

Additional Waitemata Harbour Crossing



Technical Papers: Parallel Bridge and
Wynyard Quarter Impacts



Contents

1.	Parallel Bridge Option	1
1.1	Introduction	1
1.2	Evaluation Tables	2
1.3	Relative Cost	10
1.4	Conclusion	10
2.	Wynyard Quarter Impacts	11
2.1	Introduction	11
2.2	The Vision for Wynyard Quarter.....	11
2.3	Future Development Potential	13
3.	Potential Effects on Wynyard Quarter.....	14
3.1	Opportunity Cost Associated with Bridge Footprints.....	14
3.2	Impacts on the Marine Industry	14
3.3	Wider Severance Issues.....	15
3.4	Impacts on Values	15
4.	Conclusion	15





1. Parallel Bridge Option

(Prepared 6th September 2010 by the AWHC Planning & Engineering team)

1.1 Introduction

The Additional Waitemata Harbour Crossing (AWHC) project (the project) ultimately seeks to formulate a business case to help determine the nature or form such a crossing should best take – that is over the water (bridge), under the water (tunnel) or a combination of both. A Form Assessment Study (FAS) is being undertaken to help inform the business case on the differences between a bridge and a tunnel from an engineering and planning perspective. To date, the project has involved the identification and development of options (the ‘optioneering’ phase) and the evaluation of a long list of options in terms of consenting risk, constructability and operational functionality. This has resulted in the identification of a short list of crossing options which have been refined down to define a single bridge option and single tunnel option (the defined options).

In determining the options the study has been limited to a preferred corridor that was determined in earlier studies (the Option 2 Corridor). This generally connects the State highway 1 from the vicinity of Esmonde Rd to the vicinity of Victoria Park. The width of this corridor is relatively defined, however the presence of the existing bridge and Wynyard Quarter are key constraints. To test the assumptions of the study a bridge option parallel to the Auckland Harbour Bridge (AHB) has been included in the analysis (Option 7). This will enable the NZ Transport Agency (NZTA) to understand the technical issues, environmental effects, merits and costs associated with a bridge option parallel to the AHB. This technical note provides a comparison of a parallel bridge option (Option 7) with the defined bridge option. The evaluation of each of these options is set out in the tables that follow.

1.2 Evaluation Tables

OPTION DETAILS
<p>Option 7: Road bridge parallel to AHB and rail tunnel on NoR alignment.</p>
<p>Description: Option 7 comprises an at grade road from Esmonde Interchange on the northern side of the harbour and a harbour bridge crossing parallel to the AHB (a nominal 15 metres to the east). The bridge’s southern landing traverses the southwest corner of Westhaven Marina with the route following the St Mary’s Bay motorway at-grade, before traversing Victoria Park in “cut and cover” tunnels to the CMJ. Rail is separated from road and follows direct alignment between the Akoranga Busway Station into Wynyard Quarter (the NoR alignment). It is at grade from Akoranga Station (Esmonde) to Sulphur Beach and then crosses under the harbour via twin bored or immersed tube tunnels to a future train station at Gaunt Street in the Wynyard Quarter.</p>
<p>Rationale for Rejection: As part of the options development phase of the AWHC project all options were screened against mandatory requirements to determine suitability to be taken forward to a long list. During this process it was determined that the central sector of the study area should be confined to a corridor to ensure that any option taken forward to the short list could realistically be consented (i.e. adverse effects could be avoided or mitigated). A study corridor constrained at the eastern extent by the main body of finger berths within Westhaven Marina and at the western extent by the western edge of Wynyard Quarter was identified. This generally reflected, with some variation, the Option 2 alignment corridor from the 2008 study. For the purposes of this process it was also assumed that the AHB would retain its current form, and would be separate from any new bridge structure. The design would be “future proofed” to enable future maintenance and construction work on the AHB. That is, the separation distance would be sufficient to enable removal and/or replacement of the extension spans (clip-on bridge lanes). Option 7 did not meet the mandatory screening test and subsequently was rejected as an option for the long list because It was positioned:</p> <ul style="list-style-type: none"> • outside of the identified study corridor through the central sector of the study area; and • a nominal separation of 15 metres from the AHB, was insufficient distance to future proof the ability to remove and/or replace clip-on bridge lanes, although sufficient to enable the new bridge to be constructed and provide for general maintenance, <p><i>Note: variations on option 7 that moved the alignment east by more than 15m only created greater adverse effects on Westhaven marina or moved so far</i></p>



OPTION DETAILS		
<i>that the alignment became a different option</i>		
Technical Evaluation:		
Matter	Issue	Opportunity
Geometric Design	<p>The geometric alignment of the southern approach to the AHB on the existing approach does not accord with current motorway design standards. For Option 7 to accommodate the southern bridge approach whilst meeting modern requirements for design speed it would need to traverse the southwest corner of the main body of finger berths within Westhaven Marina.</p> <p>Three additional traffic lanes would be required through the St Mary's Bay section of the motorway to accommodate traffic from the new bridge. For these to be accommodated they would have to traverse the southern edge of Westhaven Marina between Point Erin and Z-Pier.</p>	<p>Modern geometric design applied to a new bridge could provide an opportunity to realign the current southern approach to the AHB. While this would improve motorway safety it is constrained by the position of the southern AHB abutment. Any realignment of the southern AHB approach would subsequently encroach into the St Mary's Bay cliff line (a cliff line tree amenity area).</p>
Bridge Design	<p>To enable vessels to navigate to the upper harbour the design of Option 7 would need to have the same pier spacing and navigational clearance as the AHB. There is limited scope in terms of pier locations for Option 7 as piers need to 'line up' in order to maintain the ability to navigate to the upper harbour.</p> <p>The structural design of the AHB has in recent years been strengthened in order to reduce bridge flexibility and meet the</p>	

OPTION DETAILS		
	<p>structural design standards required to accommodate the traffic volumes utilising the bridge. For Option 7 to meet these structural design standards and maintain the same required navigational clearance as new bridge it would need to be designed with a greater truss depth and less flexible girders. This would result in two bridge structures at different elevations.</p> <p>To reduce visual impacts at the northern and southern approaches to the new bridge, Option 7 would need to be designed at the same height as the AHB. The height of the AHB bridge approaches do not provide for a nominal 30 metre¹ navigation clearance across the marina. Bridge design would consequentially result in the loss (or displacement) of finger berths within Westhaven Marina.</p>	
Land Use & Environmental Evaluation:		
Matter	Issue	Opportunity
Landscape and Visual	<p>Option 7 option has limited potential to achieve ‘landmark status’ or contribute to ‘sense of place’ because of its proximity to the existing AHB, which as discussed above places constraints on bridge design.</p> <p>While in plan two parallel, side by side structures look very similar, they appear very differently in section and elevation. Option 7 cannot duplicate exactly the AHB because of structural design standards and navigation clearance requirements. Visually Option 7</p>	

¹ Estimated clearance required for current vessels to be accommodated

OPTION DETAILS		
	<p>will both mask (from Birkenhead, Westhaven and Wynyard Quarter in particular) and potentially 'jar' with the existing bridge.</p> <p>Option 7 is likely to create an impression of a very large composite / non-integrated structure. This undermines the integrity of the existing bridge form, certainly when viewed from the east, and potentially also from the west.</p> <p>The visual effect / quality of experience at Westhaven Marina will be compromised particularly under the bridges and between them. With the bridges very close together, and relatively close to the water, the experience of enclosure will be quite intense, perhaps comparable to being in a wide underpass (i.e. a large overhead structure approximately 80 metres wide obscuring views of sky, horizon etc).</p> <p>Option 7 will traverse the main body of finger berths within the marina detracting from the amenity value and 'sense of place' attributed to the Marina.</p>	
Function and Viability of Business Areas	<p>To accommodate the geometric design requirements of Option 7, reclamation would be required along the southern and western edges of Westhaven Marina resulting in the loss or displacement of finger berths, buildings and other facilities (including car parking) within the marina. This would impact on the function and viability of Westhaven Marina. These effects would be particularly significant during construction and potentially long term in nature where displaced finger berths could not be accommodated elsewhere within the harbour.</p>	



OPTION DETAILS		
Coastal & Ecological	Reclamation is required through Shoal Bay (in the north) to accommodate additional traffic lanes. Extensive reclamation is also required through St Mary's Bay to accommodate traffic lanes in the south. Reclamation in the north and the south coupled with the requirement to relocate marina berth space elsewhere in the harbour would have potentially significant coastal and ecological effects.	
Noise & air quality	Whilst Option 7 largely contains impacts within the existing motorway corridor of St Mary's Bay, the increase in traffic using this section of motorway and additional lanes required to accommodate traffic from the new bridge will likely increase noise and degrade air quality along the whole corridor.	
Community Severance	Option 7 requires increased motorway width through St Mary's Bay to accommodate three additional traffic lanes, potentially exacerbating the current level of community severance between St Mary's Bay and Westhaven Marina.	

OPTION DETAILS		
Defined Bridge Option: Road bridge west of the NoR alignment and rail tunnel on the NoR alignment		
<p>Description: The defined bridge option comprise an at-grade road from Esmonde Interchange on the northern side of the harbour and a harbour bridge crossing west of the NoR alignment. The bridge’s southern landing is generally in the location of Z-Pier, with the route alignment traversing Victoria Park in cut and cover tunnels to the CMJ. Rail is separated from road and follows the NoR alignment. It is at grade from Akoranga Station (Esmonde) to Sulphur Beach and then crosses the harbour via twin bored tunnels to a future train station at Gaunt Street in the Wynyard Quarter.</p>		
<p>Rationale for Selection: As part of the options development phase of the AWHC project all options were screened against mandatory requirements to determine suitability to be taken forward to a long list. This option met the mandatory requirements and was taken forward as part of the long list of options for further evaluation. During options evaluation it was identified that this option:</p> <ul style="list-style-type: none"> • was the top ranked bridge option, having the least long term land use and visual impacts and the greatest potential to contribute positively to amenity and achieve a sense of place/ identity; and • ranked favorably against the majority of operability and constructability criteria. <p>For these reasons it was selected as the defined bridge option to be carried forward as part of the short list.</p>		
Technical Evaluation:		
Matter	Issue	Opportunity
Geometric Design	<p>The option follows an alignment that optimises the separation from the AHB whilst remaining clear of the main body of finger berths and facilities within Westhaven and Wynyard Quarter.</p> <p>The option provides for a direct alignment to the central motorway junction, meaning that it does not require additional traffic lanes along the St Mary’s Bay section of the motorway.</p>	



OPTION DETAILS		
	In order for bridge piers to be accommodated between motorway lanes at the southern bridge approach the motorway will need to be widened the vicinity of Fanshawe Street.	
Bridge Design	Bridge design needs to maintain a nominal 30 metre navigational clearance over Westhaven.	The alignment optimises scope for bridge design as it is well clear of the AHB.
Land Use & Environmental Evaluation:		
Matter	Issue	Opportunity
Landscape and Visual	The defined bridge will have localised impacts on amenity values at the northern and southern approaches where the bridge structure converges with the existing motorway. The defined bridge option will impact on harbour views from residential catchments such as St Mary's Bay and Northcote.	Given the degree of separation between the defined bridge and the AHB, the defined bridge offers the opportunity for a bridge to be designed that could achieve 'landmark status' or contribute to a 'sense of place'.
Function and Viability of Business Areas	The defined bridge option is aligned clear of Wynyard Quarter and the main body of finger berths and facilities in Westhaven Marina so as to minimise the degree of impacts on the function and viability of these business areas.	
Coastal & Ecological	The required degree of reclamation through Shoal Bay (to accommodate additional traffic lanes) has the potential to have significant adverse coastal and ecological effects. Whilst reclamation is also required to accommodate the southern bridge approach this is localised in the vicinity of Z- Pier. Given the modified nature of the CMA in this location the potential for adverse coastal and ecological impacts as a result of southern	



OPTION DETAILS		
	sector reclamation is limited.	
Noise & air quality	The defined bridge option would localise noise and air quality impacts at the approaches to the bridge, with potential significant increases in noise and air quality in these localities. Mitigation measures would require further investigation.	
Community Severance	The defined option requires additional motorway width in the vicinity of Fanshawe Street to enable bridge piers to be located between traffic lanes and manage traffic during construction. This would potentially result in localised community severance impacts.	

1.3 Relative Cost

Cost estimates (50%) identify that Option 7 would cost relatively the same as the defined bridge option. Whilst the bridge structure of Option 7 is shorter and therefore less expensive than the defined bridge structure, the connections required for Option 7 in the southern sector are longer and consequently more expensive. The length of road required to connect Option 7 to the Central Motorway Junction is approximately 300 metres longer than is required for the defined bridge option, meaning additional traffic lane and pavement construction costs as well as additional costs associated with reclamation along the western and southern edges of Westhaven Marina to accommodate the additional traffic lanes. The defined bridge also requires reclamation within Westhaven Marina (with associated costs), however the extent of reclamation is limited to a localised area (in the vicinity of Z pier).

Significantly, the 50% costing does not include the costs of relocating marina facilities and finger berth space elsewhere within the harbour nor does it include any mitigation required to deal with the effects of noise. For Option 7 it is expected that relocating marina berths and facilities would add further additional costs compared with the defined bridge option which impacts on less finger berth space. Costs associated with mitigating noise would likely be comparable for Option 7 and the defined bridge option.

1.4 Conclusion

In design terms the defined bridge option has greater design flexibility than Option 7. The design flexibility provides an opportunity for an AWHC to achieve 'landmark' status or contribute to 'sense of place'.

The degree of adverse effects associated with Option 7 within the southern sector of the study area differs from those associated with the defined bridge option. The adverse effects of Option 7 extend along the length of the St Mary's Bay motorway corridor, whereas the effects of the defined bridge option are localised at the southern approach to the bridge.

Option 7 would have significant adverse effects on the function and viability of Westhaven Marina as well as additional consequential coastal and ecological impacts. These effects would be greater than those associated with the defined bridge option as the defined bridge option is aligned to minimise impacts on the main body of finger berths and facilities within the marina. It is however recognised that whilst the defined bridge option is clear of Wynyard Quarter it will (unlike Option 7) impact to a certain degree on businesses within the Quarter.

Whilst the 50% cost estimate has identified that Option 7 would cost relatively the same as the defined bridge option it does not factor in the cost of relocating marina facilities including finger berths, but also club buildings, parking and access. In factoring in these costs it is likely that Option 7 would cost, relatively, more the defined bridge option.



2. Wynyard Quarter Impacts

(Prepared 2nd September 2010 by the AWHC Planning & Engineering team)

2.1 Introduction

The current Additional Waitemata Harbour Crossing (AWHC) project (the project) ultimately seeks to formulate a business case for an additional harbour crossing. A form assessment study is being undertaken to help inform the business case on the difference between a bridge and a tunnel from an engineering and planning perspective. To date the project has involved the identification of options (the 'optioneering' phase) and the evaluation of a long list options in terms of consenting risk, constructability and operational functionality. This has resulted in the identification of a short list of crossing options which have been refined down to define a single bridge option and a single tunnel option (the defined options). As part of the optioneering process, options which have the potential to result in significant adverse effects on the Wynyard Quarter have been eliminated.

This technical note provides an analysis of the potential effects on the Wynyard Quarter with respect to the AWHC that has resulted in the conclusion that alignments either within or directly adjacent to Wynyard Quarter are likely to be difficult to consent and have significant economic costs. The note includes input from the Economic Advisory team regarding the potential economic impacts on the Wynyard Quarter.

2.2 The Vision for Wynyard Quarter

The Auckland Waterfront Vision 2040 produced jointly by the Auckland Regional Council (ARC) and the Auckland City Council (ACC), sets the overarching framework for the whole central area waterfront. The Vision has been developed in recognition that Auckland's central area waterfront, stretching from the Auckland Harbour Bridge in the west to Teal Park in the east, is one of Auckland's greatest assets. The waterfront plays a major role in the region's economy and is also the region's gateway to the Waitemata Harbour, the Hauraki Gulf and its islands beyond. To realise the potential of the waterfront, an integrated approach to the future development of the waterfront was considered necessary. The vision for the waterfront is of *"a world-class destination that excites the senses and celebrates our sea-loving Pacific culture and maritime history. It supports commercially successful and innovative businesses and is a place for all people, an area rich in character and activities that link people to the city and sea"*.

Wynyard Quarter is the 35 hectare reclaimed area located between Westhaven Marina and the Viaduct Basin. It includes 2.8 kilometres of coastal frontage. As leases currently held by the bulk liquids industry and other activities expire over the next 20 years, the opportunity exists for the redevelopment of this area. ACC have made the decision to reallocate this land for mixed uses (residential, commercial, public space) while enabling the existing marine and fishing industries to continue operating. The redevelopment of Wynyard Quarter is integral to realising the vision for the waterfront, and the area is therefore of strategic importance to the region.

To provide for redevelopment of the Wynyard Quarter, the ACC have notified a Plan Modification (Central Area Section Proposed Plan Modification 4 (PM4)) and other associated modifications (PM 16–26, 33, 37 and 43), which rezone land and introduce rules for Wynyard Quarter. PM4 is supported by a Plan Change to the Auckland Regional Plan: Coastal which deals with the coastal marine area.

To achieve the Auckland Waterfront Vision 2040, the following key principles are identified for the Wynyard Quarter:

- Provision of public access along the waterfront edge and the creation of a variety of new public open spaces;
- Re-establishment of the east–west connection from Quay Street into Wynyard Quarter by way of a bridge;
- The management of private vehicle impacts on existing road infrastructure and the need for fully integrated public transport;
- Maintaining the viability of the marine industry and fishing industry including the management of reverse sensitivity impacts;
- Developing a place for marine events;
- Urban design of the highest quality, reflecting the outstanding coastal setting of the area and its marine heritage and marine character.

These principles have been translated into the Auckland City Centre Waterfront Masterplan which gives spatial and physical definition to the principles of the Auckland Waterfront Vision 2040. The masterplan divides the waterfront into three main areas, primarily based on their location, water space functions, and urban and land form. These are; Westhaven; Wynyard Quarter and Viaduct Harbour; and the central wharves and port. The priorities for Westhaven and Wynyard Quarter and the Viaduct Harbour are directly relevant to the AWHC as an additional crossing may impact on these priorities. The relevant priorities for Westhaven are:

- To create a premier park that attracts Aucklanders and visitors to the outstanding marina and coastal environment. A Harbour Bridge Park is planned adjacent to the AHB.
- To connect Westhaven to the city centre so that more people are encouraged to visit the area. This includes the creation of a promenade alongside the waters edge with provision for walking and cycling and improved connections to Wynyard Quarter and Fanshawe Street.
- To create a world–class marina facility that attracts boaties and visitors to Westhaven. This includes a marina village, marina consolidation and expansion, and development of additional marina facilities.

The relevant priorities for Wynyard Quarter and the Viaduct Harbour are:

- To redevelop Wynyard Quarter and integrate the area with the wider waterfront and city centre. This includes developing the Wynyard Quarter Park at the northern end of Wynyard Quarter, a linear park along Beaumont Street, a bridge connection to the Viaduct Basin and connections to Victoria Park.

- To enable the fishing and marine industries to operate and prosper in Wynyard Quarter. The western side of Wynyard Quarter has been identified for these facilities.
- To protect and enhance features in Wynyard Quarter and Viaduct Harbour that contribute to the areas' character.

2.3 Future Development Potential

The redevelopment of the Wynyard Quarter will provide a total of 2500 dwellings which could accommodate between 5,000 and 7,000 people living in the area. There is also provision for extensive commercial development including some developments of up to 52m in height.

Land development is partially constrained by medium to long-term leases, the majority of which expire between 2016 and 2026. As a result, development is planned in four stages. Phase One of Stage One includes the building of major infrastructure, such as the iconic Te Wero Bridge, the Stormwater Pond and key public open space areas such as Jellicoe Plaza and the North Wharf upgrade. There are currently five projects in which are planned to be complete by mid-2011. These include:

- North Wharf on Jellicoe Harbour – Development of Jellicoe Street and the North Wharf Promanade.
- Wynyard Crossing – an interim pedestrian and cycling bridge which links the Eastern Viaduct (Te Wero Island) with Gateway Plaza.
- Gateway Plaza – A public open space in the area just beyond the Wynyard Crossing interim bridge.
- Silo Park at the western end of Jellicoe Street which is being designed to attract people to the western end of Jellicoe Street,
- Viaduct Events Centre – A multi purpose centre offering exhibition, meeting and hospitality space.

Sea+City also has under construction three 95m and one 60m berths on the western side of the Cement Wharf adjacent to the distinctive Golden Bay cement silo. These berths, to be complete by September 2010, will be used as part of the expansion of the superyacht commissioning and refit facilities in on the western side of Wynyard Quarter.

Other current development includes the new ASB Bank head office on the corner of Halsey and Jellicoe streets which is expected to be completed in 2013.

Based on the above, it is likely that within the timeframe of the AWHC project, considerable development will have already occurred within the area.

3. Potential Effects on Wynyard Quarter

3.1 Opportunity Cost Associated with Bridge Footprints

Bridge alignments through the Wynyard Quarter will have a significant opportunity cost associated with occupying land that could otherwise have been used for productive purposes. The defined bridge option has a deck of 38m wide. If a bridge alignment was located within Wynyard Quarter, it would be of a similar width. Land would be required for construction and operation of the bridge involving the removal of existing development within the affected footprint.

The ability to use a combination bridge and tunnel (with the bridge landing and going into a tunnel) is limited due to the clearance height for a bridge through this section of the harbour (52m through the navigable span). To allow for motorway gradients, this means that an elevated bridge structure would be required until at least half way along the Wynyard Quarter.

Construction of a cut and cover tunnel would require top down construction and the removal of existing buildings. The bridge piers and tunnel could interfere with existing building foundations in the areas close to the structures. The NZTA are likely to not reinstate any land use over the cut and cover tunnel due to future maintenance and operation requirements.

Current development proposals around the Wynyard Quarter will involve between \$2–3 billion in development. It is likely that the land directly required for roading and bridging infrastructure would have a significant impact on the land available for development in Wynyard. Assuming that Sea+City could not intensify development to compensate for lost land (which has its own costs outlined below), it is likely that the opportunity cost associated with selecting an alignment through this area would be considerable. If the relationship is directly related to the proportion of land taken, a 5% requirement would cost the Wynyard Quarter development at least \$100 million.

Loss of land within Wynyard Quarter will affect the ability to deliver the vision for Auckland's waterfront, given the strategic importance of this land (including its location and redevelopment potential).

3.2 Impacts on the Marine Industry

Any bridge alignment on the western boundary of Wynyard Quarter would effectively eliminate the marine industry within the Quarter. Auckland's marine sector represents over \$1 billion in economic activity² and has significant growth potential (with estimates of 205% growth to 2020). Within this, the superyacht industry is expected to be worth about \$619 million to the Auckland economy by 2020.

Wynyard and Hobsonville represent the two key locations for the superyacht industry, and while it is unlikely that the industry would be significantly damaged long-term by a western boundary alignment (as industry

² New Zealand Trade and Enterprise, 2007.

would relocate), there would be significant relocation costs and the potential for lost orders and reduction in economic activity during the transition phase. Short-term economic impacts, particularly at the firm level would be significant.

A more central alignment, while maintaining the industry, would reduce accessibility for the industry and make the precinct less attractive as a place to work. It may also increase infrastructure costs associated with providing road connections in the area in between the bridge alignment and the marine industry (if the marine industry could not be accessed from the rest of Wynard).

3.3 Wider Severance Issues

An easterly alignment through the Wynyard Quarter would effectively cut the quarter in two resulting in reduced amenity value for users of the area. All alignments would reduce the ability to provide connections to the wider waterfront which is central to the long-term vision for Auckland's waterfront.

3.4 Impacts on Values

Leaving aside the direct impact of the land taken for a crossing, it is likely that the potential for the Wynyard Quarter to fully realise its commercial value would be reduced by locating an AWHC alignment in the Quarter. This may take a number of forms:

- Reduced prices for apartments associated with proximity, noise and visual impacts;
- Reduced prices for commercial property due to reduced rental potential associated with potential reductions in accessibility (e.g. less foot traffic) as well as potential noise and visual impacts; and
- Reductions in the amount of available recreational space reducing amenity value of the Quarter, and having a flow-on impact to residential and commercial values.

These impacts would require a more detailed investigation to accurately cost, but it is very likely that the impacts would be significant.

4. Conclusion

The optioneering process for the AWHC project has eliminated alignment options that affect the Wynyard Quarter due to the following potential impacts:

- Opportunity costs associated with bridge or tunnel footprints;
- The ability to realise the vision and masterplan for Auckland's waterfront;
- Impacts on the marine industry;
- Severance Issues within Wynyard Quarter and along the wider waterfront; and



- Impact on realising the full commercial value of Wynyard Quarter including reduced prices for residential and commercial property and reductions in the amount of available recreational space.