

APPENDIX 9 – ASSESSMENT RELATING TO LIFELINES, COST AND
PROPERTY

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DATE 25 May 2011
FILE 5C1814 – Peka Peka to Otaki
SUBJECT PP20 Assessment of Alternatives



INTRODUCTION

Basis of Assessments

The assessments undertaken are based on information provided in previous reports produced on the routes. Specifically:

- Preliminary Design Report, SH1: North Otaki to Peka Peka Road, Meritec, January 2002
- Scheme Assessment Report – Volume 1, North Otaki to Peka Peka Road, Meritec, September 2002
- Assessment of Environmental Effects, Otaki – Te Horo, Meritec, May 2003
- Te Waka Road Option, Addendum to Scheme Assessment Report - North Otaki to Peka Peka Road, SH1 Otaki – Te Horo Expressway, Meritec, May 2003
- Peka Peka to Otaki Expressway, Scoping Report Final Draft, Opus International Consultants, January 2011.
- Peka Peka to Otaki Expressway, Alternative Corridors Technical Feasibility Report Draft V2, Opus International Consultants, April 2011.

Assessment Methods

Lifelines

In order to determine the lifeline rating of each of the options the options have been compared to the existing situation as the do-minimum. The rating takes into account the resilience of the each of the new alignments as well as the benefits of providing a duplicate north-south route.

The lifelines assessment has been undertaken by reviewing previous Geotechnical information produced for the Scoping and Technical Reports for the routes. A neutral rating was given to a route if it was deemed that on balance the route would not be significantly more secure with the construction of the alignment. A negative rating was given if the route decreased the route security. A positive rating was given if all effects improved route security, and hence the north-south lifeline.

Cost

The assessment of cost was undertaken by comparing the three alternative options, A, B and C against the Board Preferred option. This assessment of cost also considered aspects of route constructability, property, cut and fill material balances and risk elements that would have a direct impact on cost outcomes.

The cost assessment has been made by judging each of the routes against the board preferred using the criteria in Table 0.4. The routes were assessed considering their 'expected' estimates, this allowed for some of the risk component of each option to be considered in the assessment.

Rating	Cost Range
'--'	>+\$20M
'-'	+\$10M - \$20M
0	-\$10M - +\$10M
'+'	-\$10M - -\$20M
'++'	>-\$20M

Table 0.4 Cost Assessment Criteria (relative to Board Preferred Option)

Property

The property assessment was made by considering the affects of the alignments on different types of parcels, Maori titles, crown land, and QEII reserves. The number of properties and dwellings affected has been accounted for in the cost estimates, the land use of the affected properties have also been accounted for in other assessments. To avoid double counting these have been considered but not weighted in the assessment.

The property assessment has been undertaken using previous work undertaken in the Alternative Corridors Technical Feasibility Report. Property information has also been sourced from QuickMap, KDCDC records and from property information held in Opus CAD drawings of the routes.

Inputs into Assessment

The following specialists were involved in making the assessments;

- Keith Atkinson (cost and constructability)
- Pathmanathan Brabhaharan (lifelines)
- Grant Webby (lifelines)

LIFELINES

Information in Previous Reports

Discussion in previous reports around lifelines relates to the geotechnical and flooding issues associated with the routes. The reports discuss these issues in relation to the Board Preferred Route and make some reference to them for the Te Waka Route.

Specifically the *Scheme Assessment Report, Volume 1, September 2001* mentions issues around bridge failure, flooding and ground liquefaction as a result of an earthquake or a large flood event.

The Te Waka Road Option, Addendum to Scheme Assessment Report, May 2003 highlights the potential issues with the peat areas adjacent to Te Waka Road and the need for engineering solutions to make it suitable for roading purposes.

There is no information on either of the two eastern alignments in previous reports.

It should be noted that the following is based on work undertaken in technical reports with regards to route security. In order to fully determine the lifeline ability of each route a full risk assessment would need to be undertaken to determine the resilience of the route following a large disaster event.

Alignment Effects

Board Preferred

Positive Effects

- A second Otaki River Road Bridge provides extra route security should the existing road bridge fail.
- The alignment is able to be designed to ensure it is not subject to the same flooding issues as the existing SH1 alignment.
- Potential opportunity to enhance flood protection to Otaki and existing Sh1 with potential for some improved resilience.

Negative Effects

- The alignment crosses the Northern Ohariu fault. Structures such as bridges and embankments situated across or near the fault should be designed carefully for ground shaking and fault rupture.
- The alignment passes over ground with varying potential for liquefaction. Liquefaction would cause subsidence during a large earthquake and affect the stability of embankments and bridge foundations if mitigation is not provided.
- The expressway, existing SH1 and rail are all within the same corridor, should a large earthquake strike near this corridor there is potential for all three to be disabled, severing north-south connectivity.

Option A

Positive Effects

- Provides a second transport corridor separated from the existing corridor providing additional route security
- A second Otaki River Road Bridge provides extra route security should the existing road bridge fail.
- The alignment is able to be designed to ensure it is not subject to the same flooding issues as the existing SH1 alignment.

Negative Effects

- The alignment runs parallel with the Northern Ohariu fault and also crosses the fault near to the crossing of the Waitohu Stream. Without proper design of structure foundation, a rupture of this fault may result in damage to any structure used to cross the stream due to the proximity of the structure to the fault.

- The alignment passes over ground with varying potential for liquefaction. Liquefaction would cause subsidence during a large earthquake and affect the stability of embankments and bridge foundations if mitigation is not provided.
- The large cuts required through the Waitohu Valley should be designed carefully to resist large earthquakes effecting the route security.
- This alignment may be susceptible to landslips and flooding due to the proximity to the foothills and also the number of cuts which will intercept overland flow from the foothills.

Option B

Positive Effects

- Provides a second transport corridor separated from the existing corridor providing additional route security
- A second Otaki River Road Bridge provides extra route security should the existing road bridge fail.
- The alignment is able to be designed to ensure it is not subject to the same flooding issues as the existing SH1 alignment.

Negative Effects

- The alignment runs parallel with the Northern Ohariu fault and also crosses the fault near to the crossing of the Waitohu Stream. Without proper design of structure foundations a rupture of this fault may result in damage to any structure used to cross the stream due to the proximity of the structure to the fault.
- The alignment crosses areas of varying potential of liquefaction. Liquefaction may cause subsidence during an earthquake, if mitigation is not provided, affecting the stability of the fill embankments, and hence the resilience of the route in these locations during an earthquake.

Option C

Positive Effects

- Provides a second transport corridor separated from the existing corridor providing additional route security
- A second Otaki River Road Bridge provides extra route security should the existing road bridge fail.
- The alignment is able to be designed to ensure it is not subject to the same flooding issues as the existing SH1 alignment.

Negative Effects

- The alignment runs near to the Fault Avoidance Zone for the Northern Ohariu fault near to Te Horo. Structures and embankments in this area may be susceptible to damage during a large earthquake.
- A large portion of the alignment is on low lying dune sand and inter-dunal peat/swamp deposits. The dune sand deposits pose liquefaction hazards for the route and during a large earthquake may cause damage to the expressway, compromising the route security if mitigation is not provided.
- The route comes within the Tsunami Evacuation Zone as indicated on KCDC maps. The route is within the zone from approximately adjacent to Lethbridge Road in the south to Tasman Road in the north, approximately 2.5km in length.

Route Rating

Board Preferred

The Board Preferred option has an overall rating of '-'. It is considered, to on average, have minor negative issues with regards to lifelines, the key considerations leading to this are;

- The proximity of the alignment to the Northern Ohariu fault;
- The liquefaction potential of the ground the expressway crosses and;
- The grouping of all the north-south transport groups into one corridor.

Option A

Option A has an overall rating of '+'. It is considered, to on average, have intermediate issues with regards to lifelines, the key considerations leading to this are;

- The route provides a second transport corridor and river crossing away from the existing
- The proximity of the alignment to the Northern Ohariu fault;
- The liquefaction potential of the ground the expressway crosses and;
- The potential for flooding and landslide issues due to alignment intersecting potentially large overland flows close to the foothills and in areas of significant cutting.

Note: the Option A rating could be improved if the route followed the Option B route north from the Otaki River.

Option B

Option B has an overall rating of '+'. It is considered, to on average, have minor positive effects with regards to lifelines, the key considerations leading to this are;

- The route provides a second transport corridor and river crossing away from the existing
- The alignment runs parallel and close to the Northern Ohariu fault and;
- The liquefaction potential of the ground the expressway crosses

Option C

Option C has an overall rating of '0'. It is considered, to on average, have minor issues with regards to lifelines however will not make the lifeline security any worse, the key considerations leading to this are;

- The route provides a second transport corridor and river crossing away from the existing
- The proximity of the alignment to the Northern Ohariu fault and;
- The liquefaction potential of a significant amount of ground the expressway crosses
- The location of the expressway within the Tsunami Evacuation Zone.

COST

Information in Previous Reports

Previous reports have limited information on the cost of the routes and as they are from 2002 – 2003 the costing information produced at that time is largely irrelevant as the designs have progressed since the original estimates.

There is no information on either of the two eastern alignments in previous reports.

Cost Implications

Board Preferred

- Has a shortfall of earthworks material requiring imported fill which increases the cost of the route.
- Has additional costs due to the rail realignment and staging required through Otaki
- Requires significant traffic management within Otaki due to the close proximity of the expressway to rail, existing SH1 and local roads
- The alignment crosses areas of peat adjacent to the existing SH1 Otaki Rail Over Bridge and at Mary Crest, which introduces significant cost implications due to the requirement to remove and replace the areas of peat, preloading and other engineered earth solutions.
- Flooding impacts require the expressway to be raised in areas, increasing the fill required for the project and hence adding additional cost.
- The majority of the expressway can be built off-line, however temporary works/diversions will be required between Taylors Road and Pukehou as the expressway utilises some of the existing SH1 carriageway. Temporary works will also be required in Otaki, at the Otaki Gorge Interchange, Te Horo and Mary Crest.
- The Pukehou to Taylors Road section may encounter areas of poor ground adjacent to the swamp.
- As a significant amount of fill material will be imported from off-site this will result in a number of truck movements, increasing the traffic management costs.

Option A

- Has a cut surplus, keeping earthworks costs down
- Will require a complex interchange at Peka Peka as it will be elevated on a terrace, it crosses the NIMTL with a significant skew and is also required to have local road connectivity.
- Has additional drainage requirements as it cuts through the foothills and collects the run-off from them.
- Is able to be built away from the existing SH1 traffic with temporary works only required at the tie-in's at either end of the alignment.
- May require engineering solutions for the stability of larger cuts in the Waitohu Valley.
- Construction occurs outside major urban areas which may loosen the restrictions on working times.
- Is constructed on good quality soils and has a very low likelihood of encountering peat areas.

Option B

- Has a surplus of cut material and also has cut and fill areas in close proximity to one another.
- The alignment crosses areas of peat at Mary Crest, which introduces significant cost implications due to the requirement to remove and replace the areas of peat, preloading and other engineered earth solutions.
- The majority of the expressway can be built off-line, however temporary works/diversions will be required at the northern tie-in. Temporary works will also be required in Otaki, Te Horo and Mary Crest.
- Crosses the Otaki River on a skew and at a point where the river bed is wide resulting in a longer bridge than the other options.

Option C

- Has a shortage of earthworks material requiring imported fill which increases the cost of the route.
- The route encounters significant peat deposits at Mary Crest and to the south of the Otaki River which introduces significant cost implications due to the requirement to remove and replace the areas of peat, preloading and other engineered earth solutions.
- The majority of the expressway can be built off-line, however temporary works/diversions will be required between Taylors Road and Pukehou as the expressway utilises some of the existing SH1 carriageway. Temporary works will also be required in Otaki and Mary Crest.
- The Pukehou to Taylors Road section may encounter areas of poor ground adjacent to the swamp.
- This option has a considerably large 'risk' element due to the unknowns around the ground conditions, particularly within the area adjacent to Te Waka and Swamp Roads.
- This option has the shortest and cheapest Otaki River Bridge as it crosses perpendicular to the river and at a narrow point of the river bed.

Route Rating

Board Preferred

The Board Preferred option has an overall rating of '0'. It is considered, to on average, have neutral issues with regards to cost, the key considerations leading to this are;

- The cost of imported fill
- The rail realignment required in Otaki
- The complexity and hence traffic management costs required to mitigate the impacts of the number of interfaces between the expressway and the existing roading network.

It should be noted that the Board Preferred is rated as neutral as it is the benchmark against which the other options are rated, not because it has neutral effects.

Option A

Option A has an overall rating of '0'. It is considered, to on average, have neutral issues with regards to cost, the key considerations leading to this are;

- The route having a surplus of material
- The ability to build almost the entire route away from the existing SH1.
- The complexity of the southern interchange at Peka Peka.

Option B

Option B has an overall rating of '+'. It is considered, to on average, have positive effects with regards to cost, the key considerations leading to this are;

- A surplus of cut material and also the proximity of cut area to fill areas.
- Is likely to encounter only a small number of peat areas.
- Crosses the Otaki River on a skew and at a point where the river bed is wide resulting in a longer bridge than the other options.
- Is the cheapest option and also has the smallest estimate range (between base and 95%ile estimates).

Option C

Option C has an overall rating of '-'. It is considered, to on average, have intermediate issues with regards to cost, the key considerations leading to this are;

- Has a shortage of material requiring imported fill which increases the cost of the route.
- The route encounters significant peat deposits at Mary Crest and to the south of the Otaki River which introduces significant cost implications due to the requirement to remove and replace the areas of peat, preloading and other engineered earth solutions.
- This option has a considerably large 'risk' element due to the unknowns around the ground conditions, particularly within the area adjacent to Te Waka and Swamp Roads.

PROPERTY

Information in Previous Reports

Discussions in previous reports is typically limited to information on the number and cost of affected properties. There is no information on either of the two eastern alignments in the previous reports.

Alignment Effects

Board Preferred

Negative Effects

- The alignment will require areas of KiwiRail land as it runs adjacent to the NIMTL. This alignment also requires rail realignment through Otaki so requires additional land for the realignment and requires the transfer of KiwiRail land for the expressway.
- The alignment will require part of the Pareomatangae Reserve
- The alignment affects Maori land titles at Te Horo, Rahui Road and North Otaki (approximately 7 titles).
- Effects a number of dwellings within the Otaki Township
- Will require land from approximately 142 parcels and effect 55 dwellings

Option A

Positive Effects

- Does not require any additional KiwiRail land
- Avoids major urban areas
- The alignment does not appear to affect any Maori land titles

Negative Effects

- Will require land from approximately 88 parcels and effect 24 dwellings

Option B

Positive Effects

- Avoids major urban areas

Negative Effects

- The alignment will require areas of KiwiRail land as it runs adjacent to the NIMTL.
- The alignment affects Maori land titles at Te Horo, Old Hautere Road, and Otaki River (approximately 6 titles).
- Will require land from approximately 103 parcels and effect 30 dwellings

Option C

Positive Effects

- Does not require any additional KiwiRail land

Negative Effects

- The alignment affects Maori land titles at Covenant Road and at Taylors Road (approximately 17 titles).
- Will require land from approximately 125 parcels and effect 22 dwellings

Route Rating

Board Preferred

The Board Preferred option has an overall rating of '-'. It is considered, to on average, have intermediate issues with regards to property, the key considerations leading to this are;

- The amount of property required from KiwiRail and for KiwiRail
- Affects on the Maori land titles
- The number of dwellings required

Option A

Option A has an overall rating of '0'. It is considered, to on average, have neutral issues with regards to property, the key considerations leading to this are;

- Not requiring additional KiwiRail land
- Affects on the Maori land titles
- Avoidance of major urban areas and hence a lower number of parcels and dwellings affected

Option B

Option B has an overall rating of '0'. It is considered, to on average, have neutral issues with regards to property, the key considerations leading to this are;

- The amount of property required from KiwiRail
- Affects on the Maori land titles
- Avoidance of major urban areas and hence a lower number of parcels and dwellings affected

Option C

Option C has an overall rating of '-'. It is considered, to on average, have minor negative issues with regards to property, the key considerations leading to this are;

- Impacts on a significant number of Maori land titles around Covenant Road
- Avoidance of major urban areas and hence a lower number of parcels and dwellings affected

SUMMARY

	Lifelines	Cost	Property
Board Preferred	-	0	-
Option A	+	0	0
Option B	+	+	0
Option C	0	-	-