$243,312,000	$9,108,000

Whilst the shorter distance of the new route has vehicle operating cost benefits, the increased speeds of vehicles using the route pushes up the costs.

5.2.4 Crash Benefits

The SATURN traffic modelling outputs are used in the Crash Rate Analysis for the options. The crash benefits were calculated in a manner consistent with previous analyses, with the existing crash history brought up to date for the Do Minimum.

The expected crash cost savings are shown in Table 5-4 below.

Table 5-4: Crash Benefits

Option	Crash Cost (PV)	Crash Cost Savings (NPV)
Do-Minimum	$138,816,000	–
Geographically Staged	$87,937,000	$50,879,000
New Route (Four Lanes or Two Lanes)	$87,350,000	$51,466,000

As a consequence of project timing and the effect of discounting, the majority (approximately 60%) of the total present value (PV) option crash cost occurs due to the do-minimum in the seven years from time zero until completion of works. This therefore limits the potential crash cost differences between the options. It also shows that the sooner construction is completed the higher the BCR.

The difference in crash benefits between the options is mostly attributed to the length that is not treated by the short to medium term works in the geographically staged option. However, this stretch is only 2km long and does not have a large fatal and serious crash history.

5.2.5 Cost Estimate

Previous cost estimates were used for the SH1-SH57 Connection and Forest Lakes safety improvement projects.

No elemental cost estimate was undertaken for the four lane project. The project was instead estimated based on unit rates as follows:

- Construction of new four lane expressway - $17M per km
- Construction of new two lane expressway - $12M per km (includes earthworks for four laning)
- Construction of new local road - $1M per km
- Bridges $3,500 per m^2

These rates are consistent with other expressway projects recently priced by the Agency. In addition to the above, an allowance was also made for property and professional fees.

5.2.6 Benefit Cost Ratio Results

Table 5-5: Economic Analysis Summary

Option Description	Total Cost (NPV)	Total Benefits (NPV)	BCR
Geographically Staged	$96.7m	$77.1m	**0.8**
New Two Lane Route	$121.7m	$82.3m	**0.7**
New Four Lane Route	$173.8m	$82.3m	**0.5**

The BCR for the staged implementation option is lower than that presented in the SH1-SH57 scoping report primarily due to the additional costs of the four laning late in the analysis period. This additional cost decreases the BCR without the addition of equivalent benefits.

Table 5-6: Incremental BCR of Project Options

Option Description	Next Higher Cost Option	Incremental BCR	Base for Next Step
Staged Implementation	Four Laning	0.1	Staged Implementation

The low incremental BCR for the four laning over the staged implementation results in the staged implementation option being favoured economically.

5.2.7 Sensitivity Testing

5.2.7.1 Levin Bypass

Modelling was undertaken for the four laning with and without Levin Bypass Option 3B.

In summary, the benefits obtained for the Levin Bypass over the four laning are the same as the benefits obtained for the Levin Bypass over the SH1-SH57 connection. No wider network benefits are obtained by undertaking the projects together.

Therefore no further economic evaluation was undertaken on this test.

5.2.7.2 AM Peak modification

The modelling outputs presented some interesting results in the AM peak period. The model did not show as many benefits in this time period than for the inter peak and PM peak. Further interrogation of the model showed that this was due to rerouting of traffic within Levin on roads not affected by the proposed improvements.

To determine the likely effect on the BCR without these changes, the economic analysis was undertaken again assuming similar benefits in the AM peak to the PM peak. However, this increase was not enough to materially change the BCR.

5.3 Economic Analysis Conclusion

From the above analysis, it can be concluded that the four laning of SH1 from Taylors Road to Ohau River is not economically viable in the short term.

Based on the options presented earlier in this report, none are likely to have significantly greater benefits to the point that it would change this conclusion.

Accordingly, it is recommended that this project is staged geographically.

6 Conclusion

This report sets out the basis, process and findings of an analysis of alternative routes undertaken for the Transport Agency for four lane routes from Taylors Road to Ohau River as part of the Ōtaki to North of Levin RoNS project.

The process involved identification of options to an extent where their effects could be assessed in a preliminary manner, followed by a multi-criteria analysis process, involving best practice techniques such as decision conferencing through a facilitated workshop at which information about the options was shared and tested. As one option was identified later, this was subject to a Delphi analysis methodology. The outcomes have been analysed on the basis of a range of weighting systems, and have also been subject to further sensitivity analysis.

Based on the on the analyses, the Magenta & Light Blue, Magenta & Yellow and Red & Purple/Light Blue alignments should be retained for further investigation, with blue retained as part of a northern alignment option. All these routes utilise much of Option 5A for the SH1-SH57 Connection project and keep the overall route west of the existing SH1.

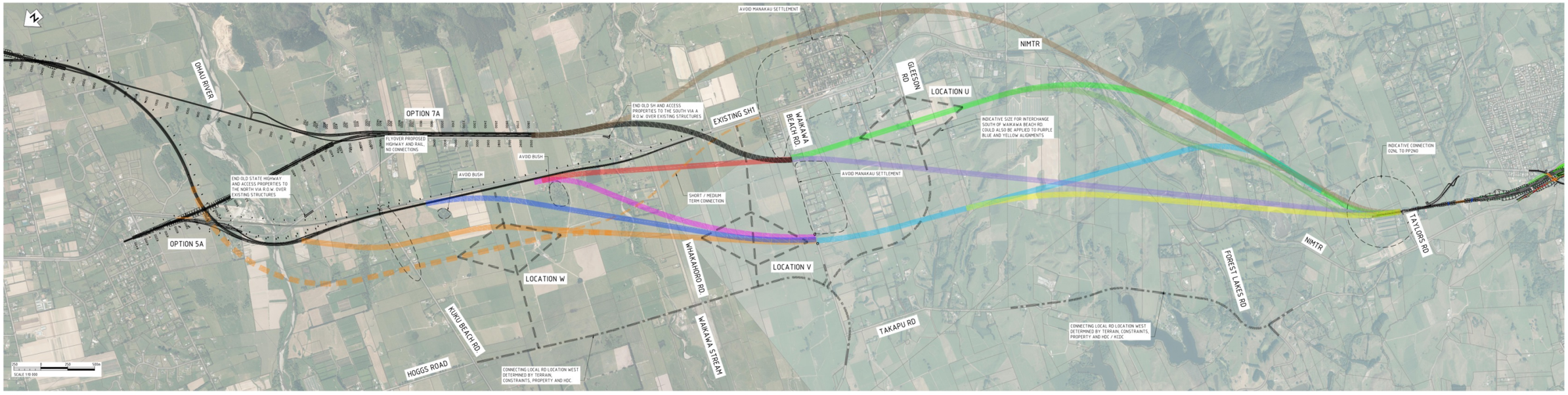
Further work commissioned into the cultural impacts of the SH1-SH57 Connection Options 5A and 7A has subsequently been received. The MCA was revisited in terms of this criterion. Results of the process are provided in and Addendum Report, included as Appendix E to this report.

Different possibilities for staging the four lane route were considered and subject to traffic modelling and economic analysis. From the analysis, the four laning of SH1 from Taylors Road to Ohau River is not economically viable in the short term.

Accordingly, it is recommended that the Agency continue with the detailed business cases for the SH1-SH57 Connection and Forest Lakes Safety Improvements as separate projects, but ensure that the projects give due consideration to the long term strategy of four laning between Otaki and Levin, which could be on any of the alignments noted above.

The information this report, and the analysis described above, will help contribute to a decision on the preferred alignment for the four lane route between Taylors Road and the Ohau River. It is considered prudent to continue to investigate the alignment for the four lane expressway to more accurately determine the likely route and therefore enable planning mechanisms to be put in place to ensure that it does not get “built out”. Even in the few years that the Otaki to Levin study has been underway, noticeable new development has occurred around the Manakau area in particular which has constrained the potential corridors for route options.

Appendix A Plan of Options



NOTE:
LINES REPRESENTING ALIGNMENTS ARE SHOWN AS APPROX. 50 m WIDE. ACTUAL IMPACT IS LIKELY TO BE APPROX. 50 - 100 m.
ALIGNMENTS ARE ALSO VERY DRAFT AND CAN BE ALTERED TO AVOID LOCALISED CONSTRAINTS.

Appendix B Workshop Background

Phil Peet

From: Phil Peet
Sent: Wednesday, 28 May 2014 9:34 p.m.
To: 'sylvia.allan'; Marten Oppenhuis (Marten.W.Oppenhuis@mwhglobal.com); Steve Kerr
Cc: 'Margaret Buttle'
Subject: Taylors Road to Ohau River MCA Workshop
Attachments: MCA Criteria.docx; Potential Alignments 80500902-05-001-SK001-REV-B.pdf; COMMENTARY ON RATING OF ATTRIBUTES - TW, HERITAGE, LU, REG DIST PLAN FIT.docx

Hi All,

As you are aware we are holding an MCA workshop on Wednesday to compare options for the above corridor.

Us four have been identified as the ones who will need to pull together the required information for the workshop.

All the information that you will need to undertake this analysis is attached to this email or is provided in links below.

1. A file note outlining the process and the categories (attached).
2. The outline plan of the options (attached).
3. The original O2L Scoping report MCA Analysis. Refer Chapters 8 and 9 and Appendices D and F. \\NZWGN1s01\Projects\Z19000up\Z19257 - Levin- Otaki\Z1925700 Otaki - Levin\0501 Scoping Report\Final Report.
4. More commentary on the scoring of some attributes for this original work (attached).
5. SH1/SH57 MCA Analysis. \\NZWGN1s01\Projects\Z19000up\Z19257 - Levin- Otaki\80500902 Otaki_Levin I&R PFRs\2 Technical_Deliverables\0602 Scoping Report 1_SH1 SH57\MCA Workshop\Report
6. Updated constraint maps \\NZWGN1s01\Projects\Z19000up\Z19257 - Levin- Otaki\Z1925700 Otaki - Levin\GIS only\Graphs and Maps\Exports\Forest Lakes to Ohau (Manakau Bypass)

Please review all the above as it is needed for your analysis.

Any questions, please get back to me.

Regards,

Phil

MWH.
BUILDING A BETTER WORLD

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Tel: +64 4 381 5783
Mobile: +64 27 211 8246

Inputs for all

Criteria	Description	Additional data sources	Person Responsible
Landscape / Visual	Existing landscape character (including degree of modification and presence of structures), route length and presence of dwellings nearby, any outstanding landscape or natural character components, and important landscape/natural features.	Landscape and Urban Design Baseline Report, Isthmus, April 2011.	Sylvia
Ecology	Terrestrial ecology values[1], particularly those relating to patches of indigenous vegetation which are nationally, regionally or locally significant in terms of habitat values and presence of known species.		Steve
Archaeology/Heritage	Presence of known archaeological and heritage sites and features, and also archaeological risks (i.e. the likelihood of encountering archaeological site).		Sylvia / Morrie
Tāngata Whenua Values	Range of cultural values including values relating to the natural environment (waterways and wetlands, areas of indigenous vegetation), key areas of settlement (marae, papakainga) and use (food gathering areas), and known wāhi tapu.		Morrie
District and Regional Plans and Consentability	Consideration of both zoning and plan objectives and policies, and any major impediments through the plans to a route location	District and Regional Plans	Steve
Fit to Project Objectives	Levels of service, and efficiency and effectiveness (in terms of best value solutions). The assessment took into account the local network and the various state highway components		Phil
Social/Community	Severance effects, access to and from settlement	Potential interchange locations and	Sylvia

[1] Aquatic ecological values considered to be localised and similar between all options. They would be largely mitigated through design and managed through the construction stage.

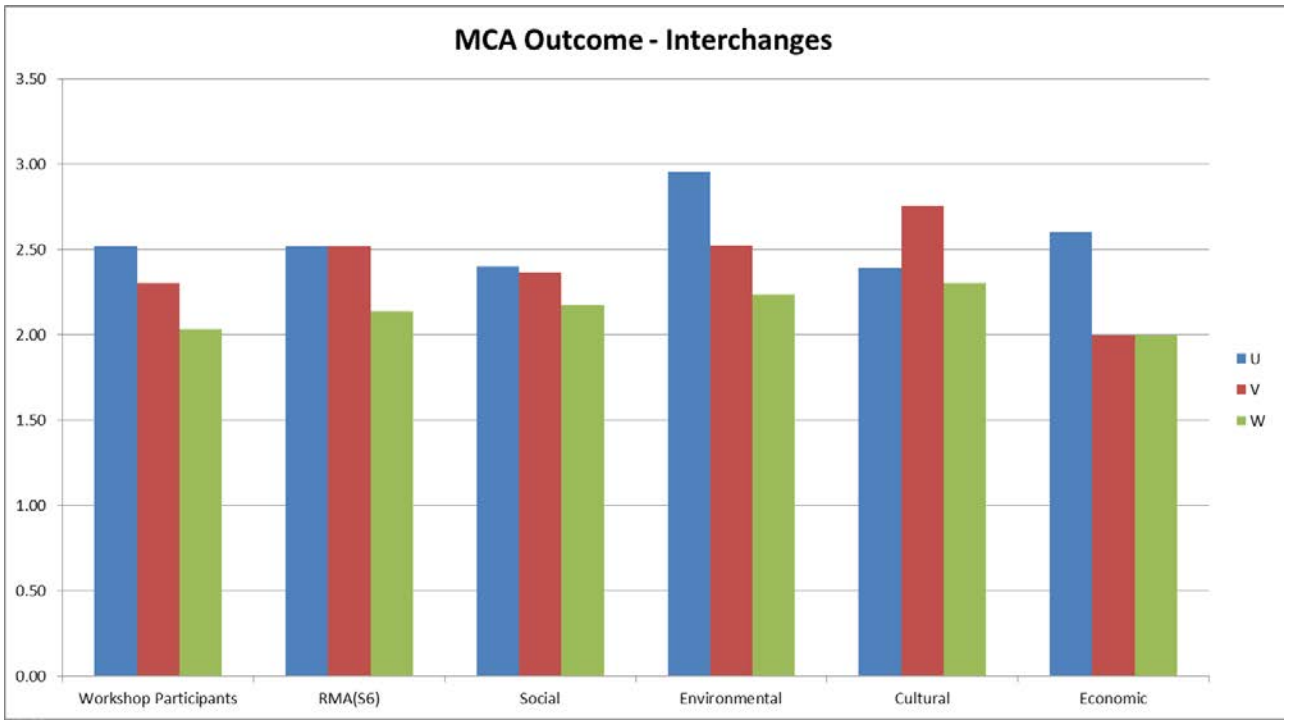
Impacts	areas and townships, general urban amenity, connectivity to community services and facilities, recreational effects, and construction impacts. Also considers direct effects on land including dwellings.	local road connections (Marten to develop). Number of properties and/or dwellings affected (Phil to develop)	
Engineering Degree of Difficulty	Volume and balance of earthworks (cut and fill suitability of/issues with material), structures, temporary works, access management, risks around “unknowns”, additional provisions to address natural hazards such as hydrological impact, and general degree of difficulty in construction. Also includes flooding and geology.		Marten
Cost	Based on $ per km plus additions for interchanges and local road provision.		Phil
Staging	Assessment based on ability to geographically or otherwise stage the works.		Marten

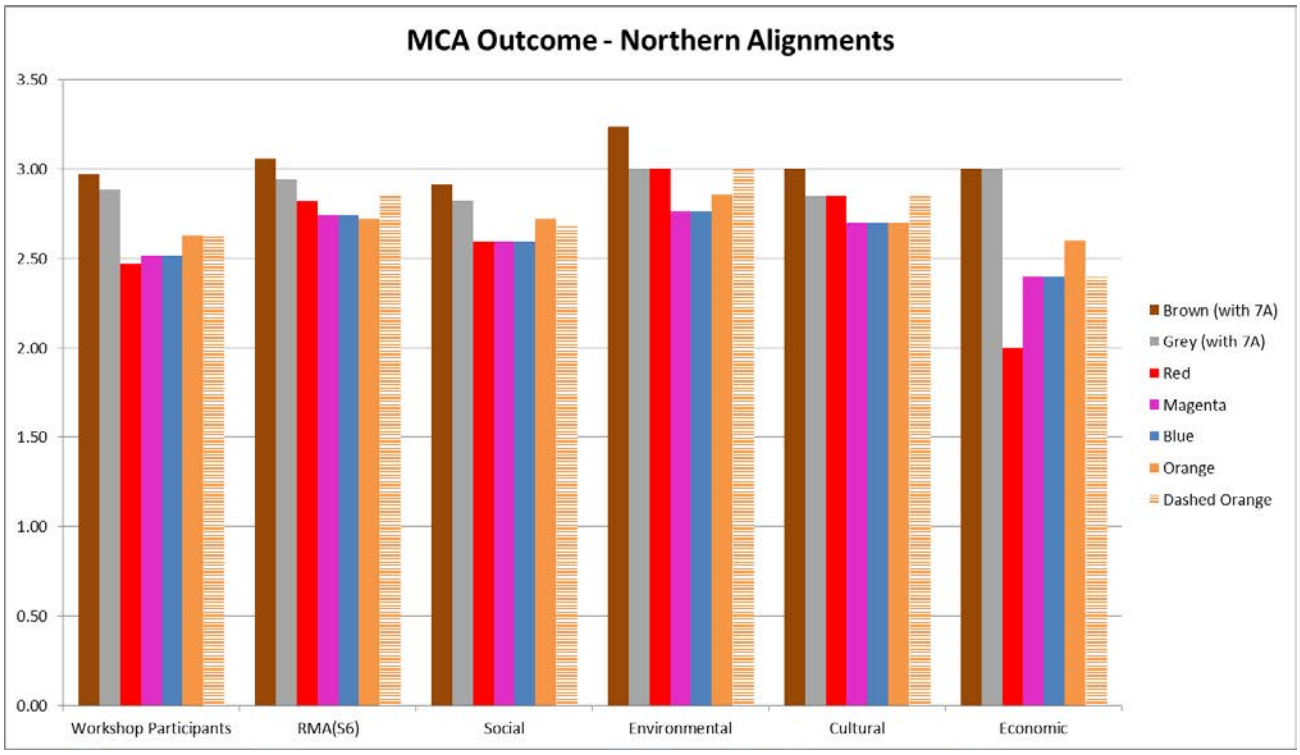
Appendix C Weighting Systems and MCA Outcomes

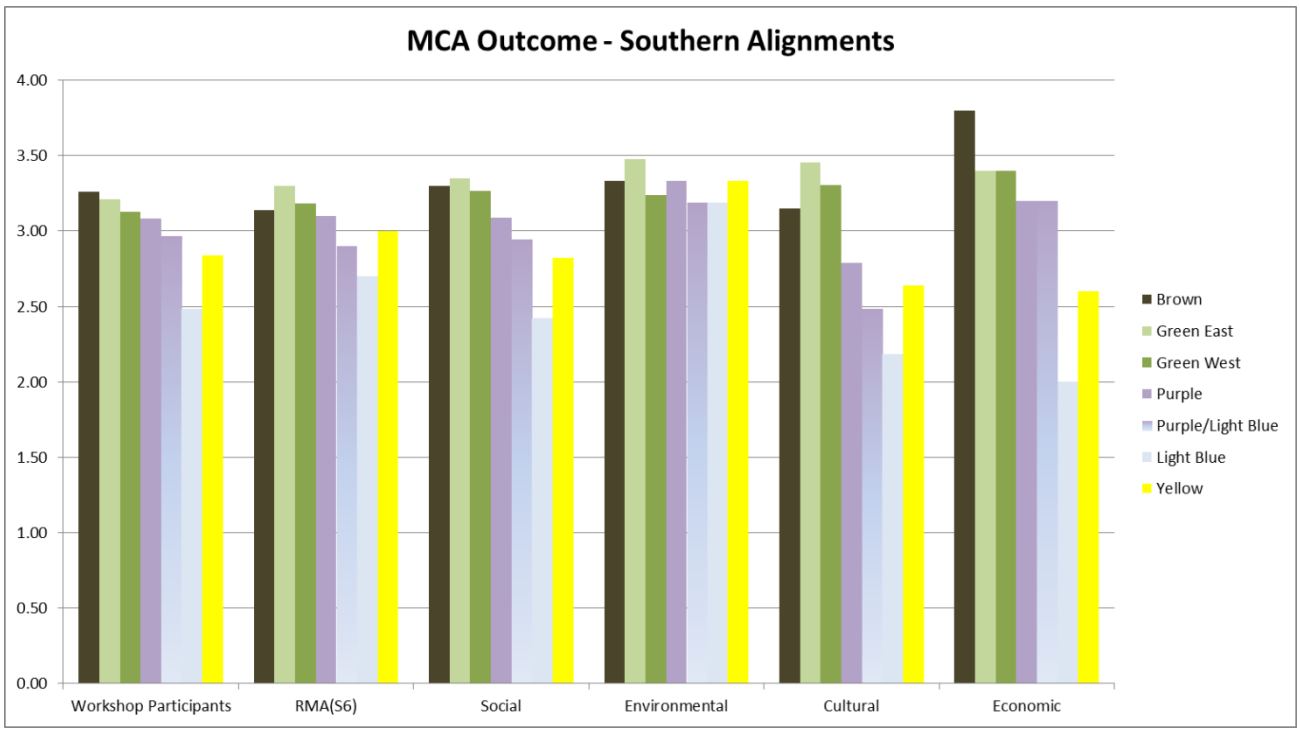
Table 6-1: Weighting Systems

	Landscape / visual	Ecology	Archaeology / heritage	Tangata whenua values	District & Regional Plan fit / consentability	Project objectives	Social / community	Engineering degree of difficulty	Cost
Workshop Participants	5	6	5	7	6	10	7	8	8
RMA(S6)	6	10	10	10	5	2	3	2	2
Social	5	5	8	8	8	5	10	3	5
Environmental	5	10	3	3	0	0	0	0	0
Cultural	5	3	10	10	0	0	5	0	0
Economic	0	0	0	0	0	5	5	5	10

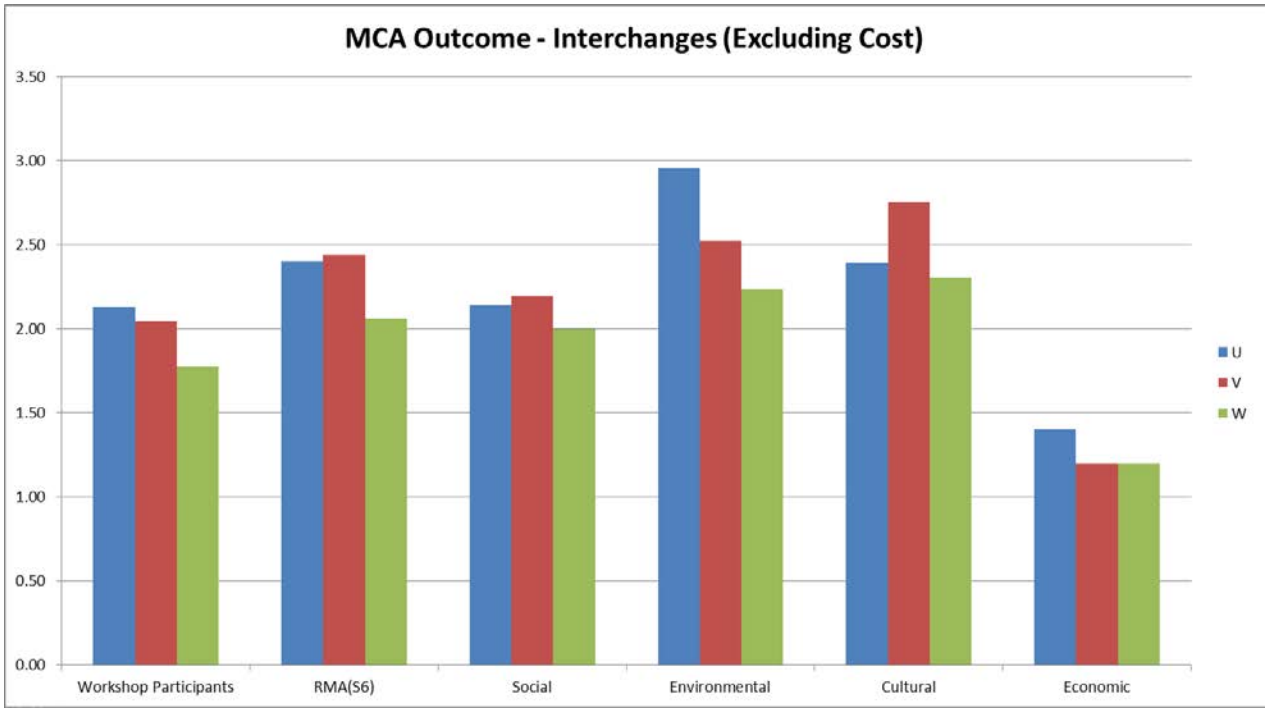
Analysis graphed incorporating all criteria

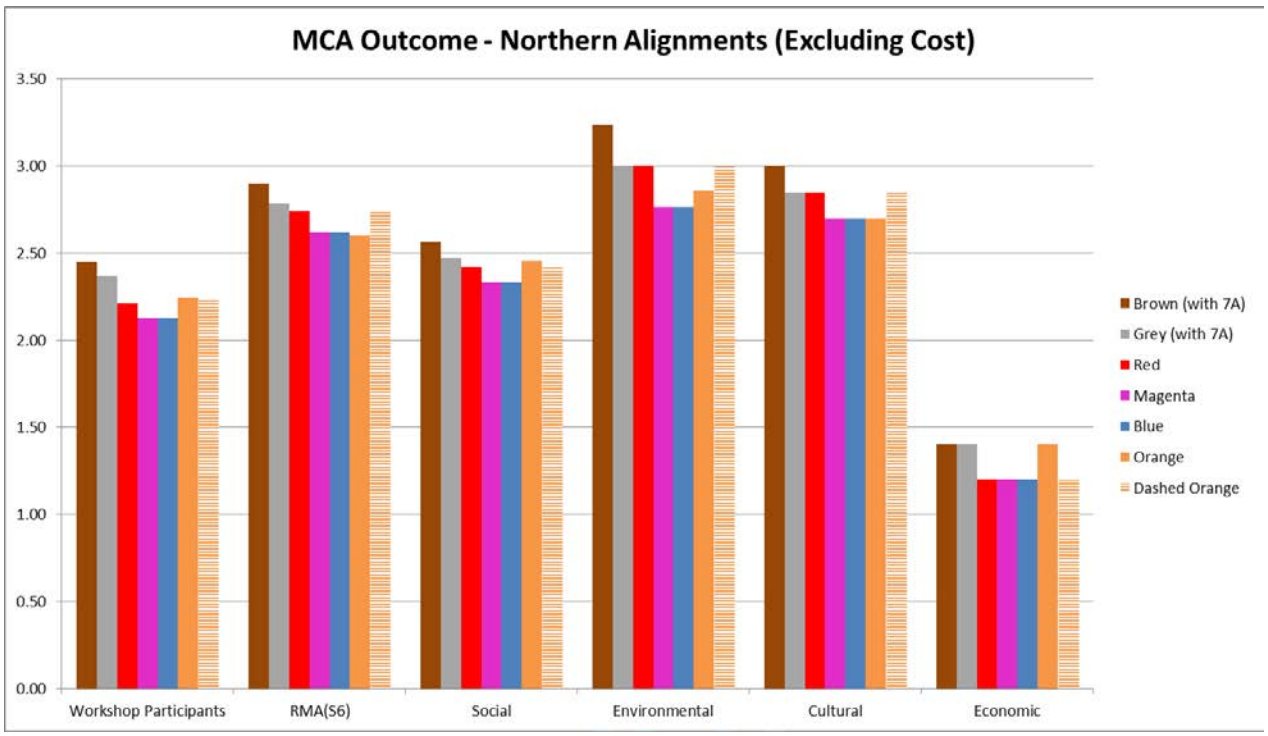


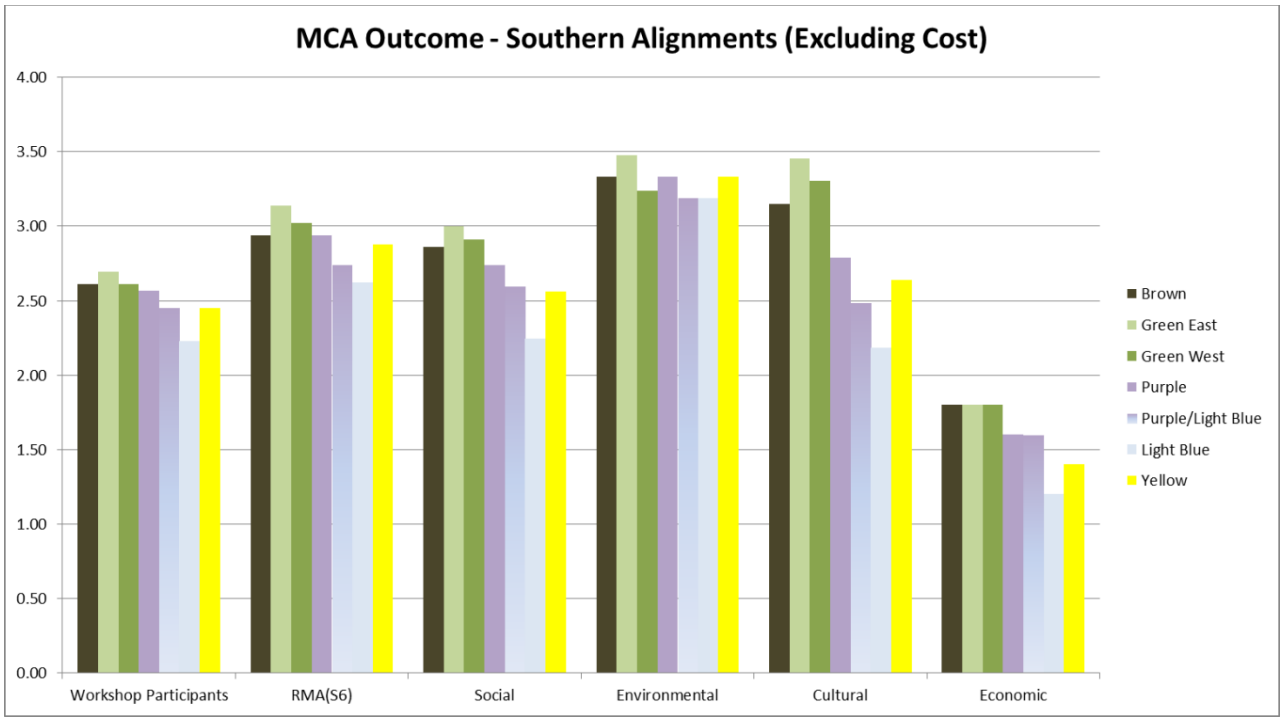

MCA Outcome - Northern Alignments
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Workshop Participants
RMA(S6)
Social
Environmental
Cultural
Economic
Brown (with 7A)
Grey (with 7A)
Red
Magenta
Blue
Orange
Dashed Orange


MCA Outcome - Southern Alignments
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Workshop Participants
RMA(S6)
Social
Environmental
Cultural
Economic
Brown
Green East
Green West
Purple
Purple/Light Blue
Light Blue
Yellow

Analysis graphed with cost criterion excluded






MCA Outcome - Southern Alignments (Excluding Cost)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Workshop Participants
RMA(S6)
Social
Environmental
Cultural
Economic
Brown
Green East
Green West
Purple
Purple/Light Blue
Light Blue
Yellow

Appendix D Staging Considerations

This attachment discussed the areas through which the current SH1 passes and what improvements would need to be undertaken as part of the first stage to create a safe and consistent highway with limited redundancy, should the SH1-SH57 Connection proceed as the first stage of the geographically staged project. This discussion applies to all preferred alignments from the MCA process.

D.1 Forest Lakes

The preferred four lane alignment runs to the east of the current state highway from Taylors Road to Forest Lakes then crosses SH1 and heads away from the highway. Accordingly, it does not appear to be sensible to upgrade the current SH1 through Forest Lakes section to a high standard as it will eventually be bypassed.

However, there is a need to address the fatal and serious crash history in the short to medium term.

Accordingly the Forest Lakes DBC should consider the following options:

- Do nothing
- Undertake the full upgrade as scoped but note that it will become redundant (approx. $17M)
- Undertake a partial upgrade (i.e. as per MWH PFR with median barrier but narrow median and shoulders – approx. $11M)
- Build two lanes of the future expressway up to Forest Lakes Road then partial upgrade north to the Pukehou Rail Overbridge.

In undertaking the analysis, more investigation should be undertaken into the exact alignment that the four lane highway would take through this section.

Based on the currently available information, it is considered that the fourth option above would achieve the best outcome by treating the full length of highway under question, whilst minimising the redundancy cost.

D.2 Pukehou Rail Overbridge

If an upgrade of Forest Lakes is undertaken, the Pukehou Rail Overbridge will be the most concerning element remaining on the existing SH1 in a staged scenario. However, there is no point in further upgrading it as it will be expensive and made redundant at the time of the full four laning. The speed environment surrounding the bridge will need to be carefully managed to ensure crash migration does not occur.

D.3 Wai-auti Realignment

This alignment was mostly completed in 2011, with work around South Manakau Road completed in 2013. Although not up to RoNS standards, this is now a good stretch of highway with appropriate geometrics and limited access.

No further work is considered needed for this section as part of the staged upgrade.

D.4 Manakau Settlement

The Agency and MWH are developing a scheme to address safety concerns through Manakau and hope to have construction mostly complete this year.

No further work is considered needed.

D.5 SH1-SH57

As discussed above, the SH1-SH57 Connection (Option 5A) can proceed as planned as part of a staged construction as it ties back into SH1 at the southern end of the project.

However, approximately 1.3km of this option will become redundant once the four lane option is progressed as the long term option deviates away from the SH1-SH57 alignment north of the Waikawa Stream.

The most problematic aspect of proceeding with a staged solution is that an at-grade intersection layout will need to be provided for Kuku Beach Road traffic. As presented previously, this provides some geometric challenges and safety concerns which are yet to be worked through.

D.6 Other improvements

Some further consideration of localised shoulder widening (for safety and cycling) or guardrail provision may be considered necessary to ensure route consistency through the short to medium term. Based on the work undertaken in the Route Improvements Report (MWH, 2013) this is likely to be in the order of $2-3M.

Passing opportunities northbound will be provided through Forest Lakes and by the SH1-SH57 Connection project. Southbound these will be provided through the SH1-SH57 project and then the expressway south of Taylors Road (assuming that the works through Forest Lakes remove the existing southbound passing lane). The southbound distance between passing lanes would be 8km. This is normally considered too far, but as it is leading into a four lane section with ongoing passing opportunities, driver frustration can be mitigated via signage.

D.7 Planning

In conjunction with the above, it is considered prudent to continue to investigate the alignment for the four lane expressway to more accurately determine the likely route and therefore enable planning mechanisms to be put in place to ensure that it does not get “built out”. Even in the few years that the Otaki to Levin study has been underway, noticeable new development has occurred around the Manakau area in particular which has constrained the potential corridors for route options.

Appendix E Addendum Report following receipt of CIA Reports

Otaki to North of Levin
Taylors Road to Ohau River Four Laning
Preliminary Options Report - Addendum

Prepared for NZ Transport Agency

April 2015

QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
Jon England	Phil Peet

PREPARED BY		
Phil Peet	……..	……/……/……
CHECKED BY		
Sylvia Allan	……..	……/……/……
REVIEWED BY		
Jon England	……..	……/……/……
APPROVED FOR ISSUE BY		
Phil Peet	……..	……/……/……

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REVISION SCHEDULE

Rev No	Date	Description	Signature or Typed Name (documentation on file).			
			Prepared by	Checked by	Reviewed by	Approved by
-	06/03/15	Draft for Client	PP	SA	SA	PP
	08/04/15	Draft following client comments	PP	SA	SA	

NZ Transport Agency

Otaki to North of Levin

Taylors Road to Ohau River Four Laning

Preliminary Options Report - Addendum

CONTENTS

LIST OF TABLES

APPENDICES

1 Introduction

The New Zealand Transport Agency (the Agency) has been investigating a package of improvements to the existing state highways between Ōtaki and north of Levin as part of its strategic approach to achieving safety and efficiency benefits in the short to medium term, while retaining a long-term option to achieve a four lane highway in the project area.

In late 2014, MWH produced the Taylors Road to Ohau River Four Laning Preliminary Options Report to investigate options between the Peka Peka to Otaki project in the south and SH57 in the north. The report included:

- A multi-criteria analysis (MCA), which is an accepted method when a number of options with a wide range of impacts, benefits and costs need to be evaluated. The methodology follows a series of process steps which are fully explained in the report.
- Consideration of how such a long term strategy could be staged.
- An economic evaluation of a long term corridor.

The work undertaken was not to a level of detail that enabled an exact route to be confirmed. It was intended to be used to enable some routes to be removed from further consideration and to determine whether or not the SH1-SH57 Connection and Forest Lakes projects that are being developed would be consistent or inconsistent with potential long term routes.

When undertaking the MCA, it was acknowledged that the project team would have preferred to have further information in two specific areas[1]. The area which was least understood was Tangata Whenua values, as Cultural Impact Assessments were yet to be completed. As draft reports of these have now been received from Te Iwi O Ngati Tukorehe and Te Iwi O Ngati Wehe Wehi, the MCA has been revisited. This addendum report outlines the outcome from the updated MCA.

The CIA report drafts have confirmed some of the project team's knowledge on some aspects, but have identified some additional sites of significance and added to the understanding of cultural values in the area,

This report must be read in conjunction with the original report to obtain a full understanding of the options identified and the process undertaken.

2 Multi-Criteria Analysis

2.1 Workshop

A workshop was convened comprising of the following people. For consistency with the previous decisions, the same participants were required to be present at this workshop (where possible):

- Phil Peet, MWH, Team Leader
- Marten Oppenhuis, MWH, Design Manager
- Sylvia Allan, sub-consultant to MWH, Planning and Consultation Leader
- Steve Kerr, MWH, Planner
- Morrie Love, sub-consultant to MWH, Maori Consultation
- Maggie Buttle, NZTA, Transport Planner
- Greg Lee, NZTA, Project Manager (new attendee – new NZTA Project Manager)
- Caroline Horrox, NZTA (new attendee – new NZTA Planner)
- Kevin Peel, HDC (new attendee)

The criteria adopted, the scores for all criteria apart from Tangata Whenua Values, and the weighting systems applied all remained as in the previous MCA.

[1] The first of these was a review of the extent of "lifestyle" development in the area south of Manakau village. This was addressed immediately following the MCA, and outcomes are reported in the Preliminary Options Report (November 2014)

2.2 Description of Criteria

The Tāngata Whenua Values criteria takes into account Maori owned land and the range of cultural values including values relating to the natural environment (waterways and wetlands, areas of indigenous vegetation), key areas of settlement (marae, papakainga) and use (food gathering areas), and known wāhi tapu.

2.3 Process and Scoring

The necessary protocols were followed to ensure that the outcome would be as reliable as possible.

Following preliminary discussion[2], the interchange scores were revisited first followed by the northern route options then the southern route options.

The outcomes are presented in Tables 2-1 to 2-3 with key points from the discussions outlined after each table.

Table 2-1: Tangata Whenua Scores – Interchange Options

Option	Original	Revised
U – South of Waikawa Beach Rd	2	2
V – South of Whakahoro Rd	4*	4*
W – South of Kuku Beach Rd	2	2

* Would be 2 if on Brown alignment due to avoiding some Maori land.

No alteration to the scores was made as a result of the additional information provided in the CIAs or from recent discussions with Tangata Whenua. No specific sites of significance have been identified in the vicinity of the interchanges so the major influence on the scores is the Maori land blocks and there are more around location V. However, as presented in the main report, this wouldn't have the same level of impact if it was on the Brown alignment or if a layout was able to be adopted which had all ramps on the southern half of the interchange.

Taking all criteria into account, the major differentiator between options continues to be Tangata Whenua values.

Table 2-2: Tangata Whenua Scores – Northern Alignment Options

Option	Original	Revised
Brown (with Option 7A at SH1-SH57)	4	4
Grey (with Option 7A at SH1-SH57)	4	4
Red	3	5
Magenta	3	5
Blue	3	5
Orange	3	5
Dashed Orange	4	5

[2] This included an outline of the background of the project and an outline of the options proposed.

All routes have impacts on many parcels of Maori owned land, both land held under the Te Turi Whenua Maori Act 1993 and also general land in Maori ownership. Many such land parcels are long and have been laid out at right angles to the main transport routes, meaning that it is impossible to avoid them.

None of the routes impact severely on sites of significance and iwi have advised that any effects from the routes should be able to be mitigated or any effects offset. Nevertheless, the routes travel through an area of high cultural interest and there is an overarching preference for the route to be further east. This moves the highway further away from the traditional living, working, and food gathering areas and towards areas in which archaeological records are less likely to be disturbed. The updated scores reflect this preference.

Table 2-3: Tangata Whenua Scores – Southern Alignment Options

Option	Original	Revised
Brown	2	2
Green East	2	2
Green West	2	2
Purple	3	4
Purple/Light Blue	2	2
Light Blue	2	2
Yellow	3	4

Again the routes don't impact on any specific known sites of significance and it appears as though this part of the project area was historically less populated by Maori. Nevertheless there is an impact on a few Maori land parcels and this is reflected in the scoring.

2.3.1 Analysis

The six weighting systems employed in the original analysis have been applied to the updated scores and are presented in the tables below and graphically in Appendix B to this Addendum report. Shading highlights the lowest scores and indicates the preferred option.

The same analysis was performed without the cost scores included. This did not change the preferences in the tables below in general terms, given the similarities in the outcomes. There were no changes in order for the interchanges and southern alignments. However, there were some small differences with the northern alignments. For example, in the analysis undertaken on the basis of the weighting preferred by the Workshop Participants, the Grey route became more preferred than the Red route; under the Social weighting analysis, Brown became preferred to Magenta and Blue; and Red, Magenta and Blue became equally preferred under the Economic weighting[3]. The outcomes are shown graphed in Appendix B to this Addendum report.

[3] But note that this last outcome is not meaningful, as the main criteria under this weighting system is cost.

Table 2-4: Updated Interchange Outcomes (scores x weights for different weighting systems)

Option	Workshop	RMA S6	Social	Environmental	Cultural	Economic
U – South of Waikawa Beach Rd	2.52	2.52	2.40	2.95	2.39	2.60
V – South of Whakahoro Rd	2.31	2.52	2.37	2.52	2.76	2.00
W – South of Kuku Beach Rd	2.03	2.14	2.18	2.24	2.30	2.00

As the participants did not alter the scores for the interchanges, Option W remains the preferred option, noting that Option V would be equally preferable (if not more so) if a layout was able to be developed that avoided the Maori land in the vicinity.

Table 2-5: Updated Northern Outcomes (scores x weights for different weighting systems)

Option	Workshop	RMA S6	Social	Environmental	Cultural	Economic
Brown (with Option 7A at SH1-SH57)	2.97	3.06	2.91	3.24	3.00	3.00
Grey (with Option 7A at SH1-SH57)	2.89	2.94	2.82	3.00	2.85	3.00
Red	2.69	3.22	2.88	3.29	3.45	2.00
Magenta	2.74	3.14	2.88	3.05	3.30	2.40
Blue	2.74	3.14	2.88	3.05	3.30	2.40
Orange	2.85	3.12	3.00	3.14	3.30	2.60
Dashed Orange	2.74	3.06	2.82	3.14	3.15	2.40

The altered scores for Tangata Whenua values have resulted in a marked reduction in the difference between the options in this section. The preferred option under this analysis appears to be the Grey option. However, because of the narrow difference in outcomes under a number of categories it was concluded that there is no clear preference at this stage of the analysis. While Orange and Brown can be considered the least preferred options, all other options justify further development and analysis.

Table 2-6: Updated Southern Outcomes (scores x weights for different weighting systems)

Option	Workshop	RMA S6	Social	Environmental	Cultural	Economic
Brown	3.26	3.14	3.30	3.33	3.15	3.80
Green East	3.21	3.30	3.35	3.48	3.45	3.40
Green West	3.13	3.18	3.26	3.24	3.30	3.40
Purple	3.19	3.30	3.23	3.48	3.09	3.20
Purple/Light Blue	2.97	2.90	2.95	3.19	2.48	3.20
Light Blue	2.48	2.70	2.42	3.19	2.18	2.00
Yellow	2.95	3.20	2.96	3.48	2.94	2.60

The Light Blue alignment continues to score consistently best under all weighting systems as it avoids all major impacts. Not far behind is Purple/Light Blue and Yellow. The Purple, Green (East and West) and Brown are least preferred.

2.3.2 Combined Route Analysis

Based on the above, northern and southern alignments were brought together to form continuous routes. Note that not all northern and southern alignment options were able to be linked up. Grey, Red, Magenta (same scores as Blue) and Dashed Orange were brought forward from the northern section and Light Blue and Purple/Light Blue were brought forward from the southern section to provide four potential continuous alignments. Yellow is also retained, being represented by the Purple/Light Blue alignment.

The MCA scores in the table below are the northern and southern scores combined, applying the Workshop weighting as a representative example. These are shown alongside the overall length of the route for both SH1 and SH57 traffic.

The lengths are taken as the distance from Taylors Road to Muhunoa East Road via SH1 or SH57 (assuming that the State Highway 1/State Highway 57 connection is in place).

Table 2-7: Updated Combined Outcomes

Option	MCA Score (Workshop weighting)	SH1 Length (existing 12.6km)	SH57 Length (existing 14.3km)
Grey & Purple/Light Blue	5.86	12.2	12.3
Red & Purple/Light Blue	5.66	12.0	13.0
Magenta (or Blue) & Light Blue	5.22	12.2	13.1

Dashed Orange & Light Blue	5.22	12.1	13.2

The table above shows that the four routes have similar lengths for SH1 and SH57 routes, with the exception that the Grey route is shorter for the SH57 route.

3 Conclusion

The overall conclusion from the updated MCA is that there are a number of alignments that could be progressed to the next stage of analysis.

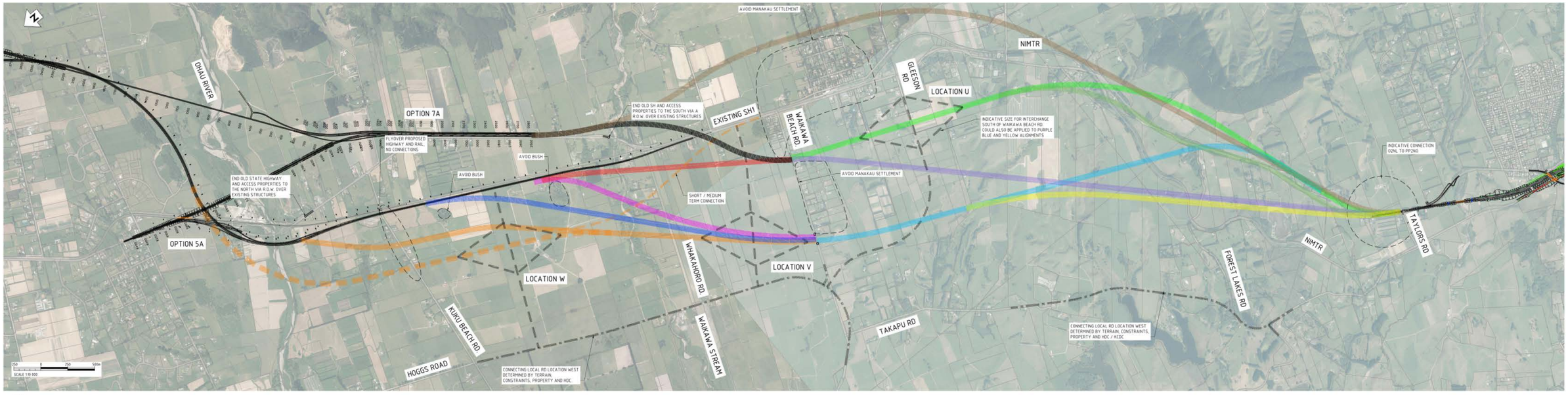
The analysis clearly shows that the Brown and Orange routes at the northern end, and the Brown, Green and Purple routes at the southern end have a number of aspects which means that they can be discarded at this stage.

The MCA analysis shows that Option W is the preferred interchange location; however the difference in scores between Option W and Option V was predominantly due to Tangata Whenua values, and Option V provides better separation of interchanges and better access to Manakau. Hence if an alternative to Option V is developed which avoids the majority of Maori land, this is likely to be considered preferable.

It should be noted that Option W is incompatible with the Magenta (or Blue) and Red alignments due to it needing to be away from the railway line, i.e. placing Option W on either of these alignments would mean that they would shift onto the Orange route. Option W is also incompatible with the Grey alignment as it would be too close to the bifurcation; if Grey is progressed it would need to be with Option U or Option V.

The outcome of the analysis can assist both the community and the Agency in that it provides an understanding of the range of aspects that need to be taken into account when considering route options, and provides more detailed levels of information about these aspects. For the Agency, recognising that multi-criteria analysis is an aid to decision-making, but does not make the decision on behalf of the NZTA, it will provide assistance in determining the preferred option to proceed with.

Appendix A Plan of Options



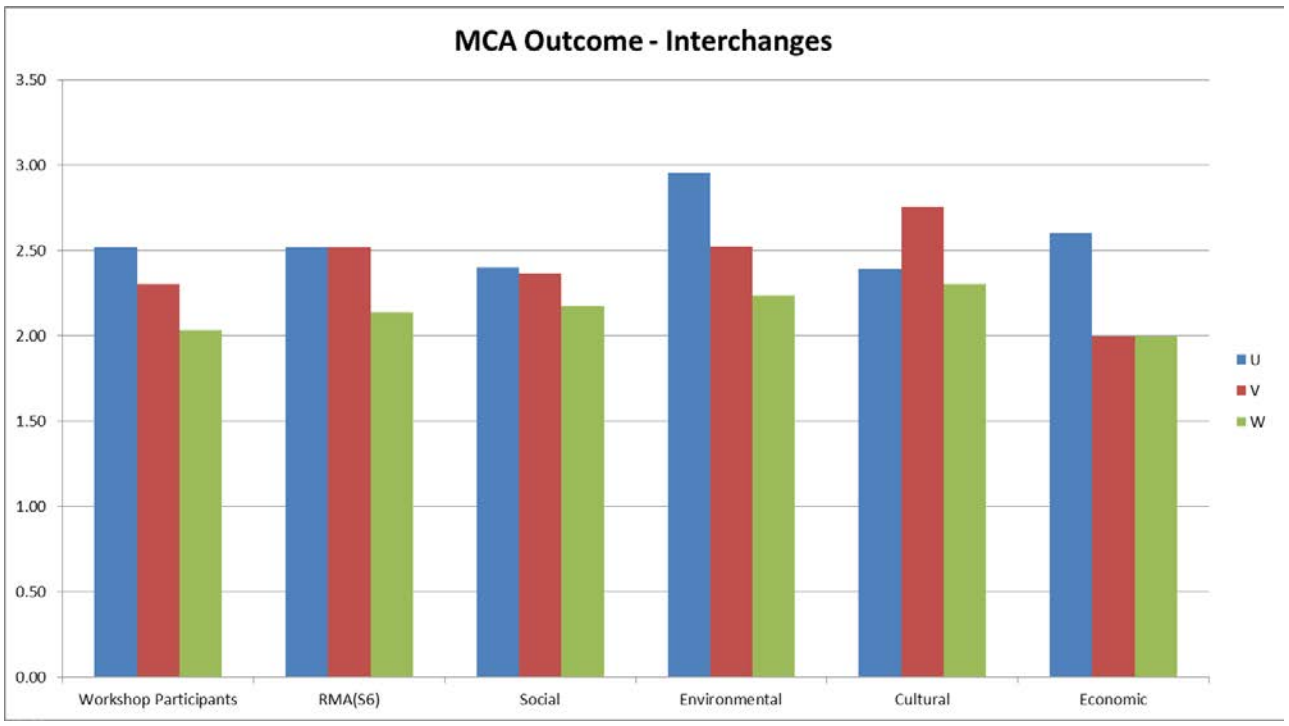
NOTE:
LINES REPRESENTING ALIGNMENTS ARE SHOWN AS APPROX. 50 m WIDE. ACTUAL IMPACT IS LIKELY TO BE APPROX. 50 – 100 m.
ALIGNMENTS ARE ALSO VERY DRAFT AND CAN BE ALTERED TO AVOID LOCALISED CONSTRAINTS.

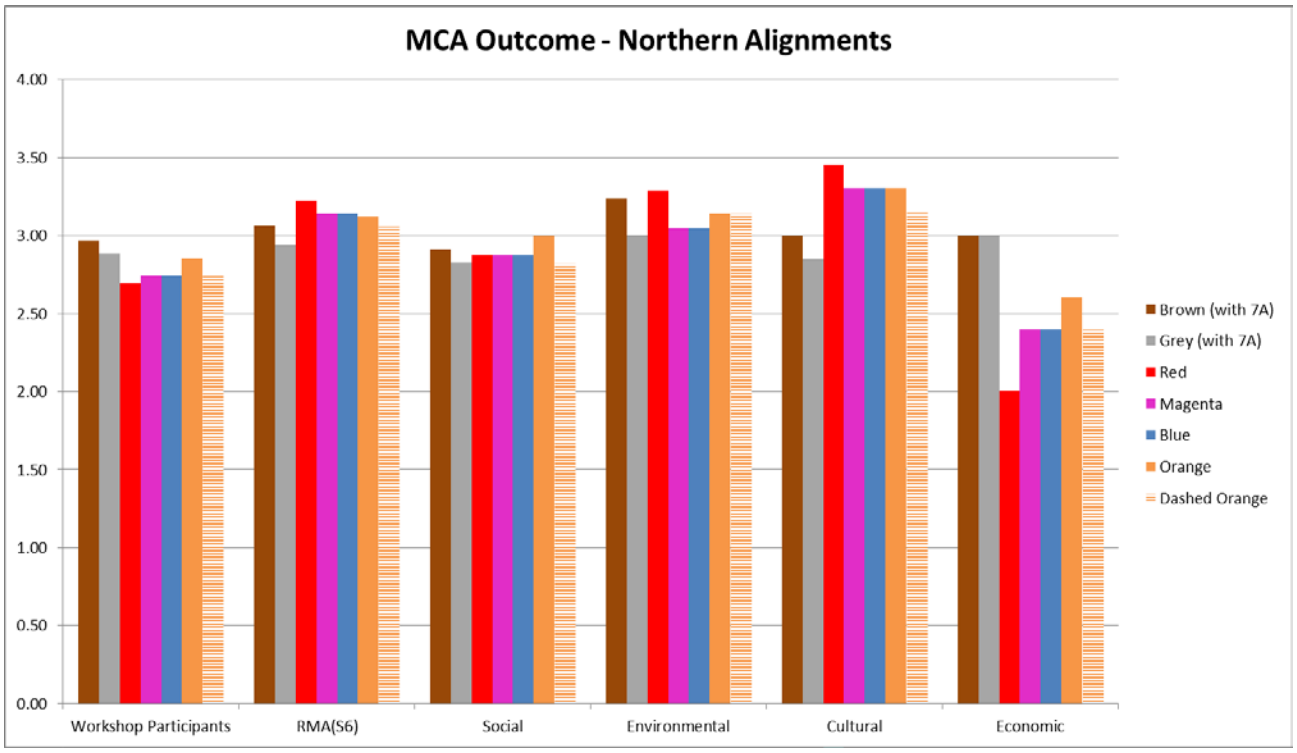
Appendix B Weighting Systems and MCA Outcomes

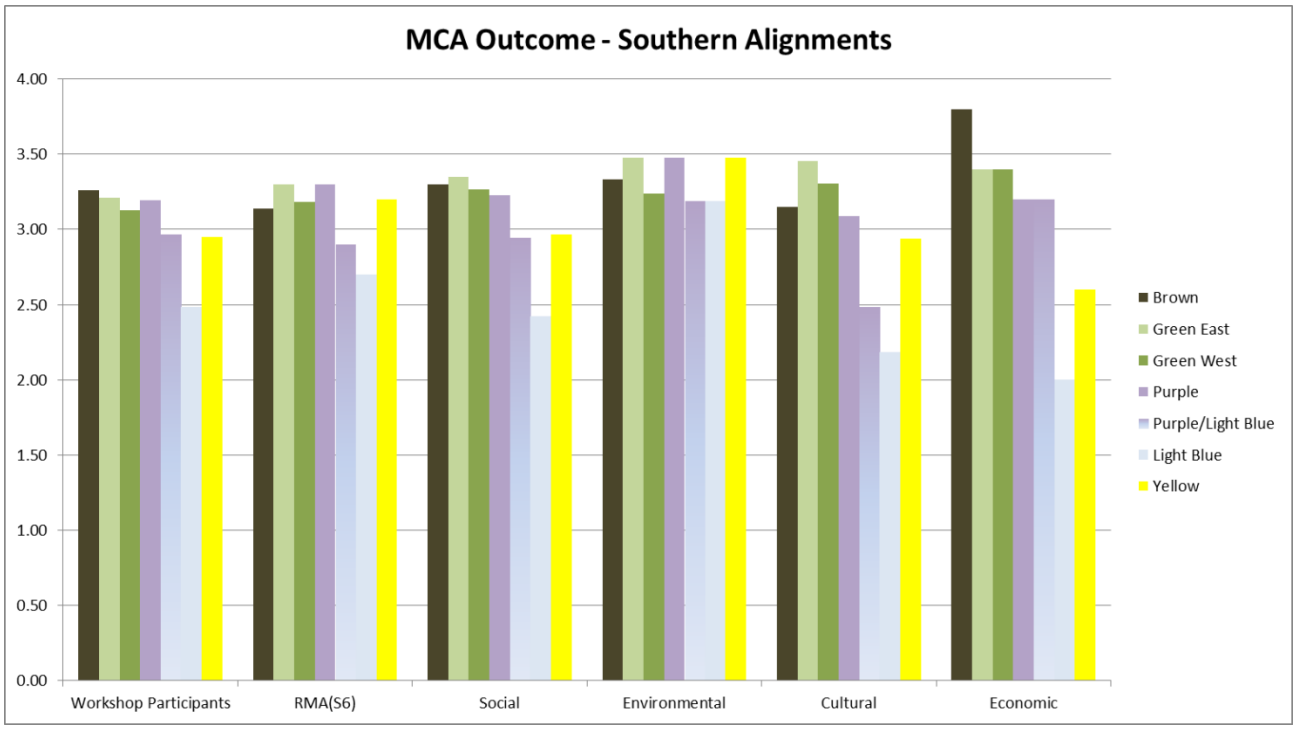
Table 3-1: Weighting Systems

	Landscape / visual	Ecology	Archaeology / heritage	Tangata whenua values	District & Regional Plan fit / consentability	Project objectives	Social / community	Engineering degree of difficulty	Cost
Workshop Participants	5	6	5	7	6	10	7	8	8
RMA(S6)	6	10	10	10	5	2	3	2	2
Social	5	5	8	8	8	5	10	3	5
Environmental	5	10	3	3	0	0	0	0	0
Cultural	5	3	10	10	0	0	5	0	0
Economic	0	0	0	0	0	5	5	5	10

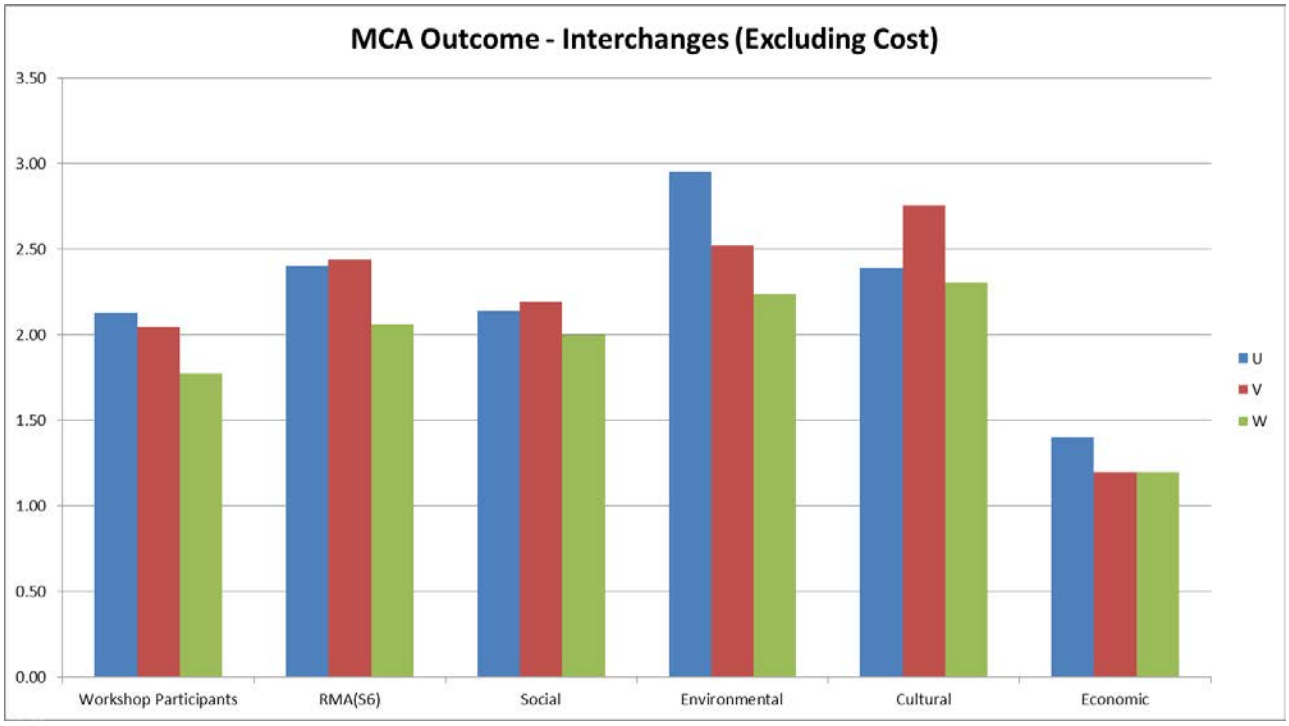
Analysis graphed incorporating all criteria (including updated Tangata Whenua Values Scores)

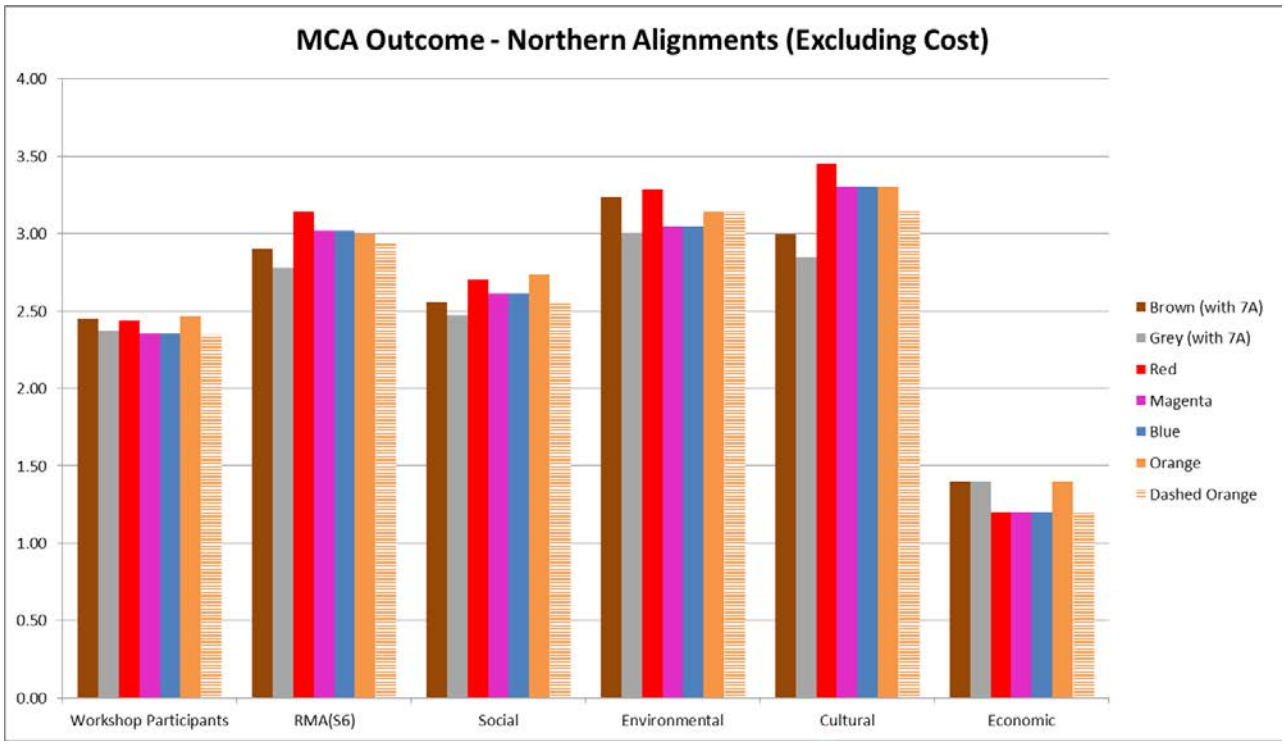


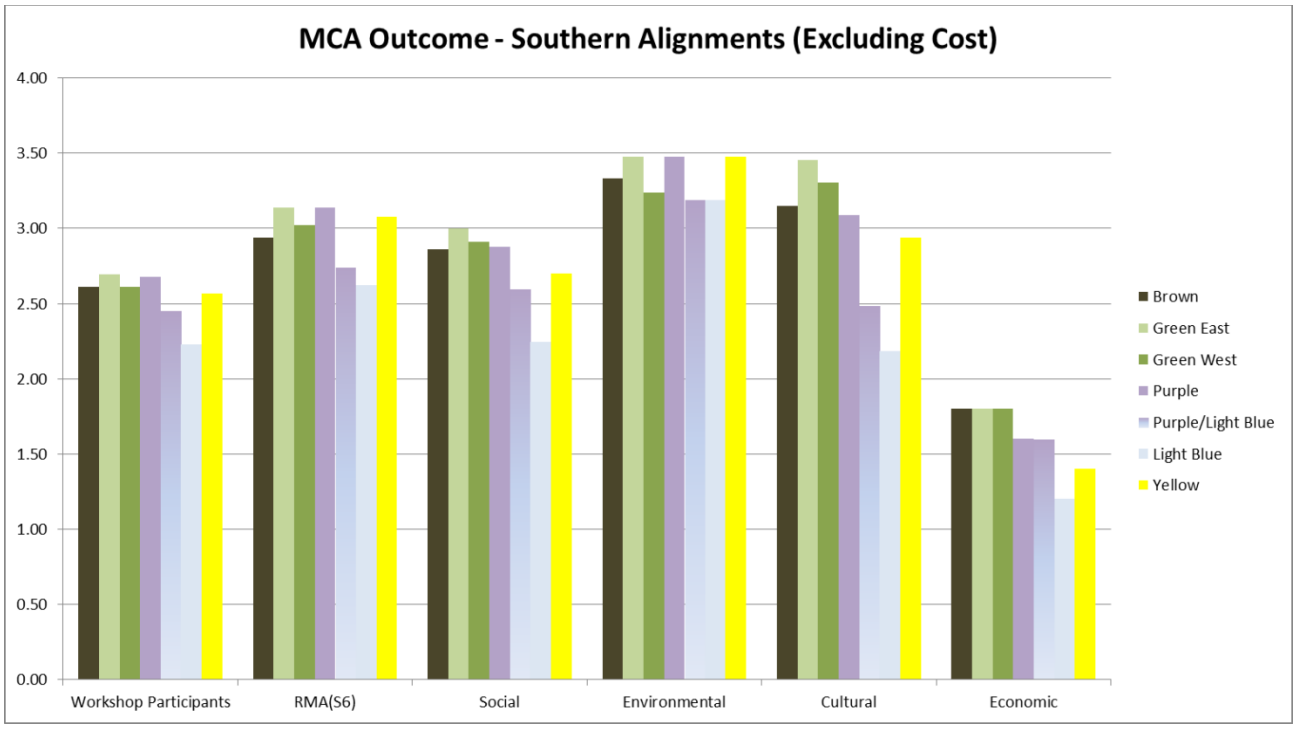

MCA Outcome - Northern Alignments
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Workshop Participants
RMA(S6)
Social
Environmental
Cultural
Economic
Brown (with 7A)
Grey (with 7A)
Red
Magenta
Blue
Orange
Dashed Orange


MCA Outcome - Southern Alignments
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Workshop Participants
RMA(S6)
Social
Environmental
Cultural
Economic
Brown
Green East
Green West
Purple
Purple/Light Blue
Light Blue
Yellow

Analysis graphed with cost criterion excluded (including updated Tangata Whenua Values Scores)






MCA Outcome - Southern Alignments (Excluding Cost)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Workshop Participants
RMA(S6)
Social
Environmental
Cultural
Economic
Brown
Green East
Green West
Purple
Purple/Light Blue
Light Blue
Yellow