

**Contents**

1	PURPOSE .....	2
2	SCOPE .....	2
3	OBJECTIVES.....	2
4	OPERATIONAL CONCEPT.....	5
5	GENERAL OPTION LAYOUT – EASTERN OPTIONS.....	6
6	GENERAL OPTION LAYOUT – WESTERN OPTIONS.....	9
7	OPTION SUMMARY .....	14
8	OPTION IMPLEMENTATION .....	15
8.1	Option 1 – Southbound 1 lane / Weekend operation / AHB Tidal operational.....	15
8.2	Option 2 – Southbound 2 lanes / Weekend operation / Tidal non-operational.....	17
8.3	Option 3 – Southbound 1 lane / Permanent operation / Tidal operational.....	18
8.4	Option 4 – Southbound 2 lanes / Permanent operation / Tidal non-operational .....	19
8.5	Option 5 – Northbound 1 lane / Weekend operation / Tidal operational.....	20
8.6	Option 6 – Northbound 2 lanes / Weekend operation / Tidal non-operational .....	21
8.7	Option 7 – Northbound 1 lane / Permanent operation / Tidal operational .....	22
8.8	Option 8 – Northbound 2 lanes / Permanent operation / Tidal non-operational.....	23
8.9	Option 9 – Centre 1 lane / Permanent operation / Tidal non-operational .....	24
8.10	Option 10 – Centre 2 lanes / Permanent operation / Tidal non-operational.....	25
8.11	Option 11 – Northbound + Southbound / Permanent operation / Tidal operational	26
9	EXISTING NETWORK MANAGEMENT TOOLS.....	27
10	PROPOSED TOOLS SUPORTING NETWORK MANAGEMENT.....	28
11	RISKS.....	29

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## 1 PURPOSE

Inform Waka Kotahi and its network operating partners with a shared vision for the operation of active modes on the Auckland Harbour Bridge.

## 2 SCOPE

This document has been developed as a reference concept of logistics, to enable further discussion of possible tactical operations for the enablement of active modes across the Auckland Harbour Bridge. The elements discussed in this document are explorative and have been developed for the purpose of discussion only. Resolve Group developed eleven active mode options on the existing Auckland Harbour Bridge (AHB) which form the basis of the options explored.

## 3 OBJECTIVES

Operating objectives:	Operating principles:
To promote the use of active mode travel network wide	<ul style="list-style-type: none"> <li>• Safe use for active mode across the harbour.</li> <li>• Safe and convenient connectivity for active modes at either end of the Harbour Bridge</li> </ul>
Provide our customers with the ability to make best use of the reduced general traffic capacity in order to provide predictable journey times on the state highway and key arterials (on local roads) during peak and off-peak flows	<ul style="list-style-type: none"> <li>• To align with our partners' network operating principles, where appropriate.</li> <li>• Manage the risk of queuing impacting on key arterials at the Onewa, Esmonde, Northcote, Tristram and Constellation Interchanges</li> <li>• Manage the risk of queuing impacting on key arterials and at the Curran St, Esmonde Rd, SH16, Gillies Ave, Wellesley St and St Lukes Interchanges</li> <li>• Encourage the use of the Western Ring Route for traffic in both directions.</li> <li>• Minimise the impact on reliability of journey times along the state highways, particularly during the peak periods on SH1.</li> </ul>
To maintain public transport reliability and attractiveness	<ul style="list-style-type: none"> <li>• Support public transport movements across the Harbour Bridge pursue outcomes where they are not adversely impacted in terms of journey time and journey time reliability.</li> <li>• Support partners to provide customers with enhanced alternative mode choice options.</li> </ul>
To manage the transport network resilience during disruptive incidents and improving the ability to quickly recover from disruptions	<ul style="list-style-type: none"> <li>• Always aim to have at least one alternative route for traffic diversion available for planned or unplanned events.</li> <li>• Improve incident response times on SH1 and the SH16, SH18 and SH20 Alternative route</li> <li>• Improve situational awareness for network operators.</li> <li>• Reduce the likelihood of secondary incidents and reduce the impact on network performance in the event of an incident.</li> </ul>
To provide customers with enough information before and during their journey to make informed travel choices	<ul style="list-style-type: none"> <li>• Inform customers of any incidents or upcoming planned events (Roadworks) downstream and alternative routes to use prior to key decision points on the network.</li> <li>• The BAU published/broadcasted traveller information around journey times, incidents and roadworks captures TG and the associated network changes.</li> </ul>

## PARTNERS AND STAKEHOLDERS

Organisation	Status	Responsibility
Waka Kotahi	Owner	Support a transport system that keeps people safe, is well connected and can be accessed by everyone. It manages the state highway system, including planning, funding, designing, supervising, constructing, maintaining and operating the system.
Auckland System Management (ASM)	Partner	Deliver desired strategic asset management and network management outcomes for the state highway network, including road maintenance, renewals and incident response.
Auckland Transport Operations Centre (ATOC)	Partner	Facilitate safe and efficient traffic movement on the road network. It undertakes real-time traffic monitoring and management.
Auckland Transport (AT)	Partner	Ensure people and goods can move quickly and safely around, and in and out of the region. It operates the bus services, while also involved in planning future road networks and building public transport infrastructure.
Public Transport Operators	Partner	AT's contracts public transport operators to provide bus, train and harbour ferry services in the Auckland Region. The primary responsibility of public transport operators is to provide safe, reliable and efficient public transport services to users.
NZ Police	Stakeholder	NZ Police have a role in proactive and reactive traffic operations including provide traffic law enforcement, provide road safety education, maintain public safety, reduce potential incidents and manage incidents on the road.
Fire and Emergency New Zealand (FENZ)	Stakeholder	FENZ is responsible for responding to incidents involving fire and explosion, motor vehicle accidents, floods and hazardous substance spills by providing resources such as fire trucks and fire fighters.
St John's Ambulance Service	Stakeholder	St John's is responsible for responding to emergency calls in respect of sick and injured people and providing on-scene first aid and triage services as appropriate. Their main functions are to preserve lives, prevent further injuries and transport of victims.
Auckland Region Emergency Management Group	Stakeholder	The role of the Emergency Management Office is to lead and coordinate all relevant stakeholders in large scale emergencies including both natural and man-made disasters.
Road Transport Forum NZ	Stakeholder	The Forum is made up of constituent associations which serves the interests of trucking operators and the road freight association. It can advise its members about use of the transport network such as the preferred freight routes.
NZ Heavy Haulage Association (NZHHA)	Stakeholder	(NZHHA) is the national trade association for companies that transport overweight or over dimension loads. It can advise its members about use of the transport network including any restrictions on over dimensional / overweight vehicles and dangerous goods vehicles.

Automobile Association (AA)	Stakeholder	The Automobile Association (AA) offers roadside breakdown assistance, motoring advice, insurance, finance, maps and travel guides. It can advise its members and services users about use of the transport network including road closures.
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**DEFINITIONS**

AHB active mode options considered:

**Auckland Harbour Bridge Shared Path Options List**

Option	Description	Temporary/Permanent	Ramp Closures/Modification	Traffic Configuration	Tidal Flow	Access North	Access South	Shared Path Width
1	East - 1 Lane	Temporary	Shelly Beach	4/3 (5/2)	Tidal	Sulphur Beach Road/Underpass	Shelly Beach Offramp	4m
2	East - 2 Lane	Temporary	Shelly Beach	3/3	None	Sulphur Beach Road/Underpass	Shelly Beach Offramp	8m
3	East - 1 Lane	Permanent	Shelly Beach	4/3 (5/2)	Tidal	Sulphur Beach Road/Underpass	Shelly Beach Offramp	4m
4	East - 2 Lane	Permanent	Shelly Beach	3/3	None	Sulphur Beach Road/Underpass	Shelly Beach Offramp	8m
5	West - 1 Lane	Temporary	Curran Street	4/3 (5/2)	Tidal	Sulphur Beach Road/Underpass	Curran Street	4m
6	West - 2 Lane	Temporary	Curran Street	3/3	None	Sulphur Beach Road/Underpass	Curran Street	8m
7	West - 1 Lane	Permanent	Curran Street	4/3 (5/2)	Tidal	Sulphur Beach Road/Underpass	Curran Street	4m
8	West - 2 Lane	Permanent	Curran Street	3/3	None	Sulphur Beach Road/Underpass	Curran Street	8m
9	Centre - 1 Lane	Permanent	None	4N/3S	None	Sulphur Beach Underpass	Fanshawe Street	3m
10	Centre - 2 Lane	Permanent	None	3/3	None	Sulphur Beach Underpass	Fanshawe Street	6m
11	Both Sides	Permanent	Shelly Beach/ Curran Street	5/3	Tidal	Sulphur Beach Road/Underpass	Shelly Beach Offramp/ Curran Street	2.5m/2.5m

Temporary denotes implementation on weekend ‘dynamic configurations’: Implementation starts 10pm Friday, decamp starts 11 pm Sunday (Unless agreed to facilitate over public holiday weekends).

Permanent denotes active path operation and access 24/7 (With option of closure to active modes via security fences and supporting customer signage).

Lane naming convention:



## **4 OPERATIONAL CONCEPT**

There are two approaches to providing active mode pathway over the AHB:

A dynamic configuration, where the route can be turned 'off and on' from vehicle access to active mode access where the outcome is that active mode users are protected by a formal barrier system. The transition between 'off and on' is anticipated to be an overnight operation and the installation is supported by preceding infrastructure such as overhead signage and early warning devices.

A permanent configuration where the route of active mode users is always available, however can be 'closed' to users in the event of an incident or high wind or other such requirement. The requirement to provide supporting infrastructure is less intensive than the 'dynamic' options.

To achieve the requirement of providing a safe environment for the active mode route (adjacent to high-speed traffic environment) both options establish a formal barrier system.

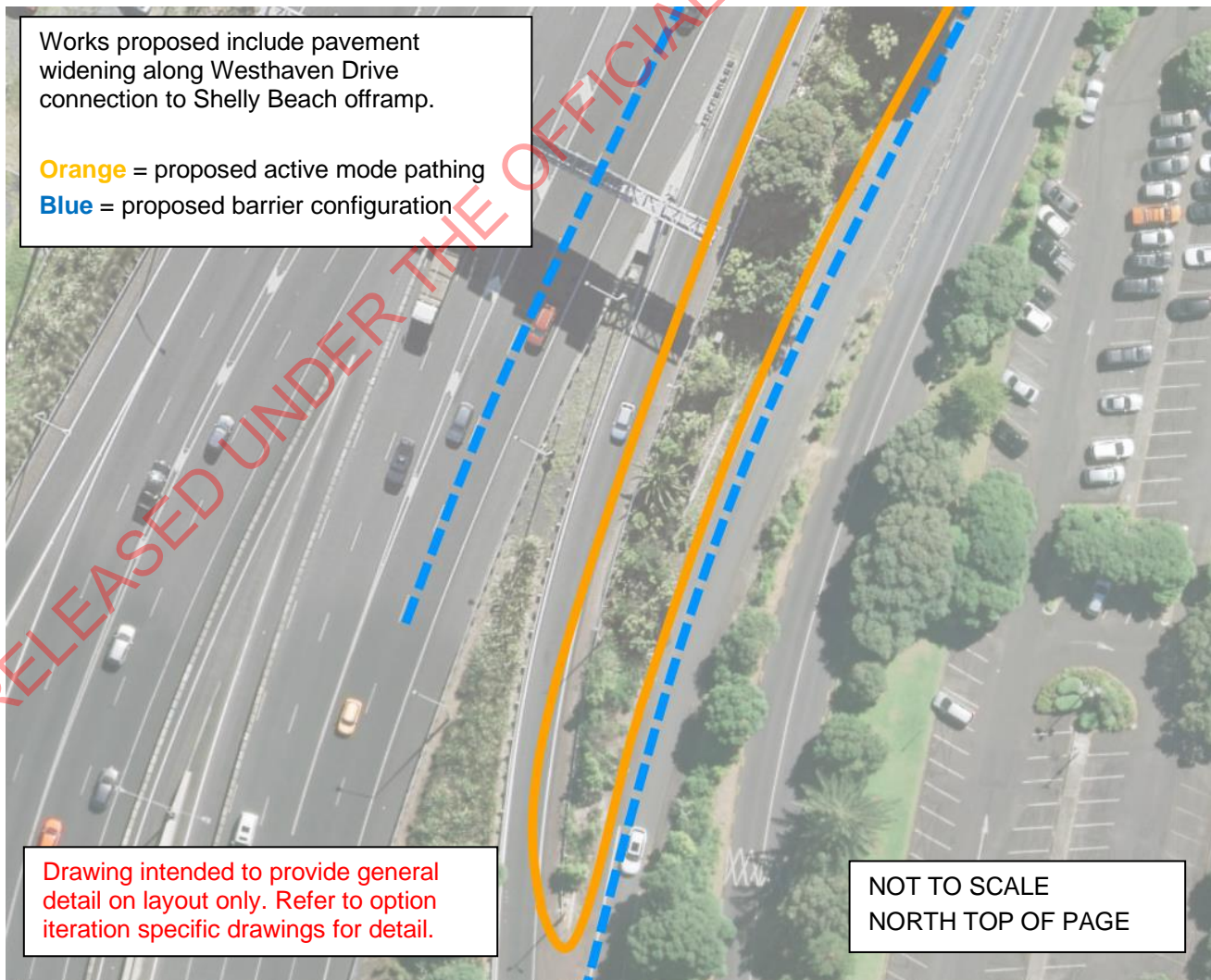
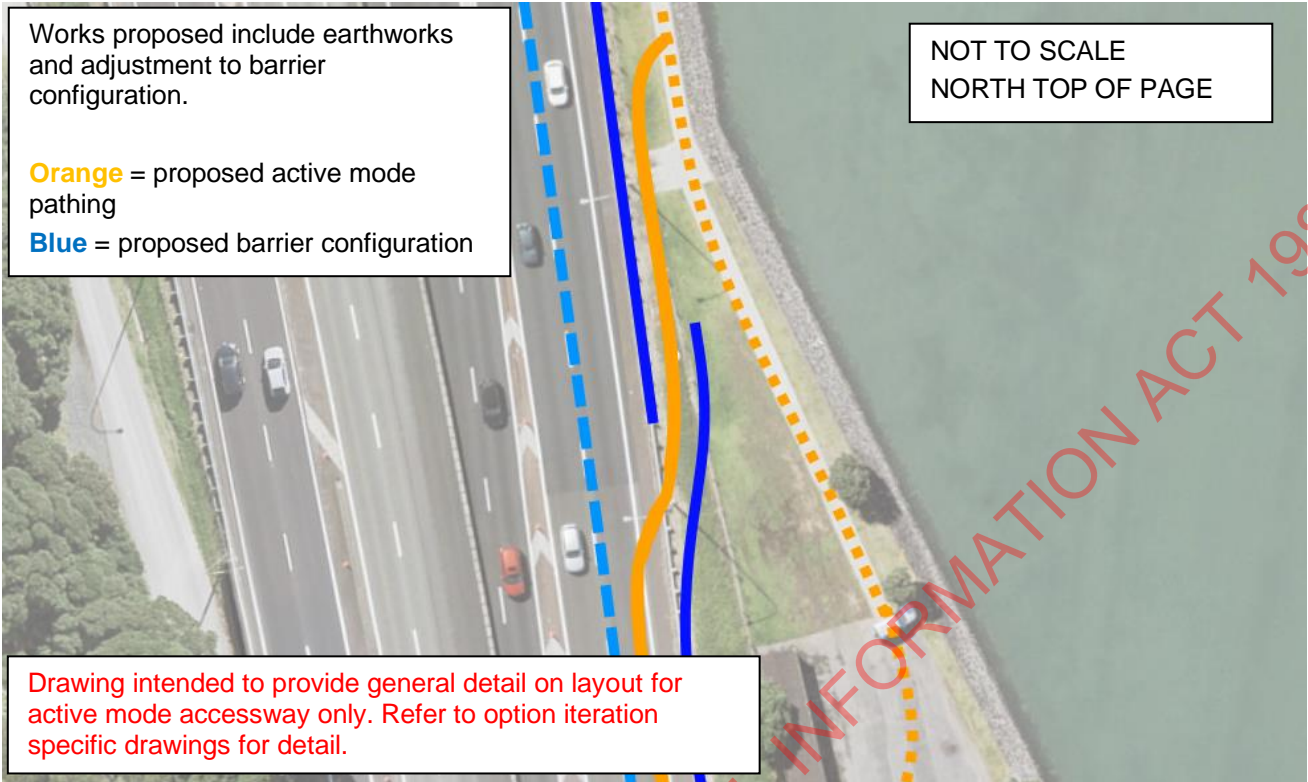
### **Dynamic configurations:**

- Barrier string is installed between lanes (On gore areas where available) and a 'lead in' is established ahead of the barrier.
- Motorist warning systems are established (Or existing infrastructure is enhanced) upstream to support lane shift and early warning.
- Directional signage is amended to reflect downstream lane allocation requirements.
- Active lane closure systems such as swift gates are established, which close or open lanes to SH traffic.
- Supporting active mode accessways and security is provided to enable route operation.

### **Permanent configurations:**

- Barrier string is installed as required to develop closure of active mode path.
- Directional signage is amended to reflect downstream lane allocation requirements.
- Active lane closure systems such as swift gates are established, which close or open lanes to SH traffic.
- Supporting active mode accessways and security is provided to enable route operation.

## 5 GENERAL OPTION LAYOUT – Eastern options



Southbound SH1 - General layout

**Purple** = area of merge / development of lanes into captive lanes

**Red** = early termination of BUS ONLY LANE ex Onewa Road

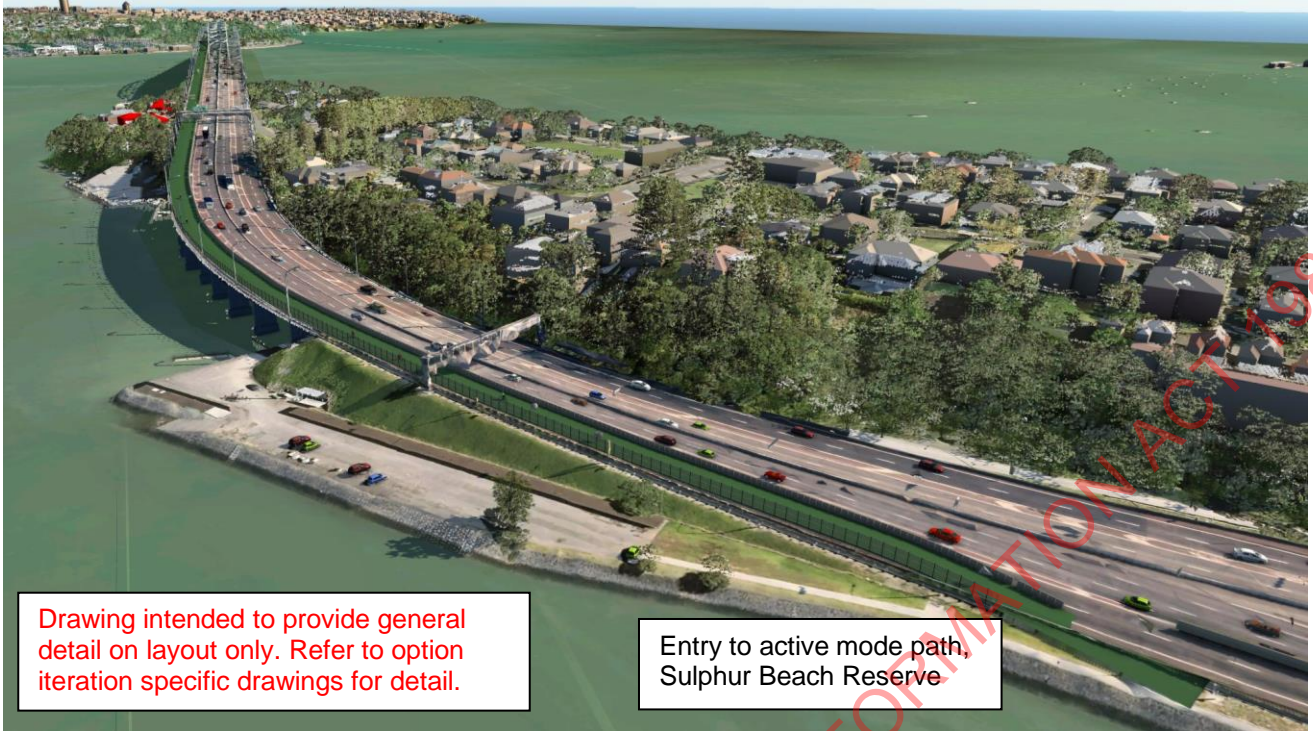
**Orange** = proposed active mode pathing

**Blue** = proposed barrier configuration



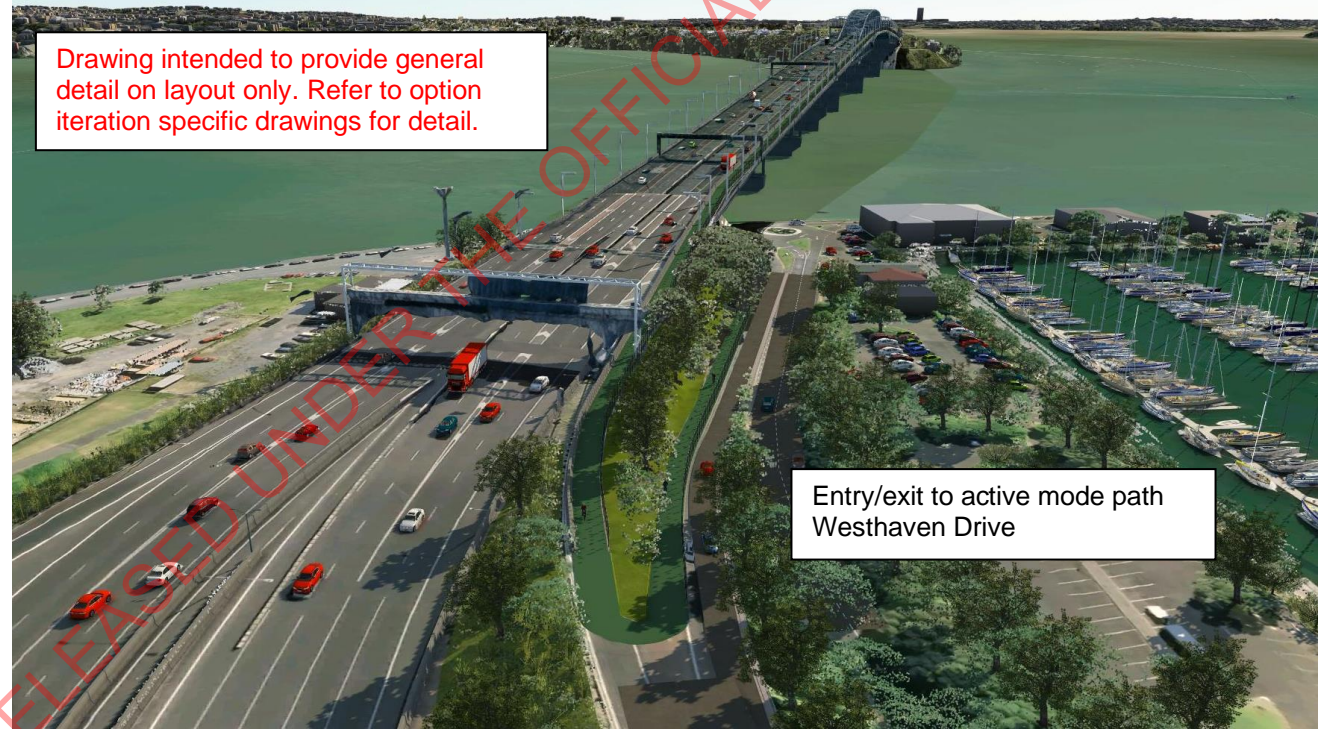
Drawing intended to provide general detail on layout only. Refer to option iteration specific drawings for detail.

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Drawing intended to provide general detail on layout only. Refer to option iteration specific drawings for detail.

Entry to active mode path, Sulphur Beach Reserve

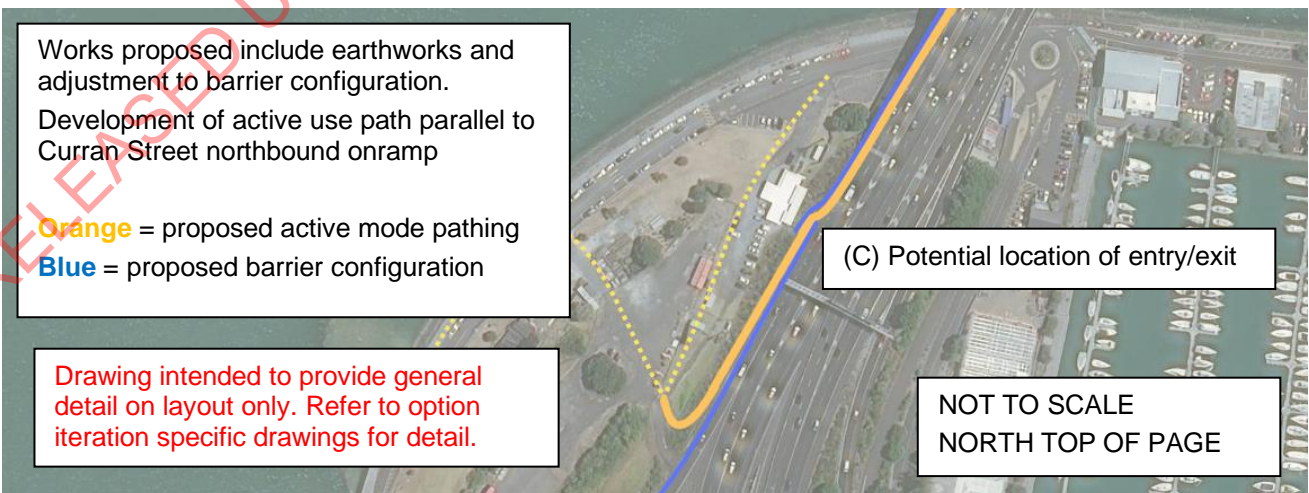
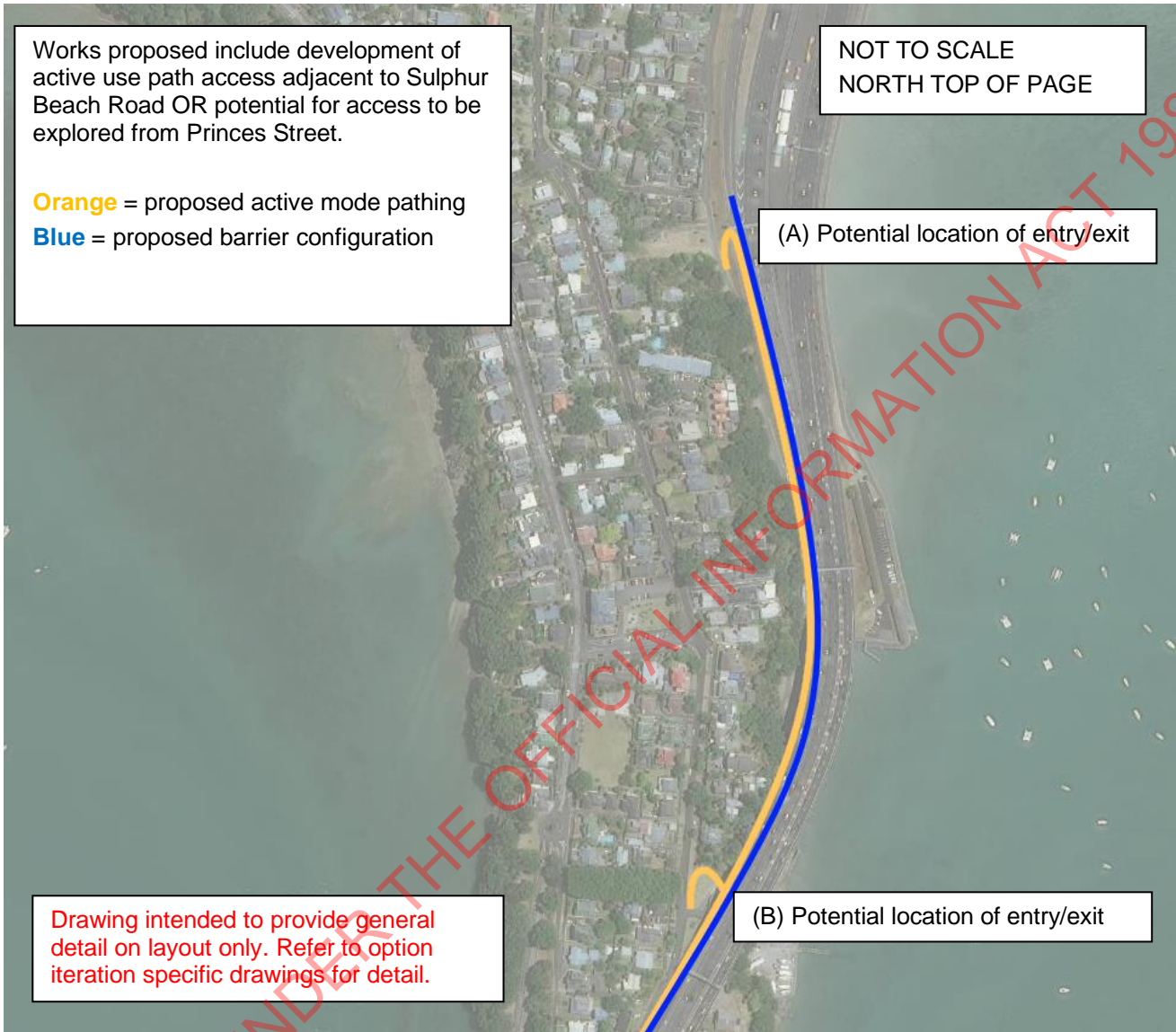


Drawing intended to provide general detail on layout only. Refer to option iteration specific drawings for detail.

Entry/exit to active mode path Westhaven Drive



## 6 GENERAL OPTION LAYOUT – Western options



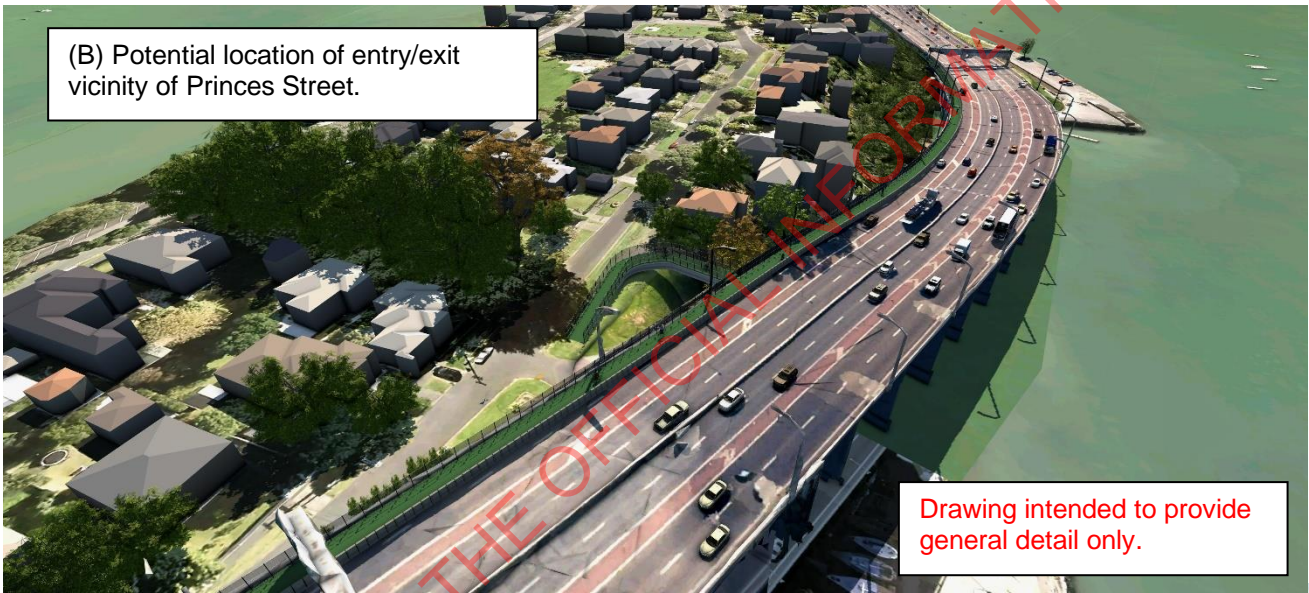
(A) Potential location of entry/exit vicinity of Princes Street.

Drawing intended to provide general detail only.



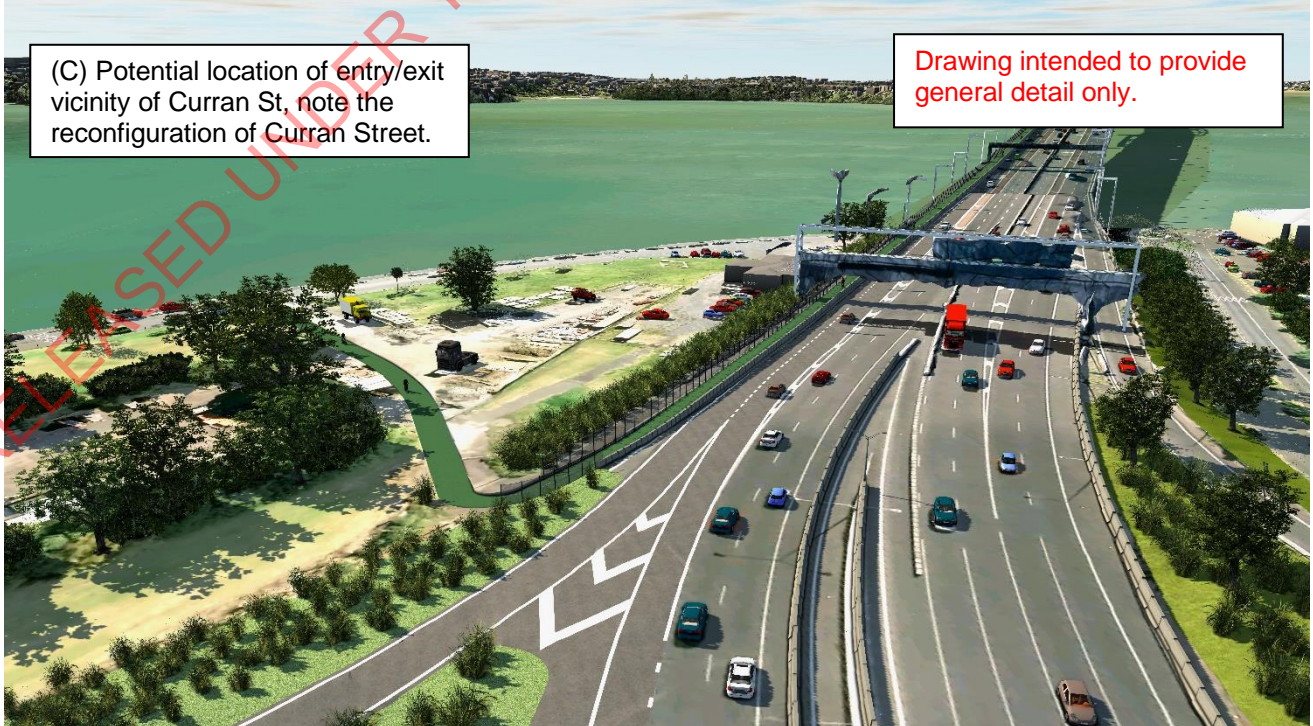
(B) Potential location of entry/exit vicinity of Princes Street.

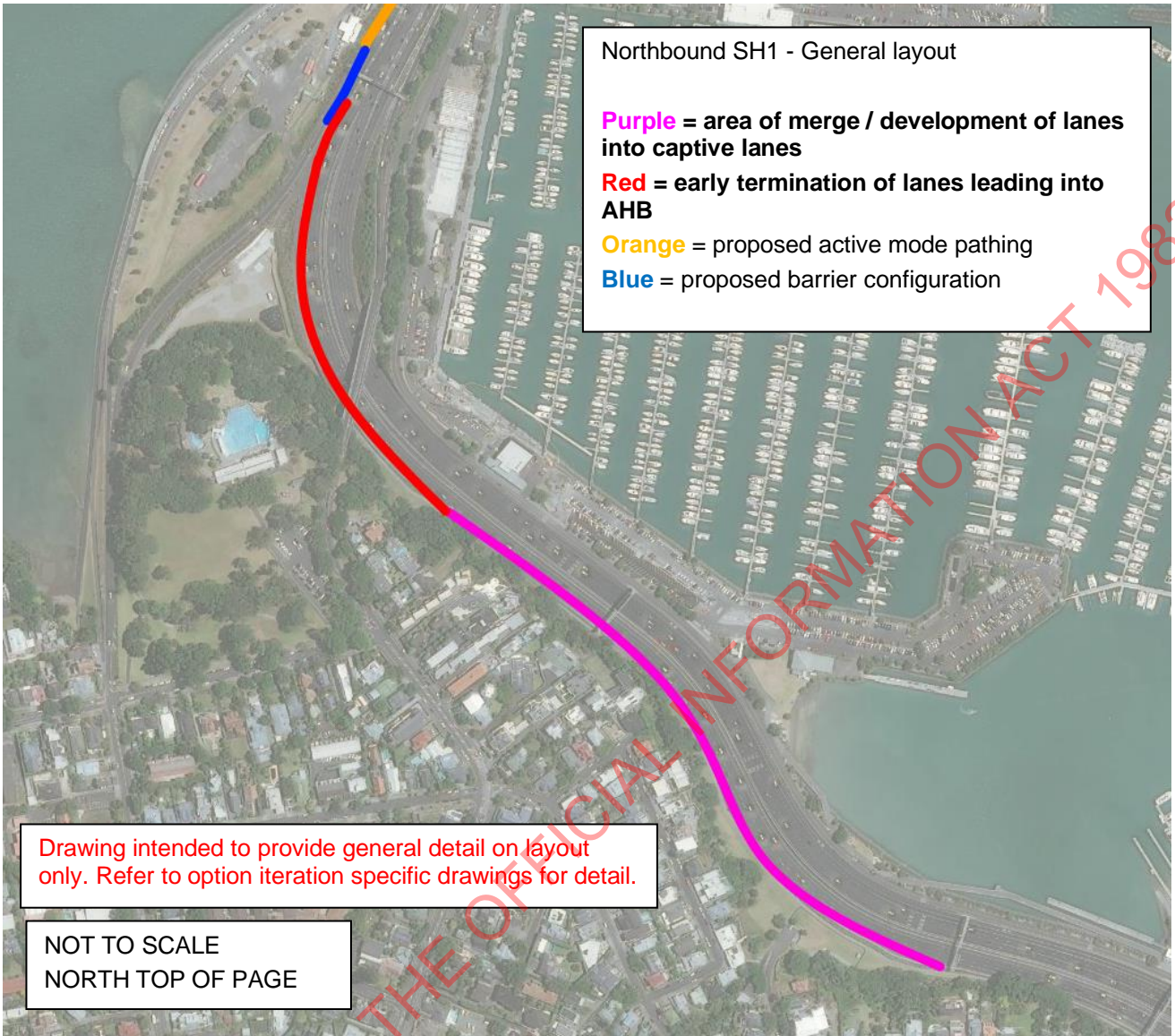
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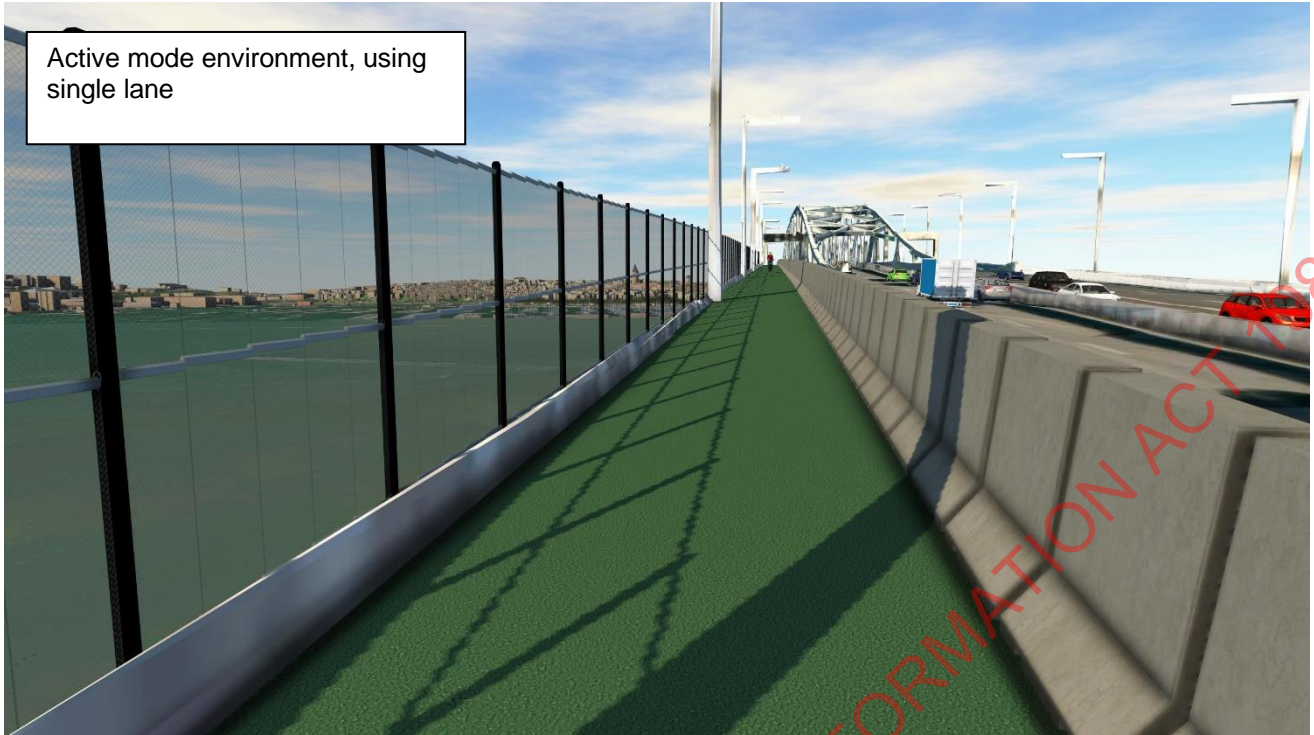


(C) Potential location of entry/exit vicinity of Curran St, note the reconfiguration of Curran Street.

Drawing intended to provide general detail only.

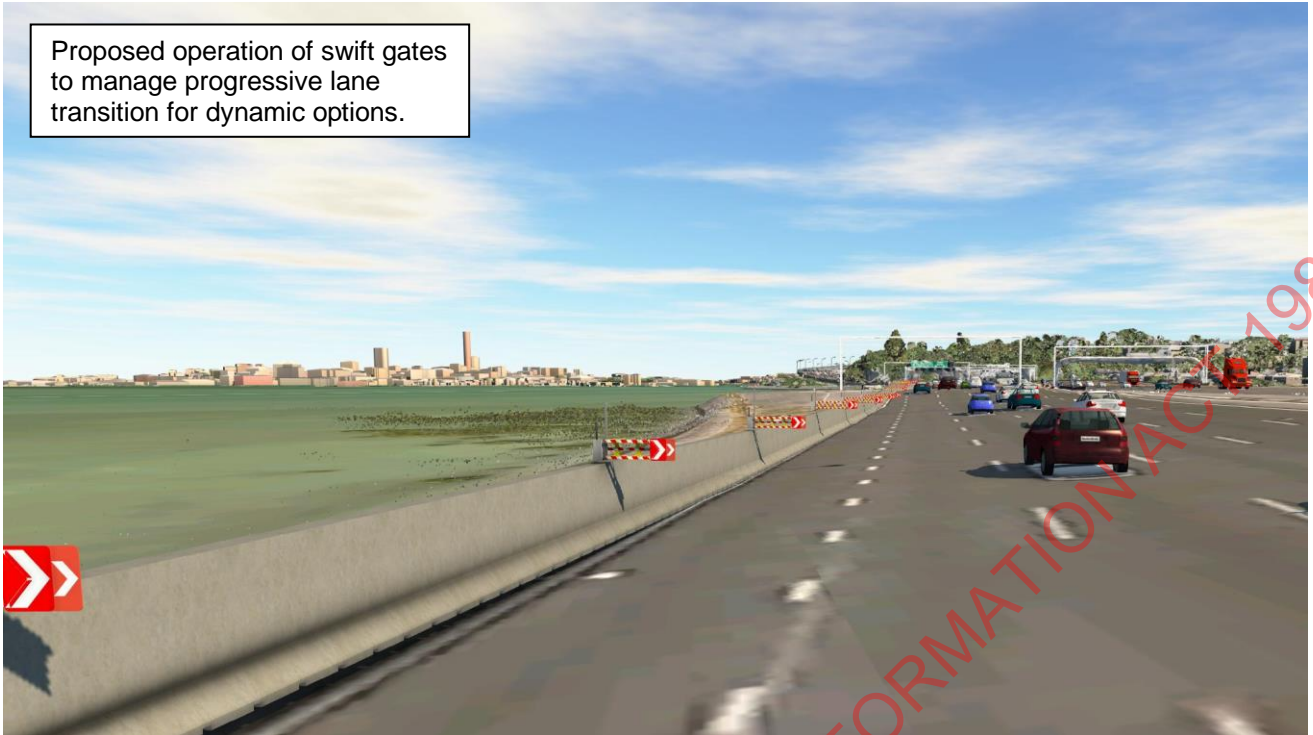






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Proposed operation of swift gates to manage progressive lane transition for dynamic options.



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## 7 OPTION SUMMARY

The table below lists the outcome from an operational viability assessment. This is not an assessment of traffic impacts or ability of structure to accommodate configuration.

OPTION #:	ACTIVE MODE ARRANGEMENT:	AHB MLB OPERATIONS	OPERATIONAL ASSESSMENT:	COMMENT:
1	SBD - 1 Lane Weekends only	Tidal OK	Viable	Requires supporting infrastructure (Advance warning elements)
2	SBD - 2 Lane Weekends only	Restricted benefit	Viable	Requires supporting infrastructure (Advance warning elements)
3	SBD - 1 Lane Permanent Install	Tidal OK	Viable	
4	SBD - 2 Lane Permanent Install	Restricted benefit	Viable	
5	NBD - 1 Lane Weekends only	Tidal OK	Not viable*	Restricted carriageway through St Marys Bay means limited opportunity to safely place barrier system.
6	NBD - 2 Lane Weekends only	Restricted benefit	Viable	Requires supporting infrastructure (Advance warning elements)
7	NBD - 1 Lane Permanent Install	Tidal OK	Viable	
8	NBD - 2 Lane Permanent Install	Restricted benefit	Viable	
9	Centre Permanent Install	Unavailable	Viable	
10	Centre Permanent Install	Unavailable	Viable	
11	NBD + SBD Permanent Install	Tidal OK	Not viable*	*Serious traffic safety implications.

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## 8 OPTION IMPLEMENTATION

### 8.1 Option 1 – Southbound 1 lane / Weekend operation / AHB Tidal operational

A proposed 'captive' lane configuration is developed which can be turned 'off and on' to vehicle traffic. This is delivered by installing and maintaining a barrier string from the approach to AHB, to where termination of active mode access occurs at Shelly Beach Road.

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>BUS ONLY lane from Onewa Road southbound onramp terminates early.</li> <li>Shelly Beach Road offramp closed when active route operational.</li> <li>Speed restrictions on Westhaven Drive when active mode access operational.</li> <li>SH1 Southbound, lane 1 closed to vehicles when active mode operational.</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Develop signage and associated warning devices (Establishment of #2 overhead VMS).</li> <li>Alteration of existing overhead directional signage.</li> <li>Installation of barrier systems to establish swift gates in advance of the site.</li> <li>Installation of safe hit posts leading into start of barrier string.</li> <li>Prior to diversion and lane closures speed reduction symbols should be implemented (lane control signals)</li> <li>Use of VMS messaging during installation and operation.</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Localised pavement widening, line marking to enable establishment of a gore area for the barrier string between L1 and L2 southbound.               <ul style="list-style-type: none"> <li>Barrier system develops adjacent to weigh station southbound.</li> <li>Terminates once past Shelly Beach Road offramp</li> </ul> </li> <li>Installation of fence or security solution along length of barrier system.</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Localised earthworks to develop access to grade at entry point.</li> <li>Configure existing guardrail to develop overlap and appropriate access.</li> <li>Install gated accessway, including supporting security fence (Enable closure of active mode path).</li> <li>Tennison Street access wayfinding</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Installation of ramp from Shelly Beach Road offramp to Westhaven Drive</li> <li>Likely widening of Westhaven Drive to Shelly Beach Road to accommodate active modes.</li> <li>Utilise Westhaven Drive to Shelly Beach Road for active mode use.</li> <li>Transition active modes from Shelly Beach Road off-ramp to local road environment</li> <li>Question on the use of stairs for access from Shelly Beach Road off-ramp.</li> </ul>
Supporting operations:	<ul style="list-style-type: none"> <li>Implementation of lane reduction (merge BUS LANE to traffic lane) at end of Onewa onramp Southbound.</li> <li>Associated cyclic maintenance regime including litter, sweeping.</li> <li>Detour route via local road for Shelly Beach Road.</li> <li>Mobile barrier unit used to provide positive protection.</li> </ul>
Operations	<ul style="list-style-type: none"> <li>To activate the active use path:               <ul style="list-style-type: none"> <li>Advance warning and overhead signage activates to provide notice to motorists that lanes are closed. ATOC operators observe lane occupation drops.</li> <li>Swift gates activate to provide delineation over closed lanes.</li> <li>TTM operations implement closure of Onewa Road Southbound bus only lane.</li> <li>TTM operations activate Shelly Beach Road detour.</li> <li>Mobile barrier apparatus is delivered to closure site and positioned.</li> <li>Active user gates are opened.</li> <li>Westhaven Drive to Shelly Beach Road (off-ramp) closure and associated detour</li> </ul> </li> <li>To disestablish active use path:               <ul style="list-style-type: none"> <li>Active user gates are closed at both ends.</li> <li>ASM team drive shared us path and inspect for detritus or hazards.</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Mobile barrier apparatus is removed from site (proceeds down closed lanes)</li> <li>○ Swift gates open lanes to traffic.</li> <li>○ Supporting TTM is removed.</li> <li>○ ATOC adjust supporting overhead signage.</li> </ul>
<p>Option specific risks:</p>	<ul style="list-style-type: none"> <li>● Risk of barrier system in lanes being hit. Lead time to replace in night. Reactive disruption during the day.</li> <li>● Performance of lightweight barrier system</li> <li>● Bus priority disadvantages</li> <li>● Limited opportunity for managing scenarios resulting from Western Ring Route closures (SH18, SH16, SH20).</li> </ul>

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**8.2 Option 2 – Southbound 2 lanes / Weekend operation / Tidal non-operational**

A proposed lane configuration system is installed along AHB to enable switching ‘off and on’ to vehicle traffic of lanes 1 and 2 southbound. This is delivered by installing and maintaining a barrier string from the approach to AHB, to where termination of active mode access occurs at Shelly Beach Road.

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>BUS ONLY lane from Onewa Road southbound onramp terminates early.</li> <li>Shelly Beach Road offramp closed when active route operational.</li> <li>Speed restrictions on Westhaven Drive when active mode access operational.</li> <li>SH1 Southbound, lane 1 + lane 2 closed to vehicles when active mode operational.</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Develop signage and associated warning devices (Establishment of #2 overhead VMS).</li> <li>Alteration of existing overhead directional signage.</li> <li>Installation of barrier systems to establish swift gates in advance of the site.</li> <li>Installation of safe hit posts leading into start of barrier string.</li> <li>Installation of supporting temporary traffic devices (delineation) between swift gates and progressive lane closures.</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Barrier system inside existing gore area of AHB between lane 2 and lane 3.</li> <li>Barrier system not required for section adjacent to existing (Truss section of AHB).</li> <li>Terminates once past Shelly Beach Road offramp.</li> <li>Installation of fence or security solution along length of barrier system.</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Localised earthworks to develop access to grade at entry point.</li> <li>Configure existing guardrail to develop overlap and appropriate access.</li> <li>Install gated accessway, including supporting security fence (Enable closure of active mode path).</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Installation of ramp from Shelly Beach Road offramp to Westhaven Drive</li> <li>Likely widening of Westhaven Drive to Shelly Beach Road to accommodate active modes.</li> </ul>
Option specific risks:	<ul style="list-style-type: none"> <li>General traffic capacity loss (2 lanes).</li> <li>Bus priority disadvantages.</li> <li>Limited opportunity for managing scenarios resulting from Western Ring Route closures (SH18, SH16, SH20).</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path:             <ul style="list-style-type: none"> <li>Advance warning and overhead signage activates to provide notice to motorists that lanes are closed. ATOC operators observe lane occupation drops.</li> <li>Swift gates activate to provide delineation over closed lanes.</li> <li>TTM operations implement closure of Onewa Road Southbound bus only lane.</li> <li>TTM operations activate Shelly Beach Road detour.</li> <li>Mobile barrier apparatus is delivered to closure site and positioned.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path:             <ul style="list-style-type: none"> <li>Active user gates are closed at both ends.</li> <li>ASM team drive shared use path and inspect for detritus or hazards.</li> <li>Mobile barrier apparatus is removed from site (proceeds down closed lanes)</li> <li>Swift gates open lanes to traffic.</li> <li>Supporting TTM is removed.</li> <li>ATOC adjust supporting overhead signage.</li> </ul> </li> </ul>

### 8.3 Option 3 – Southbound 1 lane / Permanent operation / Tidal operational

A proposed closure of lane 1 southbound over AHB to enable active mode operation. This is delivered by installing and maintaining a barrier string from the approach to AHB, to where termination of active mode access occurs at Shelly Beach Road.

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>BUS ONLY lane from Onewa Road southbound on terminates early.</li> <li>Shelly Beach Road offramp closed.</li> <li>Speed restrictions on Westhaven Drive.</li> <li>SH1 Southbound, lane 1 closed in advance of AHB</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Develop signage and associated warning.</li> <li>Alteration of existing overhead directional signage.</li> <li>Installation of safe hit posts and delineation to develop the lane closure.</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Barrier system develops adjacent to weigh station southbound and progressively closes lane 1.</li> <li>Terminates once past Shelly Beach Road offramp</li> <li>Installation of fence or security solution along length of barrier system.</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Localised earthworks to develop access to grade at entry point.</li> <li>Configure existing guardrail to develop overlap and appropriate access.</li> <li>Install gated accessway, including supporting security fence (Enable closure of active mode path).</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Installation of ramp from Shelly Beach Road offramp to Westhaven Drive</li> <li>Likely widening of Westhaven Drive to Shelly Beach Road to accommodate active modes.</li> </ul>
Supporting operations:	<ul style="list-style-type: none"> <li>Lane reduction (merge BUS LANE to traffic lane) at end of Onewa onramp Southbound.</li> <li>Associated cyclic maintenance regime including litter, sweeping.</li> <li>Detour route via local road for Shelly Beach Road.</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path:               <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path:               <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> <li>Active user gates are closed at both ends.</li> </ul> </li> </ul>
Option specific risks:	<ul style="list-style-type: none"> <li>Risk of barrier system in lanes being hit. Lead time to replace in night. Reactive disruption during the day.</li> <li>Risks of network loss in capacity and resilience due to time required to install and remove during unplanned incidents or heavy demand</li> </ul>

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**8.4 Option 4 – Southbound 2 lanes / Permanent operation / Tidal non-operational**

A proposed closure of lane 1 + lane 2 southbound over AHB to enable active mode operation. This is delivered by installing and maintaining a barrier string from the approach to AHB, to where termination of active mode access occurs at Shelly Beach Road.

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>BUS ONLY lane from Onewa Road southbound on terminates early.</li> <li>Shelly Beach Road offramp closed.</li> <li>Speed restrictions on Westhaven Drive.</li> <li>SH1 Southbound, lane 1 + lane 2 closed in advance of AHB</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Develop signage and associated warning.</li> <li>Alteration of existing overhead directional signage.</li> <li>Installation of safe hit posts and delineation to develop the lane closure.</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Barrier system develops adjacent to weigh station southbound and progressively closes lane 1 and then lane 2.</li> <li>Terminates once past Shelly Beach Road offramp</li> <li>Installation of fence or security solution along length of barrier system.</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Localised earthworks to develop access to grade at entry point.</li> <li>Configure existing guardrail to develop overlap and appropriate access.</li> <li>Install gated accessway, including supporting security fence (Enable closure of active mode path).</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Installation of ramp from Shelly Beach Road offramp to Westhaven Drive</li> <li>Likely widening of Westhaven Drive to Shelly Beach Road to accommodate active modes.</li> </ul>
Supporting operations:	<ul style="list-style-type: none"> <li>Lane reduction (merge BUS LANE to traffic lane) at end of Onewa onramp Southbound.</li> <li>Associated cyclic maintenance regime including litter, sweeping.</li> <li>Detour route via local road for Shelly Beach Road.</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path: <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path: <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> </ul> </li> <li>Active user gates are closed at both ends.</li> <li>Risks of network loss in capacity and resilience due to time required to install and remove during unplanned incidents or heavy demand</li> </ul>
Option specific risks:	<ul style="list-style-type: none"> <li>Risk of barrier system in lanes being hit. Lead time to replace in night. Reactive disruption during the day.</li> <li>Risks of network loss in capacity and resilience due to time required to install and remove during unplanned incidents or heavy demand</li> </ul>

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**8.5 Option 5 – Northbound 1 lane / Weekend operation / Tidal operational**

A proposed ‘captive’ lane configuration is developed which can be turned ‘off and on’ to vehicle traffic. This is delivered by installing and maintaining a barrier string from the approach to AHB, to where termination of active mode access occurs at Stafford Road northbound offramp.

Element:	Description
Barrier system for captive lanes.	<ul style="list-style-type: none"> <li>Further analysis required to determine the feasibility of this option. Cross section of St Marys Bay restricts simple installation.</li> </ul>

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### 8.6 Option 6 – Northbound 2 lanes / Weekend operation / Tidal non-operational

A proposed 'captive' lane configuration is developed which can be turned 'off and on' to vehicle traffic. This is delivered by installing and maintaining a barrier string from the approach to AHB, to where termination of active mode access occurs at Stafford Road northbound offramp.

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>Progressive closure of lane 1 + lane 2 northbound along St Marys Bay</li> <li>Curran Street is closed.</li> <li>SH1 northbound, lane 1 + lane 2 closed.</li> <li>Impacts to PT priority through St Marys Bay area.</li> <li>Vehicle opportunity to merge across to Stafford Road northbound offramp is severely limited.</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Develop signage and associated warning devices (Establishment of #2 overhead VMS).</li> <li>Alteration of existing overhead directional signage.</li> <li>Installation of barrier systems to establish swift gates in advance of the site.</li> <li>Installation of safe hit posts leading into start of barrier string.</li> <li>Implementation of lane reduction along St Marys Bay SH1 northbound</li> <li>Active operations implement lane closures up to site of installed barrier system.</li> <li>Mobile barrier system used to form positive protection from within closure to form active mode lanes.</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Barrier system inside existing gore area of AHB between lane 2 and lane 3.</li> <li>Barrier system not required for section adjacent to existing (Truss section of AHB).</li> <li>Terminates once past active mode is accommodated to Sulphur Beach Road</li> <li>Installation of fence or security solution along length of barrier system.</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Localised earthworks to develop access to grade at entry point.</li> <li>Configure existing guardrail to develop overlap and appropriate access.</li> <li>Install gated accessway, including supporting security fence (Enable closure of active mode path).</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Installation of ramp from Curran Street to AHB northbound access point.</li> </ul>
Supporting operations:	<ul style="list-style-type: none"> <li>Associated cyclic maintenance regime including litter, sweeping.</li> <li>Detour route via local road for Shelly Beach Road.</li> <li>Mobile barrier unit used to provide positive protection.</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path:             <ul style="list-style-type: none"> <li>Advance warning and overhead signage activates to provide notice to motorists that lanes are closed. ATOC operators observe lane occupation drops.</li> <li>Swift gates activate to provide delineation over closed lanes.</li> <li>TTM operations close Curran Street.</li> <li>TTM operations implement closure of lane 1 + lane 2 Northbound vicinity Curran Street.</li> <li>Mobile barrier apparatus is delivered to closure site and positioned.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path:             <ul style="list-style-type: none"> <li>Active user gates are closed at both ends.</li> <li>ASM team drive shared use path and inspect for detritus or hazards.</li> <li>Mobile barrier apparatus is removed from site (proceeds down closed lanes)</li> <li>Temporary traffic controls removed.</li> <li>Swift gates open lanes to traffic.</li> <li>Supporting TTM is removed.</li> </ul> </li> <li>ATOC adjust supporting overhead signage.</li> </ul>
Option specific risks	<ul style="list-style-type: none"> <li>Progressive closure SH1 along St Marys Bay will have impact on ability of stopped vehicles to access emergency stopping area.</li> </ul>

**8.7 Option 7 – Northbound 1 lane / Permanent operation / Tidal operational**

A proposed closure of lane 1 northbound over AHB to enable active mode operation. This is delivered by installing and maintaining a barrier string from the approach to AHB, after Curran Street northbound onramp to where termination of active mode access occurs at Stafford Road northbound offramp.

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>Progressive closure of lane 1 northbound along St Marys Bay</li> <li>Curran Street is open, however reconfigured to accommodate earlier merge, this will have impacts to prior lanes on SH1 northbound.</li> <li>SH1 northbound, lane 1 closed to vehicles when active mode operational.</li> <li>Vehicle opportunity to merge across to Stafford Road northbound offramp is limited.</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Develop signage and associated warning devices (Establishment of #2 overhead VMS).</li> <li>Alteration of existing overhead directional signage.</li> <li>Implementation of lane reduction along St Marys Bay SH1 northbound.</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Localised pavement widening, line marking to enable to establishment of a gore area and barrier string between L1 and L2 northbound.               <ul style="list-style-type: none"> <li>Barrier system develops under gantry after Curran Street northbound onramp.</li> <li>Terminates once past active mode is accommodated to Sulphur Beach Road</li> </ul> </li> <li>Installation of fence or security solution along length of barrier system.</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Localised earthworks to develop access to grade at entry point.</li> <li>Configure existing guardrail to develop overlap and appropriate access.</li> <li>Install gated accessway, including supporting security fence (Enable closure of active mode path).</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Installation of ramp from Curran Street to AHB northbound access point.</li> </ul>
Supporting operations:	<ul style="list-style-type: none"> <li>Associated cyclic maintenance regime including litter, sweeping.</li> <li>Detour route via local road for Shelly Beach Road.</li> <li>Mobile barrier unit used to provide positive protection.</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path:               <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path:               <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> </ul> </li> <li>Active user gates are closed at both ends.</li> </ul>
Option specific risks	<ul style="list-style-type: none"> <li>Progressive closure SH1 along St Marys Bay will have impact on ability of stopped vehicles to access emergency stopping area.</li> <li>Potential for Curran St to be kept open, but 1+1 Merge on the right lane of the clip-on may present geometry risks.</li> </ul>

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**8.8 Option 8 – Northbound 2 lanes / Permanent operation / Tidal non-operational**

A proposed closure of lane 1 + lane 2 northbound over AHB to enable active mode operation. This is delivered by installing and maintaining a barrier string from the approach to AHB, after Curran Street northbound onramp to where termination of active mode access occurs at Stafford Road northbound offramp.

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>Progressive closure of lane 1 + lane 2 northbound along St Marys Bay</li> <li>Curran Street is closed to vehicles.</li> <li>SH1 northbound, lane 1 + lane 2 closed to vehicles over AHB.</li> <li>Impacts to PT priority through St Marys Bay area.</li> <li>Vehicle opportunity to merge across to Stafford Road northbound offramp is severely limited (<i>likely not viable</i>).</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Amendment to overhead signage.</li> <li>Implementation of progressive lane reduction along St Marys Bay SH1 northbound.</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Barrier system develops adjacent to the end of Curran Street northbound onramp.</li> <li>Terminates once past active mode is accommodated to Sulphur Beach Road</li> <li>Installation of fence or security solution along length of barrier system.</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Localised earthworks to develop access to grade at entry point.</li> <li>Configure existing guardrail to develop overlap and appropriate access.</li> <li>Install gated accessway, including supporting security fence (Enable closure of active mode path).</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Curran Street onramp converted to active mode only to AHB northbound access point.</li> </ul>
Supporting operations:	<ul style="list-style-type: none"> <li>Associated cyclic maintenance regime including litter, sweeping.</li> <li>Detour route via local road for Shelly Beach Road.</li> <li>Mobile barrier unit used to provide positive protection.</li> </ul>
Option specific risks	<ul style="list-style-type: none"> <li>Progressive closure SH1 along St Marys Bay will have impact on ability of stopped vehicles to access emergency stopping area.</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path:             <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path:             <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> </ul> </li> <li>Active user gates are closed at both ends.</li> </ul>

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**8.9 Option 9 – Centre 1 lane / Permanent operation / Tidal non-operational**

A proposed closure of lane 5 northbound over AHB to enable active mode operation. This is delivered by installing and maintaining an additional barrier string from the termination of the existing MLB operation along St Marys Bay, continuing northbound and terminating inside the north shed (AHB operations yard).

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>Closure of Lane 5 northbound</li> <li>Tidal operation of AHB not viable – fixed into 4 lanes northbound, 3 lanes southbound.</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Wayfinding and specialist cyclist management through Tennyson Street pedestrian subway (Suboptimal space and configuration for large cycle movements).</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Installing and maintaining an additional barrier string from the termination of the existing MLB operation, continuing northbound and terminating inside the north shed (AHB operations yard)</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Access via existing Tennyson Street pedestrian subway.</li> <li>Confirm access upgrade details (existing access inappropriate i.e. ladder)</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Access via lanes restricted along St Marys Bay between MLB and median barrier system.</li> <li>Further details required on integration with local road network</li> <li>Reduced accessibility due to length of captured provision</li> <li>Environment challenges given located central to live running traffic either side, barrier heights, passing traffic overhang etc</li> </ul>
Option specific risks	<ul style="list-style-type: none"> <li>Risk that active mode environment has poor outcome (significant adjacent noise)</li> <li>Risk that option is not viable due to integration with Tennyson subway</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path:               <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path:               <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> </ul> </li> <li>Active user gates are closed at both ends.</li> </ul>

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### 8.10 Option 10 – Centre 2 lanes / Permanent operation / Tidal non-operational

A proposed closure of lane 4 + lane 5 northbound over AHB to enable active mode operation. This is delivered by installing and maintaining an additional barrier string from the termination of the existing MLB operation along St Marys Bay, continuing northbound and terminating inside the north shed (AHB operations yard).

Element:	Description
Road closures required:	<ul style="list-style-type: none"> <li>Closure of lane 4 + lane 5 northbound</li> <li>Tidal operation of AHB not viable – fixed into 3 lanes northbound, 3 lanes southbound.</li> </ul>
Approach on SH1:	<p>Supporting devices:</p> <ul style="list-style-type: none"> <li>Wayfinding and specialist cyclist management through Tennyson Street pedestrian subway (Suboptimal space and configuration for large cycle movements).</li> </ul> <p>Barrier system:</p> <ul style="list-style-type: none"> <li>Installing and maintaining an additional barrier string from the termination of the existing MLB operation, continuing northbound and terminating inside the north shed (AHB operations yard)</li> </ul>
Active mode:	<p>Entry/termination of active mode path (Northern End):</p> <ul style="list-style-type: none"> <li>Access via existing Tennyson Street pedestrian subway.</li> </ul> <p>Entry/termination of active mode path (Southern End):</p> <ul style="list-style-type: none"> <li>Access via lanes restricted along St Marys Bay between MLB and median barrier system.</li> </ul>
Option specific risks	<ul style="list-style-type: none"> <li>Risk that active mode environment has poor outcome (significant adjacent noise)</li> <li>Risk that option is not viable due to integration with Tennyson subway</li> </ul>
Operations:	<ul style="list-style-type: none"> <li>To activate the active use path:             <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> <li>Active user gates are opened.</li> </ul> </li> <li>To disestablish active use path:             <ul style="list-style-type: none"> <li>Permanent option – active mode path always established.</li> </ul> </li> <li>Active user gates are closed at both ends.</li> </ul>

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**8.11 Option 11 – Northbound + Southbound / Permanent operation / Tidal operational**

Element:	Description
Barrier system for captive lanes.	Assessment found that traffic safety impacts from the narrow vehicle lanes and limited width allocated to the active mode path results in poor traffic safety outcomes.

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## 9 EXISTING NETWORK MANAGEMENT TOOLS

The monitoring and management of the Auckland transport network involves a range of equipment and systems that can be utilised for different operating conditions and scenarios. Their function and coverage are summarised below:

Traffic signals	Prioritise or optimise movements at intersections along a corridor.	Key interchanges/intersections on the state highway and local road networks.
Ramp Signals	Provide metered access onto the motorway in order to manage congestion and merge flow breakdown	At all on-ramps except Onewa Road, Stafford Road (SH1) and Wellesley St (SH16)
Variable message signs (VMS)	Display messages to inform customers of network conditions ahead or upcoming events.	Generally located in advance of key decision points on the state highway and local network.
Traffic response unit	Provides a rapid response service to manage traffic, clear damaged vehicles off the network and clean up after incidents.	State highway network in Auckland with an opportunity to utilise on the local network.
Emergency services	Respond to emergency situations to protect and preserve life, property, evidence and environment.	Network wide.
Traveller information	Provide real time traveller information/advice via Transport Agency's communication channels (e.g. Facebook, Twitter, radio, website). This includes road works, journey times, and webcams.	Network wide.
Detour routes	Provide an alternative route to get around an area of restricted access due to planned or unplanned events.	Network wide.
Variable speed management	Provides the ability to display different speed limits on a section of the motorway to better suit traffic conditions, protect the ends of queued traffic, and/or reduce arrival rates from further upstream.	Advisory speed limits on SH1 between Symonds St and north of Onewa Road and on SH16 to Bond St. Mandatory speed limits on SH16 between Rosebank Rd and St Lukes Rd and on SH20 between SH16 and May Rd
Road closures	Allow a corridor / section of a corridor to be closed off as part of the response plan for planned / unplanned events.	Network wide.
Incident response coordination	Coordinate response for planned and unplanned events across multiple responding parties.	Network wide.
Lane control signals	Display symbols indicating lane use i.e. open, closed, divert left/right. Advisory speed limits can also be displayed.	On SH1 between Symonds St and north of Onewa Road and on SH16 to Bond St
Closed Circuit Television (CCTV)	Provide the ability to monitor traffic operation and incidents in real time.	Full coverage on State Highway network. Coverage via the AT CCTV system available to ATOC at key intersections on the local road network.

Vehicle detection system	Allow vehicle speed and traffic volume to be recorded for monitoring and/or operational purposes.	Various locations
Automatic Video Incident Detection (AVID)	Automatically detect incidents including breakdowns, queuing and/or debris on the motorway by sending an alarm to the operations centre.	SH1 Victoria Park Tunnel and SH20 Waterview Tunnel. An obsolete system exists on the Harbour Bridge
Customer and Stakeholder Feedback	Provides insights into our customers' perspective.	Network wide.
Traffic Monitoring System (TMS)	Collects and stores historical data on volumes, vehicle types and vehicle speeds at strategic points on the network, both on state highways and local roads (provided by RCAs).	Network wide.
Online Tool for Traffic Monitoring (e.g. Traffic Watcher, Google Traffic, Blip Track)	High level monitoring of network traffic conditions.	Network wide.

## 10 PROPOSED TOOLS SUPPORTING NETWORK MANAGEMENT

Variable message signs (VMS)	Display messages to inform customers of network conditions ahead or upcoming events.	Additional VMS establishment in advance of the options with temporary activation. With additional analysis/development this may mean that lanes could be opened reactively, should it be required to meet high level objectives.
Traffic response unit	Provides a rapid response service to manage traffic, clear damaged vehicles off the network and clean up after incidents.	Additional support for active traffic response operations would be mitigation of the impacts of minor incidents, particularly should something occur on 'captive lanes'.
Onsite security and remote monitoring	Active patrol and site operations + CCTV establishment and monitoring	Detection and intervention of incidents or risks. Ability to transport people with 'vehicle' access on active user path.
Traveller information	Provide real time traveller information/advice via Transport Agency's communication channels (e.g. Facebook, Twitter, radio, website). This includes road works, journey times, and webcams.	Particular focus on development of active mode lane availability for dynamic configurations, may include social media 'channel' or push notification for state of active mode access over harbour bridge.

## 11 Risks

Item:	Title:	Description:
0	Barrier system deflection zone	Analysis required for level of protection proposed barrier system offers to active mode users, in the event access is available within the deflection zone following a barrier strike.
1	Increase in demand for AHB tidal operations.	ASM required to move MLB frequency increases OR required to be dynamic in move operations. Opportunity to install swift gates for MLB operations to optimise.
2	Security fence / safety of active route along AHB	Security fence system proposed along barrier interfacing with vehicle traffic for dynamic options requires further analysis of safety and crash testing suitability. No system currently identified; potential mitigations include installation of temporary fence; this increases cost and limits opportunity to reactively change between configurations in good time.
3	Limitations of considerations for wider network connectivity.	No catering for active mode facilities once concepts allow access off the footprint of existing motorway.
4	Provision of space allocation for active mode.	No delineation inside active mode path over AHB for perm or temp configuration. Concern for opportunity to mark in dynamic options (Generate markings which may not be interpreted correct by vehicle traffic).
5	Active mode path inside north shed of AHB operations.	Risk that this cuts SBD access to/from North Shed for operations.
6	Unique apparatus installed for operations.	Operating risk of swift gates being hit / unacceptable lead time to remedy. (Not something easily available in NZ). Resilience can be developed as manual operations.
7	Active mode speed environment approaching termination points.	Risk of high speed (50kph +) at end of gradients approaching rapid change to geometry. Require detailed design for speed management at terminations of AHB gradient.  Gradient (5%) will lead to a wide range of speed profiles across active mode user groups.
8	Integration with future works.	Footprint of active mode solution may result in restricted access for pathway project works.
9	Departure from active mode route.	Active mode users may elect to continue along motorway beyond area of closure (i.e., breach closure) resulting on access to motorway environment.
10	Use of route in contrary to availability.	Risk that active users gain confidence and familiarity in route option and elect to use even when 'unavailable'.

11	Implementation of supporting infrastructure.	Accommodation works or supporting infrastructure development in CMA / side of SH1 in advance of site. Includes poor ground condition risks.
12	Suicide treatments	Current suicide response includes deployable markers side of AHB. Requirement or operation may be changed by proposed works.
13	Pavement/surfacing deformation.	Barrier system placement may compromise epoxy surfacing + including deformation from MLB feet.
14	Delivery of planned maintenance.	Forward works planning including paving renewal potentially compromised due to access.
15	Network resilience from closures.	Closure of Shelly Beach offramp infers lower level of resilience for SH1 SBD. Specific risk is a crash along St Marys Bay southbound.
16	Traffic behaviours impact bridge loading.	Freight use of bridge changes through behaviours or limitations resulting from the closures and consequence of more heavies on main span.
17	Collision risk with AHB structure	Opportunity for collision with truss because lane past active mode closures restrictive for corrections in driving. Opportunity, may result in higher level of protection (restrictive lane) which lowers speed or lane changing.
18	High wind management strategy	Restrictions in lanes may have significant impacts on high wind management strategy opportunity.
19	AHB pavement condition	Implementation of a barrier string on the AHB surfacing (Epoxy) may compromise the pavement and require significant remedial if the barrier is disestablished.
20	Legacy markings generate traffic safety concern.	There is potential that if delineation is required for either establishment of a barrier system or guidelines that in the event of disestablishment, there is works required to remedy 'ghost marking', which cost may be substantial, particularly if it involves surfacing on AHB.
21	High wind risk	<p>High winds represent a particular risk to active mode users on AHB, as a response to an incident also represents a hazard to responders. A limitation of operating conditions would be required along with capability to close access.</p> <p>High winds will also present a change in risk for vehicles traffic where dynamic configurations mean 'express lanes' are formed.</p>
22	Crowds gathering and occupying structure	Special events (New Years Eve) or for rally events, significant crowd loading occurs, or management of people numbers on structure is limited.
23	Objects thrown/loose	Errant vehicles components or projectiles thrown, risk of injury to active mode users.

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24	Lighting supply adequate for active user requirements	Potential that lighting for active users is not available or not suitable along entire route, i.e. where connections exist.
25	Adjacent land use availability	Risk that proposal places entry/exit from proposed active use path onto adjacent land which is restrictive or not suitable.

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