NZ TRANSPORT AGENCY
WAKA KOTAHI

AWHC

Additional Waitemata Harbour Crossing

Options Short Listing Workshop Results (including assessment criteria)

Contents

Appendices

1. Introduction

This Appendix provides details of the workshops undertaken during the shortlisting process and sets out the outcomes and results of these workshops as applicable.

1.1 Objectives, Principles, Assumptions and Constraints Workshop

This workshop was undertaken on 9 June 2010 and was attended by NZTA representatives and representatives from each of the Project work streams. See the agenda attached as Appendix A.

The aim of the workshop was to define the objectives, principles, assumptions and constraints of the project. The design scope and assumptions that resulted from this workshop are outlined in Appendix A of the Form Assessment Study Report (FASR). Project principles and constraints are discussed in detail in Chapter 2 of the FASR.

1.2 Options Definition Workshop

This workshop was undertaken on 17 June 2010 and was attended by members of the Engineering and Planning workstreams. The aim of the workshop was to identify an initial long list of options for the Project. The development of options and the resulting long list are summarised in Chapter 3 of the FASR.

1.3 Innovators Challenge Workshop

This workshop was undertaken over two days between the 30 June and 1 July 2010 and involved members of the project team. See the agenda attached as Appendix B.

The aim of the workshop was to test and challenge the options identified for the long list. The development of options and the resulting long list are summarised in Chapter 3 of the FASR.

1.4 Assessment Criteria Workshop

This workshop was undertaken on 9 July and involved members of the project team as well as experienced environmental consultants. The aim of the workshop was to refine a long list of assessment criteria that had been identified by the project team for the purposes of evaluating options (see Appendix C). The refinement process involved:

- The removal of criteria that did not differentiate between the options or covered the same issue as other criteria;

- Refinement and rewording of criteria where there was duplication; and
- The identification of two lists of criteria: one that most differentiated between tunnel options; and one that most differentiated between bridge options.

1.5 Options Evaluation Workshop 1

This workshop was undertaken on 12 July 2010 and involved members from the Planning and Engineering workstreams as well as a representative from the Economic Advisory workstream. The aim of the workshop was to undertake an evaluation of the road component of all options. Without the rail component there were only six options for evaluation, as the rail was the only factor that differentiated between two of the bridge options. As a result option B1 and B2 were combined and option B3 and B4 were combined for the purposes of workshop evaluation.

The results from this workshop are recorded within Appendix D. The results sheets within the appendix include the ranking assigned to each option against a given criteria as well as comments in relation to why the ranking was assigned.

1.6 Options Evaluation Workshop 2

This workshop was held on 15 July 2010 and was attended by NZTA and Kiwirail representatives, the strategic project advisors and representatives from each of the Project workstreams. See the workshop agenda attached as Appendix E.

The workshop's aim was to test and challenge the options evaluation undertaken in Workshop 1. The results from this workshop are recorded within Appendix F. The results sheets within the appendix include the ranking assigned to each option against a given criteria as well as comments (as applicable) in relation to why a ranking was challenged during this workshop.

1.7 Options Evaluation Workshop 3

This workshop was held on the 28 July 2010 involved members of the Project team. The aim of the workshop was to incorporate the rail component back into the top ranked options and evaluate these options against the consentability, constructability and operability criteria.

For the top ranked road bridge option (option B3/B4) three combination options were assessed during this process:

- option B3(a): Road bridge with immersed tube tunnel for rail;
- option B3(b): Road bridge with bored tunnel for rail; and

- option B4: Road bridge with separate rail bridge.

There was no requirement to assess the top ranked tunnel options as a combined option during this workshop as there was only one possible combined option. The form of the rail component of top ranked tunnel option T1 followed that of the road component (i.e. bored road and rail tunnels). The issues associated with the bored rail tunnel were assumed to be relatively the same as those associated with bored road tunnel, such that it was determined that the rail component of the shortlisted tunnel option in combination with the road component would unlikely alter the overall ranking previously assigned to the option.

The results from this workshop are recorded within Appendix G. The results sheets within the appendix include the ranking assigned to each option against a given criteria as well as comments in relation to why the ranking was assigned.

APPENDIX A

Workshop Agenda: Objectives, Principles, Assumptions and Scope

Agenda for Objectives, Principles, Assumptions and Constraints Workshop

Date: Wed 9 June 2010 **Time: 9.30am-5pm**

Venue: Copthorne Hotel, 196-200 Quay Street (Room: Copthorne 1)

Attendees	Distribution
NZTA team	Patrick Kelly/ Mieszko Iwaskow/ Neil Cree
Beca/AECOM team	Bryce Julyan / Rupert Hodson/ Neil Watson/ John Ashley/ John Connal / Alan Burford/ John Cooper / Ed Rogers / Darryl-Lee Wendelborn/ Lesley Hopkins/ Lynne Hancock/ Hugh Leersnyder/ Will Pank/ Alan Kerr/ Paul Kennedy
PWC/NZIER team	Chris Money / Peter Albert/ Steven Penney/John Yeabsley/ Chris Parker
SKM/Flow team	Richard Hancy / Ian Clarke/ David Young /Jarrod Darlington

PURPOSE: The Project Definition documentation and the basis of the Scoping Report

Time	Chair	Item	Explanation
09.30am	NZTA/BJ	Coffee and Introductions	
09.35	BJ /Neil/ Team leaders	Purpose of workshop and outline of agenda	Overview of process and why this is needed. . What we each want to get out of the day.
10.00	BJ	Background Goals Objectives Business Case Needs & Base-case	Background of investigations to date. What is the existing situation, why AWHC, what are the reasons for the project? Explore our understanding of why the project is needed. – review and agree project objectives. What is the Base case? What is "do nothing/minimum" the base case? Define " do minimum"?
10.45	Rupert	Principles and Outcomes	Key principles to meet objectives – principles will guide the project investigations and option evaluation. Client / Stakeholder aspirations.
11.45	BJ Neil W (1)	Parallel Breakout sessions: (1) Design and operational requirements - Standards - Requirements/ LOS - Guidelines - Assumptions	(1) What are the specific design parameters, standards, guidelines that will be adopted?
	(2) Lesley H/ Hugh L	(2) Environment Constraints and Opportunities	(2) What is the existing environment? What are the physical parameters or constraints on the project? Other constraints e.g.social.
	(3) Rupert/ PWC?	(3) Economic and Land Use Constraints and Opportunities	
	(4) Chris M	(4) Business Case Needs and Outcomes	
12.30pm		LUNCH	
1.00		Breakout sessions continue.	
2.00-	BJ/NW/RH	Feedback sessions 1 and 2 (30 mins ea)	

Agenda for Objectives, Principles, Assumptions and Constraints Workshop

Time	Chair	Item	Explanation
3.00		Afternoon Tea	
3.20		Feedback Sessions 3 and 4 (30 mins ea)	
4.20	Lesley H	Stakeholder Engagement	Confirm Stakeholders for the short-listing workshop. What engagement has been undertaken to date? What information or inputs are required from Stakeholders? affirmation / buy-in on requirements?
4.40	Rupert	Summary of Outcomes / Wrap up	
5.00		Finish	

Prepared by: Bryce Julyan, Team Leader, Planning and Engineering

APPENDIX B

Workshop Agenda: Innovators Challenge Workshop

Agenda of Meeting (Draft)

Additional Waitemata 2nd Harbour Crossing

Subject	Innovators Challenge Team Workshop	Page	1
Venue	Beca Office, Address and Room TBA	Time	1pm and 8am
Participants	**Challenge Team:** Amelia Linzey, Andrea Rickard, Lex Nielsen, Henry Yamazaki, Geoff Charlesworth, Anton Michielsen, Ken Wheeler, Alan Burford, Stuart Tucker, Steve Protheroe **Discipline Leads:** Rupert Hodson, Hugh Leersnynder, Andrew Campbell (for John Ashley), Geoff Heaton, Neil Watson, Ed Rogers, Lynne Hancock, Lesley Hopkins, John Connal, Bruce Skinner **Plus:** Brent Meekan, Darryl-Lee Wendelborn, Mark Pettigrew (Facilitator),Conrad Stacey, Will Pank, David Young		
Essential Pre-Reading	**All participants** - to review plan and scoping report extract so as to understand the project goal and the objectives of this study. In addition tunnel team to review geological long section and extracts from NoR document.		
File/Ref No.	AECOM: 60157303 Beca: 3910628 / 320	Date	June 30th and July 1st 2010
Distribution	As above plus Bryce Julyan		

Workshop Purpose: To challenge and test the development of the long list and the shortlisting process.

No	Item	Action	Date
	DAY ONE – WEDNESDAY, 30 JUNE, 1:00pm		
	Session Objective: **To introduce the challenge team to the broader project context and update the whole team on any new information** **DAY ONE – WED 30 JUNE**		
	COFFEE	All	1:00 - 1:30pm
1	**Welcome and Introduction** *Purpose of the 2 days, desired outcomes for today.*	Mark	1:30 – 1:35pm (5 min)
2	**Project Scope** *Project scope (3 teams), objectives, key factors affecting*	Darryl-Lee	1:35 – 1:45pm (10 min)

No	Item	Action	Date
	project, desired outcomes and programme		
3	**Project Background & Environment**		
3.1	**Background** *Previous studies and outcomes, NoR, project to date, design assumptions.*	Neil	1:45 – 2:00pm (15 min)
3.2	**Geotechnical** *Geology and geotechnical features. Key factors / constraints affecting the project Northcote to CMJ (earthworks, structures, etc)*	Andrew	2:00 – 2:15pm (15 min)
3.3	**Planning & Environment** *Statutory requirements and issues. Existing natural environment and values. Key constraints and potential impacts.*	Rupert	2:15 – 2:35pm (20 min)
3.4	**Motorways & Rail** *Design standards, design assumptions, key constraints.*	Geoff/Bruce	2:35 – 2:50pm (15 min)
3.5	**Bridges & Constructability** *Design standards, design assumptions, key constraints, cross sections, structural form, and operability.*	John Connal/ Will / Ed	2:50 – 3:10pm (20 min)
3.6	**Tunnels & Constructability (incl F&LS)** *Design standards, design assumptions, key constraints, cross sections, structural form, operability.*	Andrew/Conrad/ Ed	3:10 – 3:30pm (20 min)
3.7	**Traffic & Capacity** *Regional network context including resilience, key factors influencing capacity & connectivity Northcote to CMJ (and in particular CBD/CMJ)*	David Young	3:30 – 3:50pm (20 min)
	AFTERNOON TEA	All	3:50 – 4:00pm (10 min)
4	**Optional Small Group Sessions** *Opportunity for Challenge Team members to explore things further with Leads shown (right) as necessary*	Led by Andrew, Rupert, Geoff, John Connal	from 4:00pm

	DAY TWO – THURSDAY 1 JULY		
	Session Objective: **1. To understand the long-list options developed to date and to challenge that long-list.** **2. To understand how the long-list will be evaluated and to review the evaluation criteria.**		
1	**COFFEE**	All	8:00 – 8:30am (30 min)
	Welcome and Introduction *Purpose of workshop, options, evaluation and shortlisting.*	Mark	8:30 – 8:40am (10 min)
2	**Present long list of Options** *Key Features of tunnel and bridge options, Rationale*	Neil Watson Supported by: Andrew Campbell / John Connal / Will Pank	8:40 – 9:40am (1 hr)
3	**Questions on Options**	All esp Challenge Team	9:40 - 10:00am (20 min)
	MORNING TEA	All	10:00 – 10:20am (20 min)
4	**Long List Challenge** *Group Challenge – Issues, Ideas, Gaps* Structured brainstorming of options	Led by Mark, Andrew, John, Neil	10:20 – 12:30 (2hr 10 min)
5	**LUNCH**	ALL	12:30 – 1:00pm (30 min)
	Wrap up	Mark	1:00 – 1:30pm (30 min)
6	**Evaluation of Long-List Options** *Present Criteria,*	Rupert	1:00 – 1:40pm (20 min)
6.1	**Review of Evaluation Criteria** *Group Challenge – each criteria within each category (consentability, operability & constructability)* *Issues, Ideas, Gaps*	Neil, Lesley, Ed	1:40 – 2:40pm (1 hr)
7	**WORKING AFTERNOON TEA**	All	At 2.40pm
	Wrap Up	Mark	2:40 – 3:10pm (30 min)
8	**Wrap-Up and Next Steps** *Results, Next innovators challenge workshop and purpose, indicative timing*	Mark	3:10 – 3:30pm (20 min)

APPENDIX C

Long List of Assessment Criteria

Option Evaluation Assessment Criteria

CONSENTABILITY CRITERIA	
Consents and approvals	
E.1	Risks that consents/ approvals cannot be obtained
E.2	Impacts on Iwi (recognition of Crown/ Maori relationship)
Land and Development Impacts	
E.3	Degree of long term impact on residential areas
E.4	Degree of long term impact on function and viability of business areas
E.5	Degree of long term impact on social and community infrastructure (e.g. open space)
E.6	Amount of land acquisition required.
E.7	Provides ability to re-use land following construction
E.8	Degree of impact on archaeological and cultural sites, scheduled buildings/ trees during construction and operation
E.9	Degree of disruption to residential and business areas during construction
E.10	Degree of community severance
E.11	Degree of long term impact on public access to and along the coastal marine area
E.12	Impacts on the natural character of the coastal marine area
Environmental Impacts	
E.13	Degree of reclamation required for construction and operation
E.14	Degree of impacts of seabed disturbance during excavation and the marine disposal of sediments
E.15	Degree to which marine disposal of sediments may be required
E.16	Degree of impacts on coastal processes (e.g. sediment budget and tidal prism)
E.17	Degree of impacts on terrestrial biodiversity/ flora and fauna.
E.18	Degree of impacts on marine ecology

E.19	Degree to which connectivity and access to the coastal marine area is improved in the long term
E.20	Degree of long term impacts on groundwater
E.21	Degree of impact and manageability of contaminated groundwater (particularly at Victoria Park)
E.22	Degree of impact from noise and vibration during construction
E.23	Degree of long term impact from noise and vibration
E.24	Degree to which mitigation may be required (e.g. beach replenishment)
E.25	Degree to which option results in increased air contaminant loads in proximity to sensitive land uses
E.26	Degree to which the option may result in an improvement in air quality
E.27	Degree to which the option protects and promotes public health
Urban Design and Visual Effects	
E.28	Degree of impact on views
E.29	Degree to which the option creates aesthetic value, including vividness, memorability and image coherence
E.30	Degree to which option improves relationship between transport and open space connections
E.31	Degree to which option contributes to sense of place and/or identity
E.32	Degree to which option impacts on aesthetic value
E.33	Degree to which the option results in landscape change/ impacts on quality and character of landscape (through extensive earthworks, reclamation, removal of trees)
E.34	Degree to which option is compatible with built form, pattern, scale
E.35	Degree to which option is compatible with landscape pattern, form
E.36	Degree to which visual impacts can be mitigated/ the option enhances amenity values

Option Evaluation Assessment Criteria

CONSTRUCTABILITY CRITERIA	
Land, Environmental & utility impacts	
C.1	Minimises impacts on existing structures (settlement and foundation treatment during construction)
C.2	Minimises disruption to use of community infrastructure during construction (e.g. Victoria Park)
C.3	Reduces impacts on regionally/ nationally significant utility services (e.g.. temporary protection or relocation)
C.4	Minimises disruption to business operations (e.g.. loss of business during construction)
C.5	Minimises extent of temporary land occupation/ development for construction including temporary traffic diversions
C.6	Provides ability to stockpile, treat and use excavated material on site/ within corridor
C.7	Minimises removal of excavated material from site and disposal
Traffic impacts (limit to on site)	
C.8	Minimises impacts on the transport network during construction (all modes)
C.9	Minimises extent of traffic management (lane closures, road closures, traffic diversions)
C.10	Provides ability to access construction sites
Coastal/marine impacts	
C.11	Minimises impacts on navigation and other on-harbour activities during construction
Community impacts	
C.12	Minimises disruption to adjacent landowners and communities
Impacts during construction (Temporary)	
C.13	Minimises disposal of contaminated excavated materials
Geotechnical (Risk)	
C.14	Reduces vulnerability to geotechnical risks
C.15	Does not require extensive ground improvement

Option Evaluation Assessment Criteria

Construction duration	
C.16	Requires a shorter construction period (indicative duration for the NoR is 36-54 months (road) and 30-40 months(rail))
Construction complexity	
C.17	Minimises complexity of option construction (north)
C.18	Minimises complexity of option construction (central)
C.19	Minimises complexity of option construction (south)
Compatibility with Victora Park Tunnel	
C.20	Degree to which options are compatible with current VPT design and construction
Robustness of construction technologies	
C.21	Relative robustness of construction plant and methodologies (e.g. new crossing tunnels and bridge)
Construction staging	
C.22	Separates road and rail construction
C.23	Provides ability to stage rail & road route construction
Risk	
C.24	Minimises programme risk
C.25	Cost
C.26	Minimises level of third party risk during construction
Resources	
C.27	Construction materials are readily available
C.28	Construction workforce and expertise is readily available
C.29	Construction plant is readily available

Option Evaluation Assessment Criteria

OPERABILITY CRITERIA	
Safety & security	
O.1	Provides for pedestrian / cycle safety
O.2	Provides for emergency service access and implementation
O.3	Maintains safety of operations within the marine area
O.4	Provides an alternative route for utility services
O.5	Has a short recoverability time after incidents
O.6	Has low vulnerability to a major incident
O.7	Does not require extensive control systems monitoring and response infrastructure
O.8	Reduces the potential for accidents between SH1 Northcote interchange and CMJ
Network capacity	
O.9	Improves the capacity of Auckland's motorway system
O.10	Provides travel time savings between SH1 Northcote interchange and CMJ
O.11	Reduces the travel distance between SH1 Northcote interchange and CMJ
O.12	Improves the separation of CBD local traffic and new crossing SH1 "through" traffic
Network connectivity	
O.13	Maintains or enhances existing network connectivity
O.14	Improves efficiency and reliability of freight movement around the Region and to Port and business zones
Network resilience	
O.15	Provides the ability to maintain CBD connections in event of an existing AHB incident
O.16	Provides the ability to maintain through traffic connections in event of new crossing incident
Passenger transport	

O.17	Improves public transport connections and routes to North Shore City, CBD and southern motorway
O.18	Provides flexibility for changes in passenger transport routes
O.19	Gaunt Street rail tunnel/ station depth and location are compatible with future rail arrangements
O.20	Minimises rail operation costs (alignment)
O.21	Allows for separate/ later implementation of rail route
Walking & cycling options	
O.22	Provides for pedestrian connections and access opportunities
Impacts during operation	
O.23	Minimises long term impacts on utility services

APPENDIX D

Results: Options Evaluation Workshop 1

Options Evaluation – Tunnels - Workshop 1 (12 July 2010)

	CONSENTABLILITY	Tunnel Options				Project Team Comments from Workshop, 12 July 2010
		T1	T2	T3	T4	
E.1	Degree of long term impact on function and viability of business areas (consideration should be given to the ability to re-use land following construction and impacts on Westhaven Marina)	û-	ûû+	û	û	Option T1, being a bored tunnel will only impact on the Victoria Park Market area in the north. Option T2 significantly impacts business currently located in Southern Sector (including Orams Marine, Westhaven Marina and Victoria Park Market) and results in the loss of land (particularly in the vicinity of Opus / Orams Marine). Option T3 will have less impact on the Orams Marine area given the alignment further to the west. Option T4 will not impact on Westhaven Marina given that it is a bored tunnel but will potentially result in the loss of land in the vicinity of the Beaumont
E.2	Amount of land acquisition required	¡	ûû	ûû	ûû	Option T1 requires least land take given that it is a bored tunnel through the marina area and land associated with the cut and cover section may be returned after construction. Option T2 and T3 need the most landing space (and therefore substantial land take) given that they are immersed tube options. Option T4 requiring cut and cover through the Victory Christian Church and Beaumont Quarter apartments/ Gas Works Site will require significant land take.
E.3	Degree of disruption to residential and business areas during construction (e.g. noise, vibration, visual and traffic related impacts as well as construction impacts on Westhaven Marina)	û	ûû+	ûû	û	All options have similar noise, vibration, visual and traffic related construction impacts on the surrounding residential areas during construction. Option T2 and T3, being immersed tube tunnel options, will have greater impact on Westhaven Marina than the bored tunnel options. Option T3 is slightly worse given the proximity to Wynyard Quarter.
E.4	Degree of reclamation required for construction and operation	ûû	ûû+	ûû+	ûû	All options require extensive reclamation, particularly in the protected northern sector. Options T2 and T3 also require reclamation at the southern end to provide space for the landing of the tunnels. Given that the southern end is not a protected coastal area it was determined that the additional reclamation required only made a nominal difference in terms of effects on the environment.
E.5	Degree of seabed disturbance associated with excavation and the marine disposal of sediments (excluding works associated with reclamation)	¡	û	û	¡	Options T1 and T4 (being bored tunnel options) will have less seabed disturbance than options T2 and T3 (being immersed tunnels) as there is no requirement for dredging to accommodate the tunnels within the seabed or for the disposal of marine sediments offshore.
E.6	Degree of impact on marine ecology	û	ûû	ûû	û	Options T1 and T4 (being bored tunnel options) will have less impact on marine ecology than options T2 and T4 (being immersed tunnels) as there is no requirement for dredging to accommodate the tunnels within the seabed or for the disposal of marine sediments offshore.
E.7	Degree of impact on archaeological and cultural sites, scheduled buildings and scheduled trees	û	û	û	ûû	All options have the potential to impact on archaeological and cultural sites and/or scheduled building and/or scheduled trees given the proximity of these options to Stokes Point Pa site, Victoria Park, Victoria Park Market, the Rob Roy Hotel and Stokes Point Pa. Option T4 would however have a greater impact given that it involves cut and cover tunnel construction through the gas works site.
	Ranking (1 - best, 4 - worst)	1	4	3	2	

	CONSTRUCTABILITY	Tunnel Options				Project Team Comments from Workshop, 12 July 2010
		T1	T2	T3	T4	
C.1	Minimises impacts on existing structures (consideration should be given to settlement and foundation treatment during construction)	¡	¡	ü	û	Option T3 best meets criteria as is clear of Wynyard Quarter Area. Options T1 and T2 will have more impact as they transverses Wynyard Quarter (in vicinity of Opus/ Orams Marine). Option T4 least meets criteria as has a long section of bored and cut and cover tunnel through built up areas.
C.2	Minimises removal of excavated material from site and disposal	û	ûû	ûû+	û+	All tunnels require removal of material. Options T2 and T3 being immersed tubes will also require the disposal of marine sediments potentially offshore beyond the 12 mile limit.
C.3	Reduces vulnerability to geotechnical risks	ûû	û	û	ûû	Options T1 and T4 being bored tunnels are more vulnerable to geotechnical risk than immersed tube options T2 and T3.
C.4	Minimises complexity of option construction (central)	ü	¡	¡	ü	Bored tunnel options T1 and T4 will be easier to construct than immersed tube options T2 and T3 which require the seabed to be dredged and sections of tunnel to be cast on land then floated into place.
C.5	Minimises complexity of option construction (south)	ûû	û	ûû	¡	The bridge connection to SH1 makes use of the existing Victoria Park Tunnel. The sequencing through Victoria Park makes options T1, T2 and T3 complex. Option T4 bypasses these problems by connecting south of Victoria Park.
C.6	Relative robustness of construction plant and methodologies	û	¡	û	û	The bored and immersed tube tunnels are specialised methods with significant complexity. These options are therefore less robust. Option T2 (immersed tube) is marginally more robust given the demonstrated performance of many of these structures elsewhere.
C.7	Minimises programme and cost risk	ûû	û	û	ûû	Bored tunnel options T1 and T4 carry more risk than immersed tube options T2 and T3 as they require cutting edge technology.
C.8	Construction cost	ûû	û	û	ûû	Options T1 and T4, being bored tunnels, are more expensive to construct than options T2 and T3 which are immersed tubes.
	Ranking (1 - best, 4 - worst)	4	1	2	3	

	OPERABILITY	Tunnel Options				Project Team Comments from Workshop, 12 July 2010
		T1	T2	T3	T4	
O.1	Safety & Security - Has shorter recovery time after incident (consideration should be given to proximity and access for emergency services, nature of infrastructure damage, repair and commissioning durations)	¡	¡	ü	ü	Options T1 and T2 have access to mainlines at Onewa Road and SH16/Port. Options T3 and T4 are slightly better as they also have Wellington Street access.
O.2	Safety & Security - Has shorter average outage duration for maintenance over operational life	ü	¡	¡	ü	Options T2 and T3, being immersed tubes will require longer outage duration for major lining structural repair, than a bored tunnel that is through rock. The bored tunnel options T1 and T4 therefore best meet the criteria.
O.3	Network Capacity - Provides travel time savings between SH1 Northcote interchange and CMJ	ü ü	ü ü	ü	ü	All options meet criteria. Options T1 and T2 are slightly better than options T3 and T4 because mainline capacity is not reduced by Wellington Street on-ramps.
O.4	Network Capacity - Provides travel time savings between SH1 Northcote interchange and CBD	ü	ü	ü ü	ü ü	All options meet criteria. Options T3 and T4 are slightly better than options T1 and T2 because they have additional CBD access via Wellington Street on-ramp.
O.5	Network Capacity - Improves the separation of CBD local traffic and new crossing motorway "through" traffic	ü ü	ü ü	ü	ü	All options meet criteria. Options T1 and T2 are slightly better than options T3 and T4 because options T1 and T2 don't have a Wellington Street connection, providing for greater separation of CBD local traffic and new crossing through traffic.
O.6	Network Connectivity - Improves efficiency and reliability of freight/ commercial traffic movements to Port and business zones	ü ü	ü ü	ü	ü	All options meet criteria. Options T3 and T4 are slightly worse than options T1 and T2 because the "through" capacity for freight/ commercial traffic movements is reduced by the provision for Wellington Street connections (which reduce capacity through CMJ).
O.7	Network Resilience - Provides the ability to maintain CBD/ motorway connections in event of an incident/ maintenance on the existing AHB and approaches	û	û	¡	¡	If AHB is fully closed options T1 and T2 allow access to CBD via SH16/ Port off ramp. Options T3 and T4 have same connections as T1 and T2 plus Wellington St connection. Therefore options T3 and T4 have better connectivity.
O.8	Utility Services - Provides for utility services	ü ü	¡	¡	ü ü	Options T1 and T4 best meet criteria as there is space in a bored tunnel (below the road) for utility services. Options T2 and T3 being immersed tube tunnels do not provide this degree of space for utility services.
	Ranking (1 - best, 4 - worst)	1	2	4	3	

Options Evaluation – Bridges - Workshop 1 (12 July 2010)

	CONSENTABLILITY	Bridge Options B1 / B2	Bridge Options B3 / B4	Project Team Comments from Workshop, 12 July 2010
E.1	Degree of long term impact on function and viability of business areas (consideration should be given to the ability to re-use land following construction and impacts on Westhaven Marina)	ûû	û	Option B1/ B2 will impact on Westhaven Marina and business in the vicinity of the Gasworks site as it is a elevated bridge structure through the central and southern sectors. NZTA are likely to want land under and around bridge piers to remain clear following construction so there will be little potential to return land affected by Option B1/ B2 to business use following construction. Options B3/B4 will only impact on Westhaven Marina as is a tunnel through southern sector. It is likely that the majority of Westhaven affected by B3/ B4 will be able to return to marina use
E.2	Degree of long term impact on social and community infrastructure (e.g. open space land (including public aspects of Westhaven Marina) and churches)	û	û	Both options will impact on Westhaven Marina.
E.3	Amount of land acquisition required	ûû	û	Option B1/ B2 will require business/ residential land to be acquired through the southern sector. As this land will be below a bridge structure, most will not be able to be returned to business/ residential use. Option B3/ B4 only requires land at the southern landing point at Z-pier as land associated with the cut and cover tunnel section can be returned to open space use following construction.
E.4	Degree of disruption to residential and business areas during construction (e.g. noise, vibration, visual and traffic related impacts as well as construction impacts on Westhaven Marina)	ûû	û	Both options will have similar impacts on the Freemans Bay residential area, businesses in the vicinity of Victoria Park, Wynyard Quarter and Westhaven Marina. Option B1/ B2 will also impact on the Beaumont Quarter apartments, businesses in the vicinity of the Gasworks site and the St Mary's Bay residential area.
E.5	Degree of long term impact on public access to and along the coastal marine area	¡	û	Option B1/ B2 will have least impact on access to and along the coast as it is a higher level bridge than option B3/ B4, enabling maintenance of access via Westhaven Drive. Option B3/ B4 which lands at Z-pier has the potential to compromise access to and along the coast via Westhaven Drive.
E.6	Degree of reclamation required for construction and operation	û	û	Both options require substantial reclamation in the northern sector and small areas of reclamation in the vicinity of Z-pier in the central sector.
E.7	Degree of long term impact from noise and vibration	ûû	û	Both options will result in long-term noise and vibration impacts given the proximity of residential, Business and Open Space areas. Option B1/ B2 has the most significant impact as it will introduce increased/ new sources of noise and vibration to the area of St Mary's Bay (given that it is an elevated bridge structures adjacent to this area).
E.8	Degree of impact on archaeological and cultural sites, scheduled buildings and scheduled trees	û	û	Both options have the potential to impact on archaeological and cultural sites and/or scheduled building and/or scheduled trees given the proximity of these to Victoria Park, Victoria Park Market, the Rob Roy Hotel and the Gasworks site.
E.9	Degree to which option results in increased air contaminant loads in proximity to sensitive land uses (e.g. schools and residential areas)	ûû	û	Both options will increase contaminant loads in proximity to residential areas (given the increased capacity of the road network). Option B1/ B2 has the most significant impact as it introduces increased/ new contaminant sources to the area of St Mary's Bay (given it is an elevated bridge structure adjacent to this area).
E.10	Degree of impact on views	ûû	ûû	Both options are highly visible from residential areas in Northcote and St Mary's Bay and would result in changes to existing harbour views.
E.11	Degree to which the option contributes to sense of place and/or identity/ impacts on amenity values	ûû	ü	Option B1/ B2 being elevated through the southern sector will have significant impact on amenity values and has the greatest potential to compromise sense of place. Option B3/ B4 is a tunnel through the southern sector and will result in the removal of the Victoria Park viaduct, thereby improving amenity values in the southern sector. Option B3/ B4 therefore provides an opportunity to create a bridge that could contribute positively to sense of place.
	Ranking (1 - best, 2 - worst)	2	1	

	CONSTRUCTABILITY	Bridge Options B1 / B2	Bridge Options B3 / B4	Project Team Comments from Workshop, 12 July 2010
C.1	Minimises impacts on existing structures (consideration should be given to settlement and foundation treatment during construction)	ü	ü	Support criterion is similar for both options. Both options are high level bridges. Options B1/ B2 pass over residential and business areas west of Victoria Park. Option B3/ B4 include additional cut and cover tunnel for mainline southbound. Cut and cover tunnels are through open space and only will have minimal impact on existing structures.
C.2	Minimises removal of excavated material from site and disposal	ü ü	¡	Option B1/ B2 being an elevated structure through the southern sector best supports this criteria. Options B3/ B4 will require the removal of contaminated material through the cut and cover sections (at Victoria Park).
C.3	Reduces vulnerability to geotechnical risks	ü	¡	Option B1/ B2 best meets the criteria as it involves less cut and cover tunnel. Option B3/ B4 has tunnel through southern sector (at Victoria Park).
C.4	Does not require extensive ground improvement	ü	¡	The amount of ground improvement is limited for bridges generally. Option B1/ B2 being an elevated bridge scores better with a more straightforward connection to SH1 with limited ground contact.
C.5	Minimises complexity of option construction (central)	ü	ü	Both options have the same complexity of construction as they are bridge structures through the central sector.
C.6	Minimises complexity of option construction (south)	ü	¡	Option B1/ B2 has less construction complexity as is an elevated structure through southern sector. Option B3/ B4 is more complex as it is a tunnel through southern sector.
C.7	Relative robustness of construction plant and methodologies	ü ü	ü	Option B1/ B2 has robust construction and plant methodologies as is an elevated bridge through the southern sector (rather than a tunnel) with the simplest connection to SH1. Option B3/B4 also has relatively robust construction and plant methodologies as cut and cover tunnel through the southern sector will replicate VPT.
C.8	Minimises programme and cost risk	ü	¡	Option B1/ B2 has less programme cost and risk compared to option B3/B4 as it is has less cut and cover tunnel through Victoria Park.
C.8	Construction Cost	û -	û	Option B1/ B2 is relatively less expensive than option B3/ B4 as it has less cut and cover.
	Ranking (1 - best, 2 - worst)	1	2	

	OPERABILITY	Bridge Options B1 / B2	Bridge Options B3 / B4	Project Team Comments from Workshop, 12 July 2010
O.1	Safety & Security - Reduces the potential for vehicle accidents between SH1 Northcote Interchange and CBD/ CMJ and has lower vulnerability to incidents (consideration should be given to geometry and clearances to obstructions and the nature of infrastructure)	ü ü	ü	Option B1/ B2 best meets criteria as these options have better geometrics. Options B3/ B4 also meet geometric design standards, but not as good as option B1/ B3. Generally higher risk of striking obstructions for tunnels than bridges. Options B1 and B2 slightly better as have less cut & cover tunnel than Options B3 and B4.
O.2	Safety & Security - Has shorter recovery time after an incident (consideration should be given to the proximity and access for emergency services, nature of infrastructure damage, and repair and commissioning durations)	ü ü	ü	Both options have same access for incident recovery. Generally tunnel infrastructure is more vulnerable to damage. Options B1/ B2 are therefore ranked better as they have less cut and cover tunnel.
O.3	Safety & Security - Hazardous good vehicles are provided for	ü	ü	Both options support criteria. All have cut and cover tunnels only and can provide for hazardous goods vehicles as does adjacent VPT.
O.4	Safety & Security - Has shorter average outage duration for maintenance over operational life	ü ü	ü	Both options support criteria. Option B1/ B2 better as they have less cut and cover tunnel.
O.5	Passenger Transport - Provides flexibility for changes in passenger transport routes / future proofs network considering future changes to transportation network	ü ü	ü	Both options support criteria. Options B1/ B2 are slightly better than options B3/ B4 as they allow flexibility with Cook Street ramp connection because the mainline alignments do not pass through Victoria Park.
	Ranking (1 - best, 2 - worst)	1	2	Notes: All bridge options have the same connectivity, so not included as a criteria. Option B1/ B2 allow VPT to be used for Cook Street off ramp from Auckland Harbour Bridge. Similar travel times for all bridges.

ECONOMIC & FUNDING		Best				Worst	Comments
E.1	**Impacts on local development:** Provides for local development around the landings, entrances and exits to structure.		**T1**	**B3/B4, T2, T3**	**T4**	**B1/B2**	Option B1/B2 is the worst ranked of all options given that it traverses mixed use zoned land through the southern sector. All other options have impacts on local development within Westhaven and Wynyard Quarter. These impacts will be least for T1 as a bored tunnel compared to B3/ B4 as a bridge and T2 and T3 as immersed tube tunnels. T4 will have slightly greater impacts on local development than B3/ B4 than T2 and T3 because it also traverses mixed use zoned land in a cut and cover tunnel which may restrict development opportunities (but not as much as a bridge).
E.2	**Cost of land purchase/ reclamation:** Limited additional land has to be purchased for the option	**T1**		**B3/B4**		**T2, T3, T4, B1/B2**	T1 being a bored tunnel (rather than an immersed tube tunnel or bridge) has the lowest land purchase/ reclamation cost (including costs associated with the purchase of occupational rights within Westhaven). B3/B4 is ranked better than B1/B2 and T2, T3 and T4 because it is a bridge accross Westhaven (rather than an immersed tube), is clear of Wynyard Quarter and traverses Victoria Park through the souther sector (rather than mixed use zoned land). Option T2 also traverses Victoria Park but impacts on Wynyard Quarter and as an immersed tube will have greater impacts on Westhaven than a bridge structure because of the reclamation required to accomodate the tunnel portal and the invasive nature of immersed tube tunnel construction. Option T3 traverses Victoria Park and does not impact on Wynyard but will have the same degree of impacts on Westhaven as option T3. Option T4 being a bored tunnel will not impact on Westhaven and is clear of Wynyard but traverses mixed zoned land (as does option B1/B2).
E.3	**Capital cost:** Qualitative at this stage		**B1/B2, B3/B4**		**T1, T2, T3, T4**		The capital costs of all tunnel options are greater than all bridge options. There are little differences in the costs of a bored tunnel compared with an immersed tube tunnel.
E.4	**Operational cost**: Qualitative at this stage		**B1/B2**	**B3/B4**		**T1, T2, T3, T4**	All tunnel options have a high operating cost, given the power requirements to operate a tunnel. Option B3/B4 is slightly less well ranked than option B2/B1 because it has a tunnel through the southern sector (whereas B1/B2 has a bridge struture).
E.5	**Risk rating (for financing purposes):** Project has a lower financing risk (over and above risk adjustments to capital costs, riskier projects may attract a higher financing cost)		**B1/B2, B3/B4, T2, T3**			**T1,T4**	All bridge options and the immersed have a lower risk rating than the tunnels given certainty around bridge and immersed tube/ cut and cover tunnel technologies. There are much gretaer risks in constructing a bored tunnel hence the lower ranking of these options.

APPENDIX E

Workshop Agenda: Options Evaluation Workshop 2

Agenda

Additional Waitemata Harbour Crossing - Option Short Listing Workshop
To be held 15th July 2010 at 9.30am

at Rendezvous Hotel (Tasman Room II),corner Mayoral Drive & Vincent St.

Invitees:

NZTA Project Stakeholders and Advisors	As per Group listings attached
NZ8 Project Team	As per Group listings attached

Prior to Workshop:	All participants to review pre-circulated material on evaluation process and description of long-list options
Workshop Purpose:	Allow for Stakeholder input to the Shortlisting process

Item	Action	Time
2. Welcome • Opening workshop & introduction. • Overview of / purpose of the workshop.	Mieszko Iwaskow Amelia Linzey	**9.30 - 9.40 (10 min)**
3. Introduction • Project Objectives & Study Objectives. • Context of three workstreams (Planning & Engineering, Modelling and Economic Advisory) and Network Plan. • Key deliverables – The Business Case. • Consideration of the Anzac Centenary Bridge proposal.	Brent Meekan	**9.40 - 9.50 (10 min)**
4. Options Presentation • Process of establishing long-list. • Presenting the long-list options, including, constraints (environmental and land use), key design features; geotechnical, geometrics, operation and construction considerations.	Neil Watson	**9.50 - 10.20 (30 min)**
5. Option Evaluation Process • Explanation of the option evaluation process to date. • Process to develop the short list.	Rupert Hodson	**10.20 - 10.35 (15 min)**
6. Workshop Group Introduction • Introduction and explanation of how group evaluation will run.	Amelia Linzey	**10.35 - 10.40 (5 min)**
Coffee break –atrium lounge		**10.40 - 10.50 (10 min)**

7. Workshop Group Option Evaluation
Split into groups (see attached tables for group allocation).
• A: Evaluate the options. Project team panel available to answer queries.
  • Group 1: Consentability (facilitated by Amelia Linzey)
  • Group 2: Constructability (facilitated by Darryl-Lee Wendelborn)
  • Group 3: Operability (facilitated by Tom Morton)
• B: Evaluate the options against Economic and Fundability.
	Facilitated by: Amelia Linzey ; Darryl-Lee Wendelborn; Tom Morton	**10.50 - 11.50**
		A: (45 min)
		B: (15 min)

8. Wrap Up • Report back from each Group Session. • Missing Options? • Resulting draft Shortlist.	Amelia Linzey	**11.50 - 12:40 (50 min)**
9. Next Steps • Summary from each workstream of where to next.	Brent Meekan Richard Hancy John Yeabsley Matthew Richards	**12.40 -1.00 (20 min)**
10. Workshop Close	Mieszko Iwaskow	**1.00**
11. Lunch (Atrium lounge)		**1.00 - 1.30**

Group 1 – Consentability

Name	Company	Specialisation
Facilitator		
Amelia Linzey	Beca	**Facilitator**
Workshop Participants		
Patrick Kelly	NZTA	NZTA Project Manager Implementation
Jenna Phillips	NZTA	Project Support
Jacque Bell	NZTA	Urban Design
Matthew Richards	NZTA	Network Plan
David Greig	NZTA	Senior Resource Planner
Nita Chhagan	NZTA	Senior Resource Planner
Graham Taylor	NZTA	Engineering/Construction Design Standards
Clare Sinnott	NZTA	Legal Advisor
Chris Parker	NZIER	
Gordon Moller	Moller Architects	Urban Design Reviewer
Roger S Kerr	Asia-Pacific Risk Management Ltd	Economics Reviewer
Errol Kiong	Sweeny Vesty Ltd	Communications
Paula Brosnahan	CTSY	Legal Advisor
Project Team Panel		
Lauren Jewell	PWC	Economic Advisory
Rupert Hodson	Beca	Planning Manager
Lynne Hancock	Beca	Urban Design
Hugh Leersnyder	Beca	Environmental
Lesley Hopkins	Beca	Planning

Group 2 – Constructability

Name	Company	Specialisation
Facilitator		
Darryl-Lee Wendelborn	Beca	Engineering and Planning Deputy Team Leader
Workshop Participants		
James Hughes	NZTA	National Design Engineer
Jerry Giango	NZTA	NZTA Project Controls Manager
Craig Turner	NZTA	Procurement Manager– Engineering/Construction
Robert Strong	NZTA	AHB/Complex Project Manager
Ian Bond	Bond Construction Management Ltd	Engineering Review
Mark Johnson	NZTA	Acting Auckland Capital Manager
Michael Collins	Bond Construction Management Ltd	Cost Estimating
Duncan Peters	Peters and Cheung	Engineering Review
Troy Page	Bond Construction Management Ltd	Cost Estimating
Catherine McMechan	Sweeny Vesty Ltd	Communications
Project Team Panel		
Chris Money	PWC	Economic Advisory: Deputy Team Leader/Programme Manager
Peter Albert	PWC	Project Manager
Brent Meekan	Beca	Acting Engineering and Planning Team Leader
John Cooper	AECOM	Constructability Manager
Darren Cash	Resolve Group Ltd	Project Support
Andrew Campbell	AECOM	Engineering and Planning Team – Geotechnical Designer

Group 3 – Operability

Name	Company	Specialisation
Facilitator		
Tom Morton	Resolve Group Ltd	Project support
Workshop Participant		
Brian Rainford	NZTA	Senior Traffic Engineer/Traffic Safety
Graham O'Connell	NZTA	Senior Traffic Engineer
Dave Gennard	NZTA	Principal Transport Planner
Neil Cree	NZTA	NZTA Project Director
Karen Boyt	NZTA	Tolling
Julie Ballantyne	Traffic Design Group	Modelling Reviewer
Chris Hedley	Asia-Pacific Risk Management Ltd	Economics Reviewer
Paul Crawford	KiwiRail	Rail
Russell Turnbull	PB	AWHC Network Plan Lead
Project Team Panel		
Mieszko Iwaskow	NZTA	NZTA Project Manager Strategy
Will Pank	Beca	Engineering and Planning Team – Bridge design
Neil Watson	Beca	Design Lead
Richard Hancy	SKM	Transport / Toll Modelling Team Leader
Ian Clark	Flow	Lead Transport Modeller – Implementation
David Young	David Young Consulting	Transport Modelling
Steven Penney	PWC	Economic Advisory
John Yeabsley	NZIER	Economic Advisory
Geoff Heaton	AECOM	Engineering and Planning Team – Motorway Design

APPENDIX F

Results: Options Evaluation Workshop 2

Options Evaluation – Tunnels – Workshop 2 (15 July 2010)

CONSENTABLILITY		Tunnel Options				Comments from NZTA Workshop, 15th July 2010
		T1	T2	T3	T4	
E.1	Degree of long term impact on function and viability of business areas (consideration should be given to the ability to re-use land following construction and impacts on Westhaven Marina)	¡	ûû+	ûû	û	Option T1 has less impact as it only impacts on the Victoria Park Market (i.e. 6.0 metre encroachment) which is nominal compared to impacts on other business areas. Option T3 has greater impact than Option T4, given impacts associated with immersed tube in vicinity of Orams Marine.
E.2	Amount of land acquisition required	¡	ûû	û	ûû	Option T3 and T2 should be ranked worse than option T1 given the occupational rights associated with Westhaven Marina. Option T2 and T4 involve cut and cover through business land so require more land take than options T1 and T3.
E.3	Degree of disruption to residential and business areas during construction (e.g. noise, vibration, visual and traffic related impacts as well as construction impacts on Westhaven Marina)	û	ûû+	ûû	ûû	Option T4 has more impact than demonstrated as it will impact on business and residential areas near gas works/ Beaumont Quarter apartments. Disruption is relative to the construction period. If the marine industry driven out again it might not come back.
E.4	Degree of reclamation required for construction and operation	ûû	ûû+	ûû+	ûû	Rankings were not challenged
E.5	Degree of seabed disturbance associated with excavation and the marine disposal of sediments (excluding works associated with reclamation)	û	ûû	ûû	û	Neutral ranking for this criteria doesn't seem logical as all options require substantial seabed disturbance. Options T1 and T4 should be ranked X. Options T2 and T3 should be ranked XX.
E.6	Degree of impact on marine ecology	û	ûû	ûû	û	Rankings were not challenged
E.7	Degree of impact on archaeological and cultural sites, scheduled buildings and scheduled trees	û	û	û	ûû+	Option T4 should be ranked XX+ given the significant impacts on the gasworks
	Ranking (1 - best, 4 - worst)	1	4	3	2	

CONSTRUCTABILITY		Tunnel Options				Comments from NZTA Workshop, 15th July 2010
		T1	T2	T3	T4	
C.1	Minimises impacts on existing structures (consideration should be given to settlement and foundation treatment during construction)	¡	¡	ü	û	Rankings were not challenged
C.2	Minimises removal of excavated material from site and disposal	û	ûû	ûû+	û+	Rankings were not challenged
C.3	Reduces vulnerability to geotechnical risks	ûû	û	û	ûû	Rankings were not challenged
C.4	Minimises complexity of option construction (central)	ü	û	û	ü	Risk associated with immersed tube options T2 and T3 is understated.
C.5	Minimises complexity of option construction (south)	ûû	û	ûû	¡	Rankings were not challenged
C.6	Relative robustness of construction plant and methodologies	û	û	û	û	All options should be ranked the same as they have relatively the same degree of robustness of construction plant and methodologies.
C.7	Minimises programme and cost risk	ûû	û	û	ûû	Rankings were not challenged
C.8	Construction cost	ûû	û	û	ûû	Rankings were not challenged
	Ranking (1 - best, 4 - worst)	4	1	2	3	

OPERABILITY		Tunnel Options				Comments from NZTA Workshop, 15th July 2010
		T1	T2	T3	T4	
O.1	Safety & Security - Has shorter recovery time after incident (consideration should be given to proximity and access for emergency services, nature of infrastructure damage, repair and commissioning durations)	¡	¡	ü	ü	Rankings were not challenged
O.2	Safety & Security - Has shorter average outage duration for maintenance over operational life	ü	¡	¡	ü	Rankings were not challenged
O.3	Network Capacity - Provides travel time savings between SH1 Northcote interchange and CMJ	ü ü	ü ü	ü	ü	Rankings were not challenged
O.4	Network Capacity - Provides travel time savings between SH1 Northcote interchange and CBD	ü	ü	ü ü	ü ü	Rankings were not challenged
O.5	Network Capacity - Improves the separation of CBD local traffic and new crossing motorway "through" traffic	ü ü	ü ü	û	û	Options T1 and T2 only have a CBD connection from SH16/ Ports to east of CBD. Options T3 & T4 have same connection as options T1 and T2 plus a Wellington Street connection. Therefore options T3 and T4 provide for far less separation of CBD local traffic from motorway through traffic than stated.
O.6	Network Connectivity - Improves efficiency and reliability of freight/ commercial traffic movements to Port and business zones	ü ü	ü ü	û	û	Options T1 and T2 provide substantially better route separation than options T3 and T4 as they do not have Wellington Street connections. Therefore options T1 and T2 will provide for substantially better efficiency and reliability of freight/ commercial vehicle movements than options T3 and T4.
O.7	Network Resilience - Provides the ability to maintain CBD/ motorway connections in event of an incident/ maintenance on the existing AHB and approaches	¡	¡	¡	¡	Additional connectivity for options T1 and T2 could be designed in the future. Therefore all options should be scored equally.
O.8	Utility Services - Provides for utility services	ü ü	¡	¡	ü ü	Rankings were not challenged
	Ranking (1 - best, 4 - worst)	1	2	4	3	

Options Evaluation – Bridge – Workshop 2 (15 July 2010)

	CONSENTABILITY	Bridge Options B1 / B2	Bridge Options B3 / B4	Comments from NZTA Workshop, 15th July 2010
E.1	Degree of long term impact on function and viability of business areas (consideration should be given to the ability to re-use land following construction and impacts on Westhaven Marina)	--	-	Rankings were not challenged
E.2	Degree of long term impact on social and community infrastructure (e.g. open space land (including public aspects of Westhaven Marina) and churches)	--	-	Option B1/ B2 as a bridge through the southern sector has more impact than Options B3/ B4 from a social and community perspective. The potential for community severance associated with this option is understated.
E.3	Amount of land acquisition required	--	-	Rankings were not challenged
E.4	Degree of disruption to residential and business areas during construction (e.g. noise, vibration, visual and traffic related impacts as well as construction impacts on Westhaven Marina)	--	-	Rankings were not challenged
E.5	Degree of long term impact on public access to and along the coastal marine area	O	O	Option B1/ B2 have a higher clearance over Westhaven Drive enabling access along this extent of CMA to be retained. Option B3/ B4 should have neutral ranking as there are engineering solutions that would enable access to be provided from Wynyard Quarter along the southern edge of the Westhaven Marina.
E.6	Degree of reclamation required for construction and operation	-	-	Rankings were not challenged
E.7	Degree of long term impact from noise and vibration	--	-	Rankings were not challenged
E.8	Degree of impact on archaeological and cultural sites, scheduled buildings and scheduled trees	-	-	Rankings were not challenged
E.9	Degree to which option results in increased air contaminant loads in proximity to sensitive land uses (e.g. schools and residential areas)	--	-	Rankings were not challenged
E.10	Degree of impact on views	--	--	Rankings were not challenged.
E.11	Degree to which the option contributes to sense of place and/or identity/ impacts on amenity values	--	✓	Rankings were not challenged
	Ranking (1 - best, 2 - worst)	2	1	

	CONSTRUCTABILITY	Bridge Options B1 / B2	Bridge Options B3 / B4	Comments from NZTA Workshop, 15th July 2010
C.1	Minimises impacts on existing structures (consideration should be given to settlement and foundation treatment during construction)	✓	✓	Rankings were not challenged
C.2	Minimises removal of excavated material from site and disposal	✓✓	O	Rankings were not challenged
C.3	Reduces vulnerability to geotechnical risks	✓	O	Rankings were not challenged
C.4	Does not require extensive ground improvement	✓	O	Rankings were not challenged
C.5	Minimises complexity of option construction (central)	✓	✓	Rankings were not challenged.
C.6	Minimises complexity of option construction (south)	✓✓	O	Ranking is understated for option B1/ B2 as it does not require complex construction methodologies given that it is an elevated bridge structure through the southern sector.
C.7	Relative robustness of construction plant and methodologies	✓✓	✓	Rankings were not challenged
C.8	Minimises programme and cost risk	✓	O	Rankings were not challenged
C.8	Construction Cost	- -	-	Rankings were not challenged
	Ranking (1 - best, 2 - worst)	1	2	

	OPERABILITY	Bridge Options B1 / B2	Bridge Options B3 / B4	Comments from NZTA Workshop, 15th July 2010
O.1	Safety & Security - Reduces the potential for vehicle accidents between SH1 Northcote Interchange and CBD/ CMJ and has lower vulnerability to incidents (consideration should be given to geometry and clearances to obstructions and the nature of infrastructure)	✓✓	✓	Rankings were not challenged
O.2	Safety & Security - Has shorter recovery time after an incident (consideration should be given to the proximity and access for emergency services, nature of infrastructure damage, and repair and commissioning durations)	✓✓	✓	Rankings were not challenged
O.3	Safety & Security - Hazardous good vehicles are provided for	✓	✓	Rankings were not challenged
O.4	Safety & Security - Has shorter average outage duration for maintenance over operational life	✓✓	✓	Rankings were not challenged
O.5	Both options support criteria. Options B1/ B2 are slightly better than options B3/ B4 as they allow flexibility with Cook Street ramp connection because the mainline alignments do not pass through Victoria Park	✓✓	✓	Rankings were not challenged
	Ranking (1 - best, 2 - worst)	1	2	

APPENDIX G

Results: Options Evaluation Workshop 3

Options Evaluation Workshop 3 (28 July 2010)

	CONSENTABILITY	Bridge Options B3(a)	B3(b)	B4	Project Team Comments from Workshop, 28 July 2010
E.1	Degree of long term impact on function and viability of business areas (consideration should be given to the ability to re-use land following construction and impacts on Westhaven Marina)	--	-	--	It is difficult to redevelop land above cut and cover tunnels for Business purposes. As such Option B3(a) and B4 have the greatest long term impact on the function and viability of business areas as they require cut and cover tunnel through Wynyard Quarter to accommodate rail access to Gaunt Street Station, whereas option B3(b) has a bored tunnel for rail to Gaunt Street Station
E.2	Degree of long term impact on social and community infrastructure (e.g. open space land (including public aspects of Westhaven Marina) and churches)	-	-	-	The rail component did not change the ranking
E.3	Amount of land acquisition required	--	-	--	Option B4 is a bored tunnel for rail to Gaunt Street Station, requiring no additional land take for rail purposes. Options B3(a) and B4 require additional land take through Wynyard Quarter to accommodate rail component which has a cut and cover rail tunnel to Gaunt Street Station.
E.4	Degree of disruption to residential and business areas during construction (e.g. noise, vibration, visual and traffic related impacts as well as construction impacts on Westhaven Marina)	--	-	--	Options B3(a) and B4 involving cut and cover tunnel for rail through Wynyard Quarter will have greater impacts during construction than option B3(b) which is a bored tunnel through Wynyard Quarter.
E.5	Degree of long term impact on public access to and along the coastal marine area	-	-	-	The rail component did not change the ranking
E.6	Degree of seabed disturbance associated with excavation and the marine disposal of sediments (excluding works associated with reclamation)	--	-	-	All options will impact on the seabed. An immersed tube tunnel requires substantial dredging of the harbour and disposal of marine sediments offshore. As such option B3(a), having an immersed tube for rail will have greater impacts on the seabed than option B3(b) having a bored tunnel for rail and B4 being an all bridge option
E.7	Degree of impact on marine ecology	--	-	-	All options will impact on marine ecology. An immersed tube tunnel requires substantial dredging of the harbour and disposal of marine sediments offshore. As such option B3(a), having an immersed tube for rail will have greater impacts on marine ecology than option B3(b) having a bored tunnel for rail and B4 being an all bridge option.
E.8	Degree of reclamation required for construction and operation	---	-	--	All options require substantial reclamation. Options B3(a) and B4 require additional reclamation adjacent to Wynyard Quarter and Z-Pier to accommodate the rail component of these options. The reclamation for Option B3(a) is slightly greater than option B4 as the landing area required to accommodate the rail immersed tube before entering Wynyard Quarter is greater than the landing area required for the rail bridge decent to Wynyard Quarter.
E.9	Degree of long term impact from noise and vibration	-	-	--	The rail component of option B4, being on a bridge structure will have additional noise and vibration impacts to the rail components of options B3(a) and B3(b) which are accommodated in tunnel structures.
E.10	Degree of impact on archaeological and cultural sites, scheduled buildings and scheduled trees	-	-	-	The rail component did not change the ranking
E.11	Degree to which option results in increased air contaminant loads in proximity to sensitive land uses (e.g. schools and residential areas)	-	-	-	The rail component did not change the ranking
E.12	Degree of impact on views	--	--	---	All options impact on views. B4 will have greater impact on views than the other options as this option has two separate bridge structures (one from road and one for rail) whereas options B3(a) and B3(b) have a single bridge structure with rail accommodated in a tunnel.
E.13	Degree to which the option contributes to sense of place and/or identity/ impacts on amenity values	O	O	--	Option B4 comprising two bridge structures (one for road and one for rail) will have substantially greater impacts on visual amenity than options B3(a) and B3(b) which accommodate rail within a tunnel. The greatest degree of impacts relate to the northern and southern sectors where the rail bridge diverges away from the road bridge. In the southern sector the divergence of rail and road bridges at different heights will have significant impact on sense of place associated with Westhaven and the degree of sense of place that may be attributed to Wynyard Quarter as a mixed use precinct in the future.
	Ranking (1 - best, 3 - worst)	2	1	3	

	CONSTRUCTABILITY	Bridge Options B3(a)	B3(b)	B4	Project Team Comments from Workshop, 28 July 2010
C.1	Minimises impacts on existing structures (consideration should be given to settlement and foundation treatment during construction)	O	✓	O	B3(a) and B4 have greater impact on structures than B3(b) because they require a cut and cover tunnel for rail through Wynyard Quarter.
C.2	Minimises removal of excavated material from site and disposal	--	-	O	All options require the removal of excavated material. Options B3(a) and B3(b) having rail tunnels require more removal of excavated material than option B4 which is an all bridge option with only a short length of cut and cover tunnel to accommodate rail access to Gaunt Street Station. Option B3(a) having an immersed tube tunnel for rail is slightly worse ranked overall as marine sediments dredged from the harbour to accommodate the tunnel need to be disposed offshore.
C.3	Reduces vulnerability to geotechnical risks	-	--	O	B3(a) and 3(b) have greater degree of vulnerability to geotechnical risk because they have long lengths of rail tunnel, whereas B4 is an all bridge option with only a short length of cut and cover tunnel to accommodate rail access to Gaunt Street Station. B3(b) has a slightly greater degree of vulnerability because it has a bored tunnel for rail (rather than immersed tube).
C.4	Does not require extensive ground improvement	O	-	O	All options require some ground improvement associated with rail alignment through Wynyard Quarter. B3(b) requires greatest degree of ground improvement because the rail component is a bored tunnel through Wynyard Quarter which will require cross passages and may require buildings to be underpinned.
C.5	Minimises complexity of option construction (central)	-	O	✓	The rail component of options B3(a) and B3(b) being tunnels require more complex construction methodologies than the rail bridge component of B4. The rail component of B3(b), being a bored tunnel is slightly less complex to construct than the rail component of B3(a) which is an immersed tube tunnel.
C.6	Minimises complexity of option construction (south)	O	✓	-	B4 is the worst ranked against this criteria given the level of complexity associated with separating the rail bridge from the road bridge on decent into Gaunt Street Station. Option B3(a) is slightly more complex than option B3(b) as it requires both immersed tube and cut and cover tunnels for the rail component, compared with B3(b) which is a bored tunnel construction for the full extent of the rail tunnel.
C.7	Relative robustness of construction plant and methodologies	-	-	O	The rail component of options B3(a) and B3(b) being tunnels require more specialist construction methodologies than the rail component of option B4 which is a bridge.
C.8	Minimises programme and cost risk	-	--	O	Options B3(a) and B3(b) have greater programme cost and risk than B4 as the rail component of these options is a tunnel rather than a bridge. B3(b) having a bored tunnel for rail requires specialist technology and as such carries more risk than B3(a) which has an immersed tube for rail.
C.9	Construction Cost	-	-	O	Options B3(a) and B3(b) have a greater relative cost as the rail component of these options is a tunnel, compared with option B4 which has a rail bridge.
	Ranking (1 - best, 3 - worst)	3	2	1	

	OPERABILITY	Bridge Options B3(a)	B3(b)	B4	Project Team Comments from Workshop, 28 July 2010
O.1	Safety & Security - Reduces the potential for vehicle accidents between SH1 Northcote Interchange and CBD/ CMI and has lower vulnerability to incidents (consideration should be given to geometry and clearances to obstructions and the nature of infrastructure	✓	✓	✓	The rail component did not change the ranking.
O.2	Safety & Security - Has shorter recovery time after an incident (consideration should be given to the proximity and access for emergency services, nature of infrastructure damage, and repair and commissioning durations)	O	O	✓	B3(a) and B3(b) having a far greater length of rail tunnel are more vulnerable to incidents and will take longer to recover from an incident than B4 which has a rail bridge with only a short length of tunnel through the southern sector.
O.3	Safety & Security - Hazardous good vehicles are provided for	✓	✓	✓	The rail component did not change the ranking.
O.4	Safety & Security - Has shorter average outage duration for maintenance over operational life	O	O	✓	B3(a) and B3(b) having a far greater length of rail tunnel than option B4 will have longer outage duration for maintenance compared to B4 which has a rail bridge with only a short length of tunnel through the southern sector.
O.5	Safety & Security - Minimises fire safety requirements	-	-	O	Tunnels require more complex fire life safety design compared to bridges. As such, B4 being an all bridge option with only a short length of cut and cover tunnel for rail access to Gaunt Street Station is less complex in terms of fire life safety compared to options B3(a) and B3(b) which have a long length of rail tunnel.
O.6	Network Resilience - Reliability of Operations Complexity	-	-	O	Options B3(a) and B3(b) having rail tunnel component provide less reliability of operation than option B4 which is an all bridge option. Given the gradient of the rail bridge component of option B4 there is some potential for the rail component to create reliability issues.
O.7	Passenger Transport - Provides flexibility for changes in passenger transport routes / future proofs network considering future changes to transportation network	✓	✓	✓	The rail component did not change the ranking.
	Ranking (1 - best, 3 - worst)	2	2	1	