

**MINISTERIAL BRIEFING NOTE**

<b>Subject</b>	Additional Waitematā Harbour Crossing Transport Modelling
<b>Date</b>	13 September 2018
<b>Briefing number</b>	BRI-1270

<b>Contact(s) for telephone discussion (if required)</b>				
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**Action taken by Office of the Minister**

- Noted**
- Seen by Minister**
- Agreed**
- Feedback provided**
- Forwarded to**
- Needs change [please specify]**
- Withdrawn**
- Overtaken by events**

13 September 2018

Minister of Transport and Associate Minister of Transport

## ADDITIONAL WAITEMATĀ HARBOUR CROSSING (AWHC) - TRANSPORT MODELLING

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### Purpose

1. As requested, this briefing provides you with a summary of the 2017 modelling data used for the 22 February 2018 briefing BRI-1146 Additional Waitematā Harbour Crossing – Route Protection for a Multi-Modal Transport Corridor (**attached**). This briefing also provides more recent modelling to ensure consistency with the Auckland Transport Alignment Project 2018 (ATAP 2018).

### Background

2. This briefing supplements BRI-1146 which provided you with an update of the route protection process for a multi-modal (rail and road) transport corridor across the Waitematā Harbour.
3. Over the next 6 to 12 months, the key decisions that will have to be made are:
  - To commence a business case that will determine what combination of modes an AWHC would need to cater for, including the timing of the construction for each of those modes.
  - Following the conclusion of this work to commence route protect for the appropriate mode across the Waitemata Harbour to provide planning certainty for Auckland.
4. The Government and Auckland Council endorsed the \$28bn ATAP 2018 package earlier this year, which forms the basis for transport investment in Auckland over the next 30 years. ATAP's position on the AWHC is:

*Current investigation work into an additional Waitemata Harbour Crossing needs to be completed to provide more certainty about the optimal timing, modal mix, configuration and operation of the crossing. Consistent with earlier ATAP work construction is not anticipated to commence until at least the late 2030s. The Auckland Harbour Bridge forms a critical part of the national transport network as the main connection between the North Shore, the city centre and locations further south, meaning an additional crossing would improve network resilience. The structural capacity of the Auckland Harbour Bridge has also been maximised, with projected growth meaning future heavy vehicle restrictions are likely to be required. In determining optimal timing, these restrictions will need to be weighed against the very high cost of an additional road crossing. Further development of this project should ultimately enable delivery of a multi-modal corridor across the harbour, with flexibility for rapid transit and road to potentially be delivered in separate tunnels at separate times.*

5. The Government released the Government Policy Statement on Land Transport (GPS) in June 2018. The AWHC project objectives will be developed in the next phase to ensure alignment with the GPS objectives, priorities and themes. In particular, the importance of generally improving transport access to support growth, enabling transport choice,

improving resilience, and ensuring that transport and land use planning reduces the need to travel by private motor vehicle (excluding commercial vehicles) by:

- improving access by reducing the need to travel long distances to access opportunities like employment, education and recreation
- supporting a mode shift for trips in urban areas from private vehicles to more efficient, low cost modes like walking, cycling and public transport.

### **The modelling process**

6. The assessment of operational transport effects of the AWHC crossing scenarios has been based on the forecast operation of the transport network with and without rail and road AWHC crossings.
7. All modelling is based on 2046 forecasts, using the Auckland Forecasting Centre strategic model. Forecast growth in population and employment to 2046 is based on the I11 growth scenario, which was the basis for the ATAP 2018 modelling.
8. The Transport Agency has reviewed the 2017 modelling data to ensure consistency with the data used for ATAP 2018. The ATAP 2018 data shows no fundamental change in forecasts from the 2017 model used (see Appendix 1 for more details), so the Transport Agency considers that the information included in BRI-1146 remains valid.

### **Modelling scenarios**

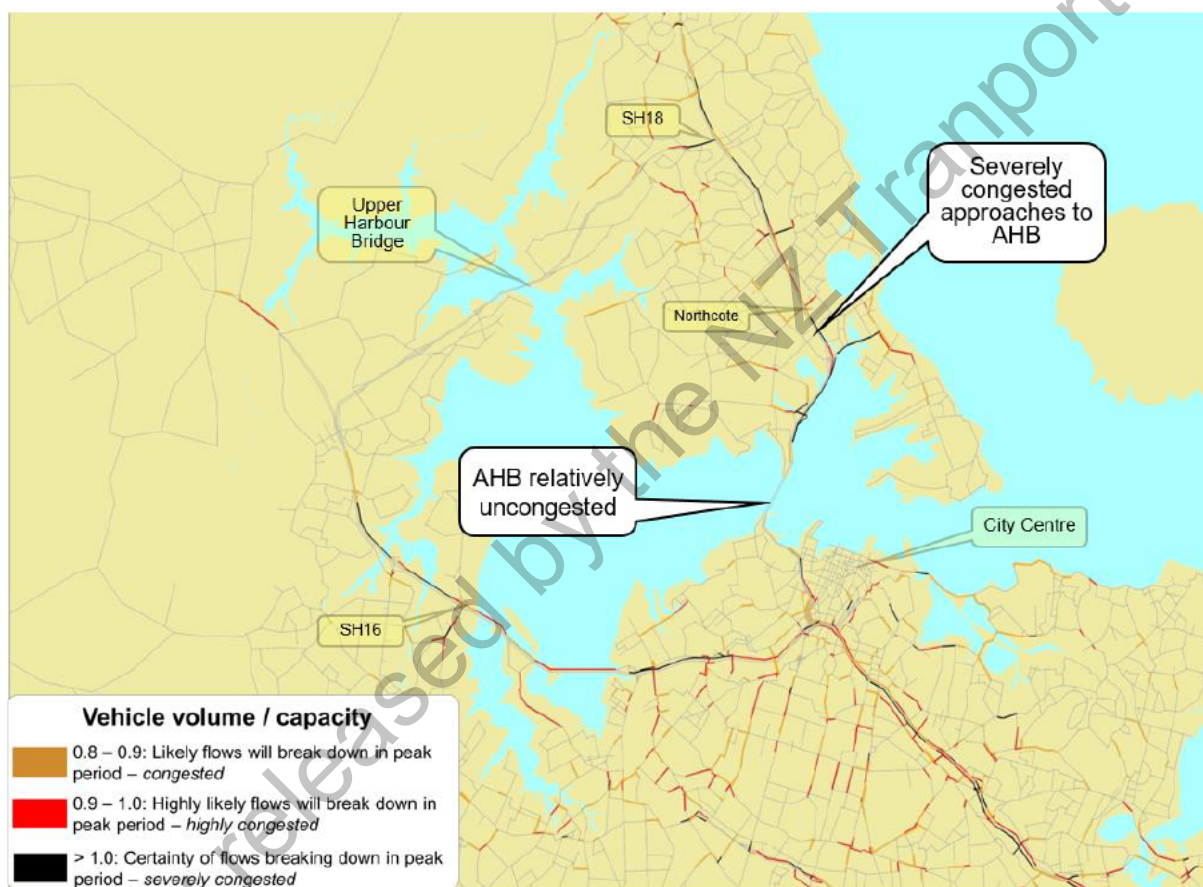
9. There are a great number of possible future scenarios for the harbour crossing transport environment that can be modelled. The scenarios modelled to date are consistent with ATAP 2018 and road pricing recommendations (see Appendix 1).
10. The modelling scenarios considered as part of this briefing paper are:
  - Scenario 1: no AWHC ('do minimum')
  - Scenario 2: both light rail and road AWHC crossings
  - Scenario 3: a light rail (LRT)-only AWHC crossing
11. The LRT option assumes the busway is converted, rather than a new LRT corridor provided north of the bridge. Heavy rail has not been modelled, however the proposed AWHC designations allow for either light or heavy rail.
12. The three scenarios have been modelled with and without road pricing (ATAP Smarter Pricing), and with and without motorway widening on SH1 (north of Esmonde Road to SH18).
13. None of the modelling scenarios reported in this briefing include heavy vehicle weight restrictions on vehicles using the Auckland Harbour Bridge (AHB). Such restrictions are likely to be required in the future to manage the longevity of the AHB. Work done during ATAP 2018 by NZTA suggested restricting heavy vehicle weights on the AHB to less than 35 tonnes as one possible scenario. Additional work is needed before a firm recommendation can be made.
14. The forecast demands reported in this briefing note are not intended to finalise the exact design and delivery details of the project at this early stage. The detailed business case will refine important factors, such as optimal timing for the crossing, modal mix, configuration and operation, financing and funding, weight restrictions on the AHB and potential demand management opportunities (such as number of vehicle lanes and possible tolling scenarios).

15. Similarly, the demand forecasting has been undertaken at a strategic level. In the next phase, more detailed modelling will be undertaken. This will provide more accurate and reliable forecasts of patronage and network operations.

### The existing situation

16. While public transport use is showing strong and sustained growth, the approaches to the Auckland Harbour Bridge (AHB) are at capacity for vehicles in the morning (AM) and afternoon (PM) peak periods and heavy vehicle use is increasing
17. In terms of vehicles, the approaches to the AHB are now at capacity in both directions in both the AM and PM peak periods. Figure 1 below shows this for the morning peak period.

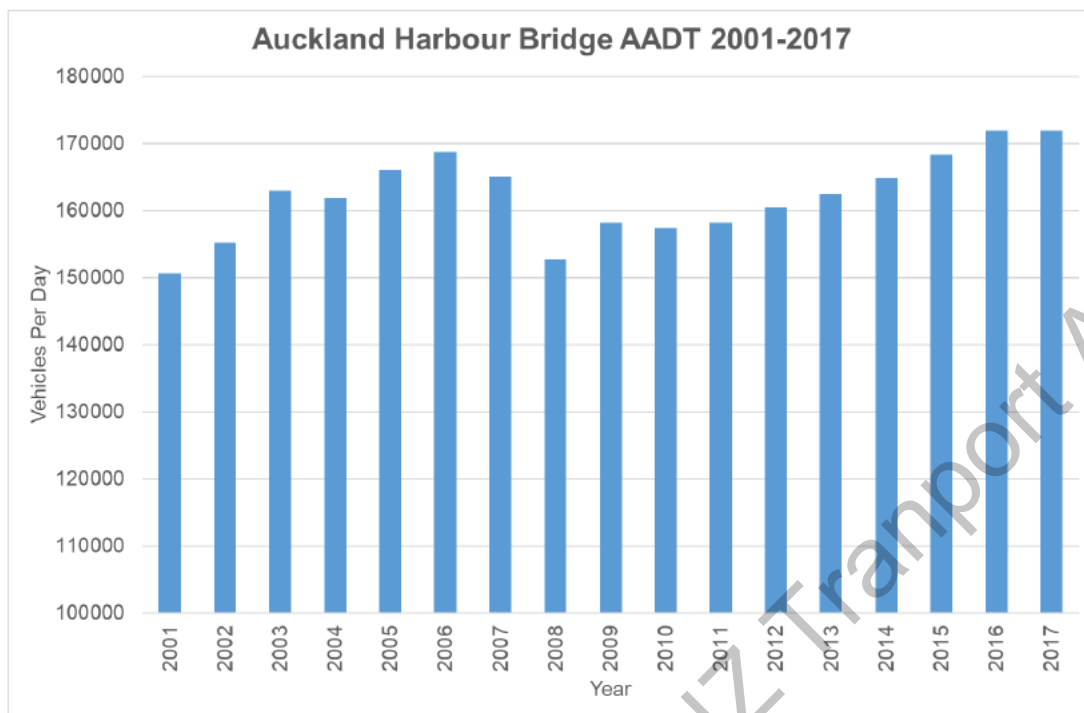
**Figure 1: 2016 AM Peak Period - Congestion On the Road Network**



18. While the AHB carries up to 14,000 vehicles per hour (two-way), the approaches are at capacity causing evening traffic congestion to spread to the AHB. Generally in the morning peak periods, traffic over the AHB while heavy, flows better than on the congested approaches.
19. Outside peak traffic periods, AHB daily traffic flow has increased by approximately 2% per year since 2008. Daily flows sometimes exceed 200,000 vehicles.
20. Reductions in daily traffic flow following the peak of the Global Financial Crisis (GFC) in mid 2008, have been eroded by subsequent growth. The graph below illustrates the GFC induced reduction in daily traffic flows.

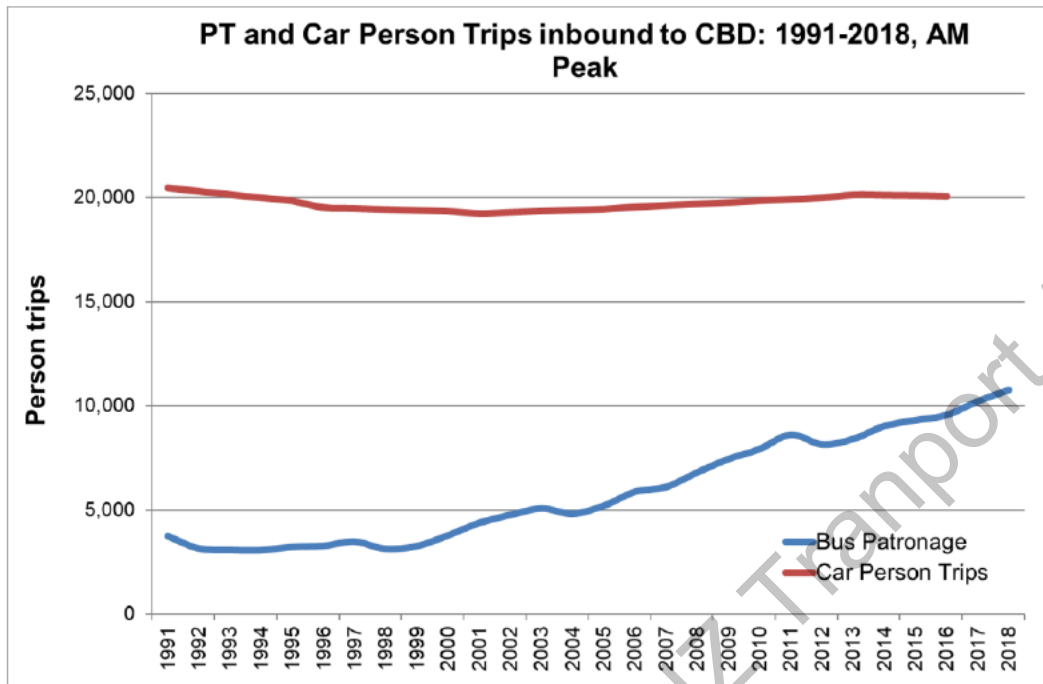


**Figure 2: Auckland Harbour Bridge Average Annual Daily Traffic 2001 - 2017**



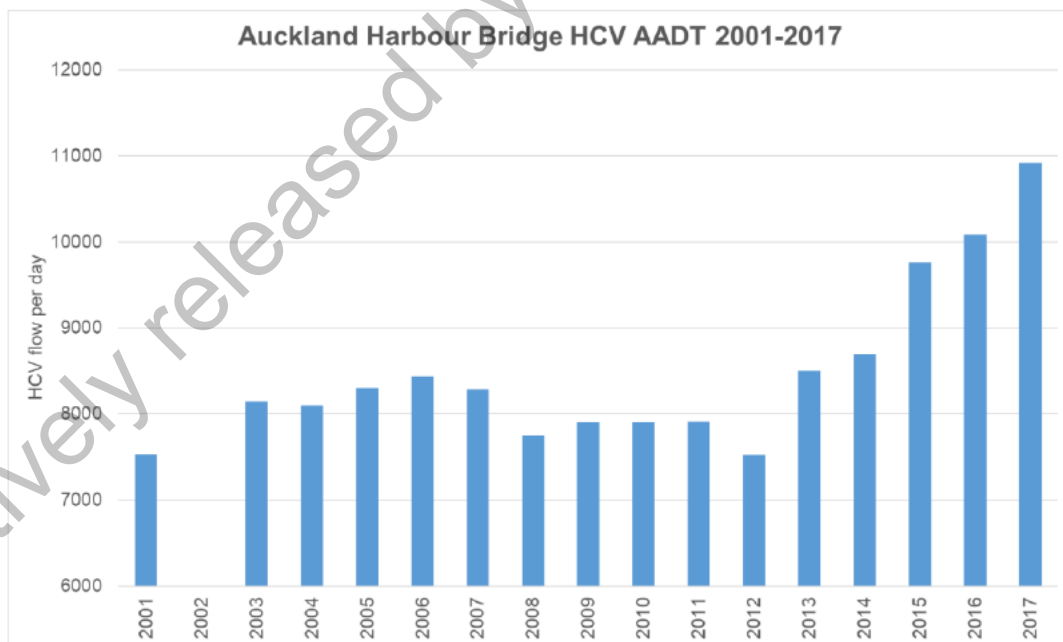
21. On the other hand, the number of people carried by public transport over the AHB during peak periods shows high and sustained growth. Over 1,000 bus trips carry about 36,000 passengers across the AHB per day – bus users are about 18% of all daily person trips, but up to 38% in the AM peak period.
22. In the morning peak period, around 31,000 people travel southbound over the AHB – 20,000 people travel by car and 11,000 by bus.
23. Of the 31,000 people travelling southbound, about 14,000 have City Centre destinations. Of these, around 6,000 people (42%) travel by car and about 8,000 people (58%) travel by bus.
24. Figure 3 below shows that public transport (PT) patronage over the AHB in the morning peak period (7am–9am) has increased by 58% since the busway opened. PT patronage is now over 11,000 people southbound in the morning peak period. On the other hand, people travelling by car have remained more or less constant at 20,000 over this period – reflecting that, for vehicles, the approach to the AHB north of Onewa Road is at capacity during peak periods.

**Figure 3: PT and Car Person Trips Inbound to the City Centre: 1991 - 2018 AM Peak**  
 (Auckland Forecasting Centre)



25. AHB heavy commercial vehicle (HCV) use has increased by 30% over five years (2012 to 2016) and is now approaching 11,000 HCV movements on a weekday, as shown on the graph below.

**Figure 4: Annual Average Heavy Vehicle Daily Traffic 2001 - 2017**

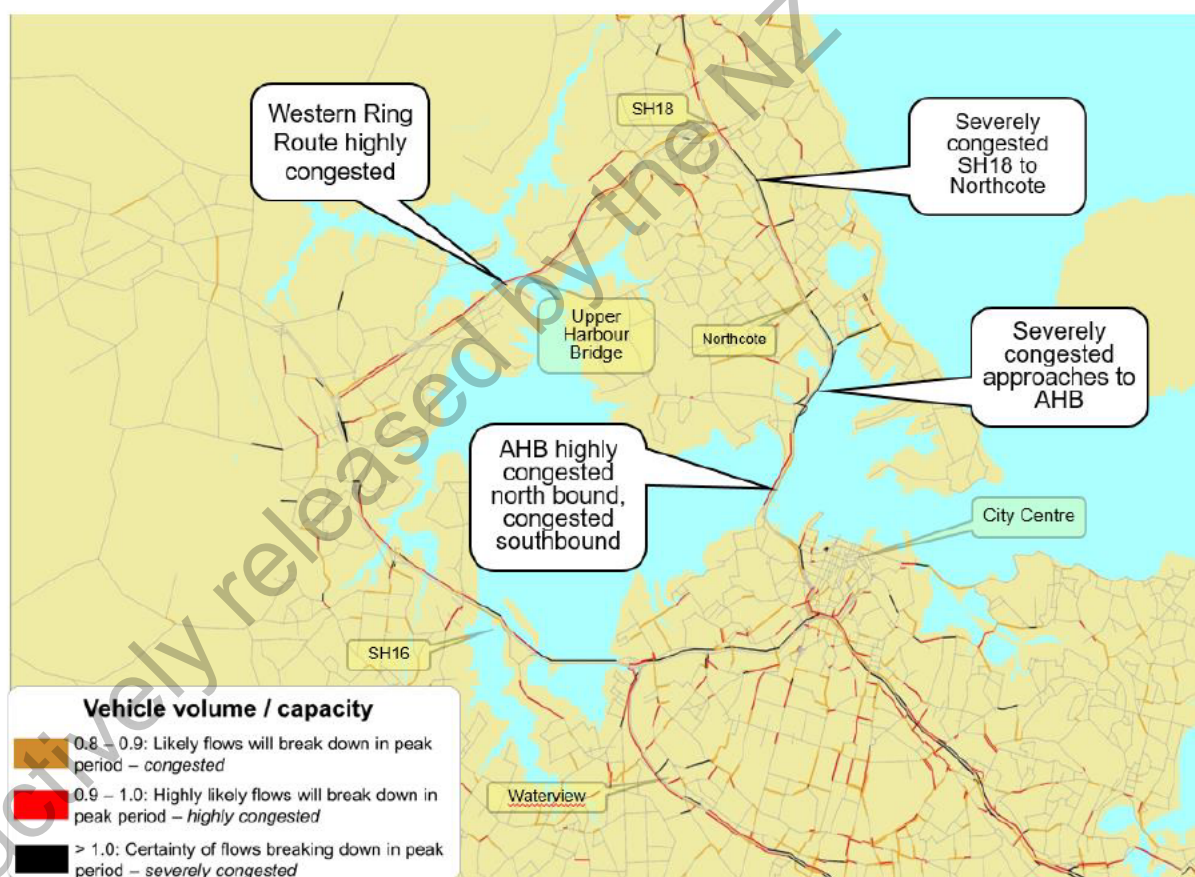


## Scenario 1: 2046 Do Minimum – No Road or Rapid Transit AWHC<sup>1</sup>

### Spreading of peak periods for vehicle traffic

26. Weekday AHB traffic flow is forecast to increase by 17% (or by 13% with road pricing<sup>2</sup>) by 2046.
27. Without changes in vehicle technology or Mobility as a Service (MaaS), the road connections either side of the AHB cannot carry any more private vehicle trips or more people in cars (higher car occupancy) in the AM and PM peak periods so any growth in vehicle trips will increase the extent and duration of peak period congestion (peak spreading).
28. It is important to note that as the approaches to the AWHC are at capacity, providing an AWHC road crossing would also require widening of its approaches from Northcote to Constellation if the benefits that could be achieved are to be optimised.
29. Figure 5 below shows the forecast road congestion for the do minimum scenario – i.e. No AWHC for any mode and no road pricing.

**Figure 5: 2046 AM Peak Period – Forecast road congestion for the do no AWHC or related improvements scenario**



<sup>1</sup> Forecasts from ART3 model October 2017, using i11 growth scenario.

<sup>2</sup> Network road pricing is as per Auckland Transport Alignment Project (ATAP) Smarter Pricing work stream 2016. See Appendix 1 for raw data.

### **Limited additional capacity of the northern busway**

30. As a result of increased travel demand and the forecast traffic congestion, demand for public transport is forecast to double in the AM and PM peak periods by 2046. For example, in the 2046 AM peak, cross harbour forecast public transport patronage is 22,000 person trips – double current patronage. This patronage will exceed the practical capacity of the bus system well before this date without improvements.
31. Auckland Transport's North Shore Rapid Transit Programme Business Case (2017) predicts that growth of travel demand on the Northern Busway will put pressure on the AHB and city centre public transport (PT) infrastructure. It concludes that a higher capacity PT mode will be required by the mid-2030s.

### **The likely need for future heavy vehicle restrictions**

32. Forecasts indicate that restrictions for heavy vehicles on the AHB may be required by approximately 2030. Work done during ATAP by NZTA suggested restricting heavy vehicle weights on the AHB to less than 35 tonnes as one option. Additional work is needed to understand the on the best option to manage heavy vehicles and the economic impacts.
33. The estimated average cost of diverting a single weekday truck trip from the AHB to the Western Ring Route is approximately \$40. In 2046, approximately 27,000 HCV cross harbour trips are forecast per day.

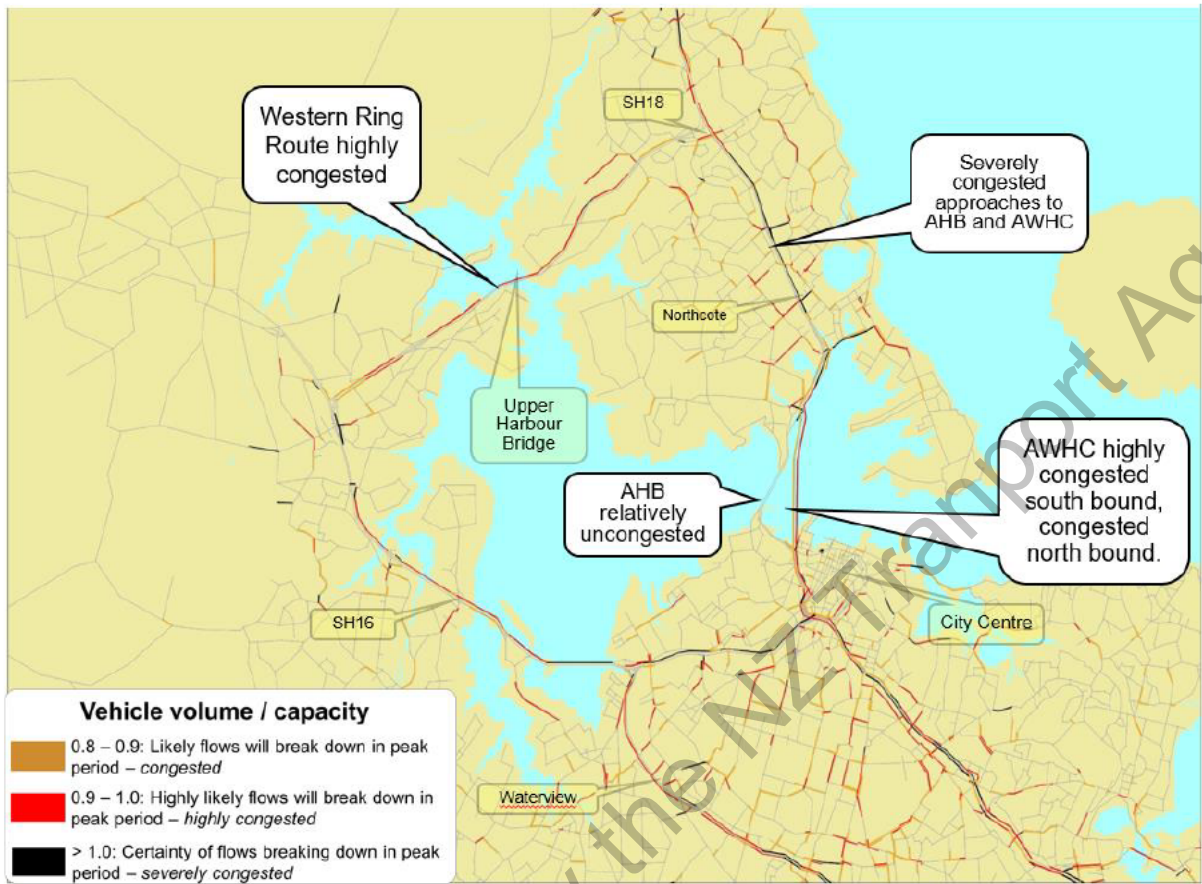
### **Key Questions Examined From the Modelling Scenarios**

#### **If the AWHC is built as a dual road / LRT crossing, what other road upgrades could be required without road pricing?**

34. Figure 6 below shows congestion levels on the road network in the 2046 AM peak following the construction of the AWHC as a combined road and LRT crossing without pricing.
35. While the AWHC experiences high congestion southbound and is congested northbound, the northern approach to the AWHC between Constellation Drive and Northcote Road experiences higher, severe levels of congestion.
36. Based on these results, a widening of SH1 between Northcote Road and Constellation would have to be included as part of the AWHC project if the benefits that could be achieved are to be optimised. South of the harbour, while there is also significant congestion, the highly constrained nature of the Southern Motorway means widening could involve significant land acquisition, extremely high costs and potentially major amenity impacts.
37. As forecast congestion on the AWHC is high, serious consideration would have to be given to managing traffic flow through the AWHC and its southern approaches.



Figure 6: 2046 AM Peak Period - Forecast road congestion for a combined road and LRT AWHC and no pricing

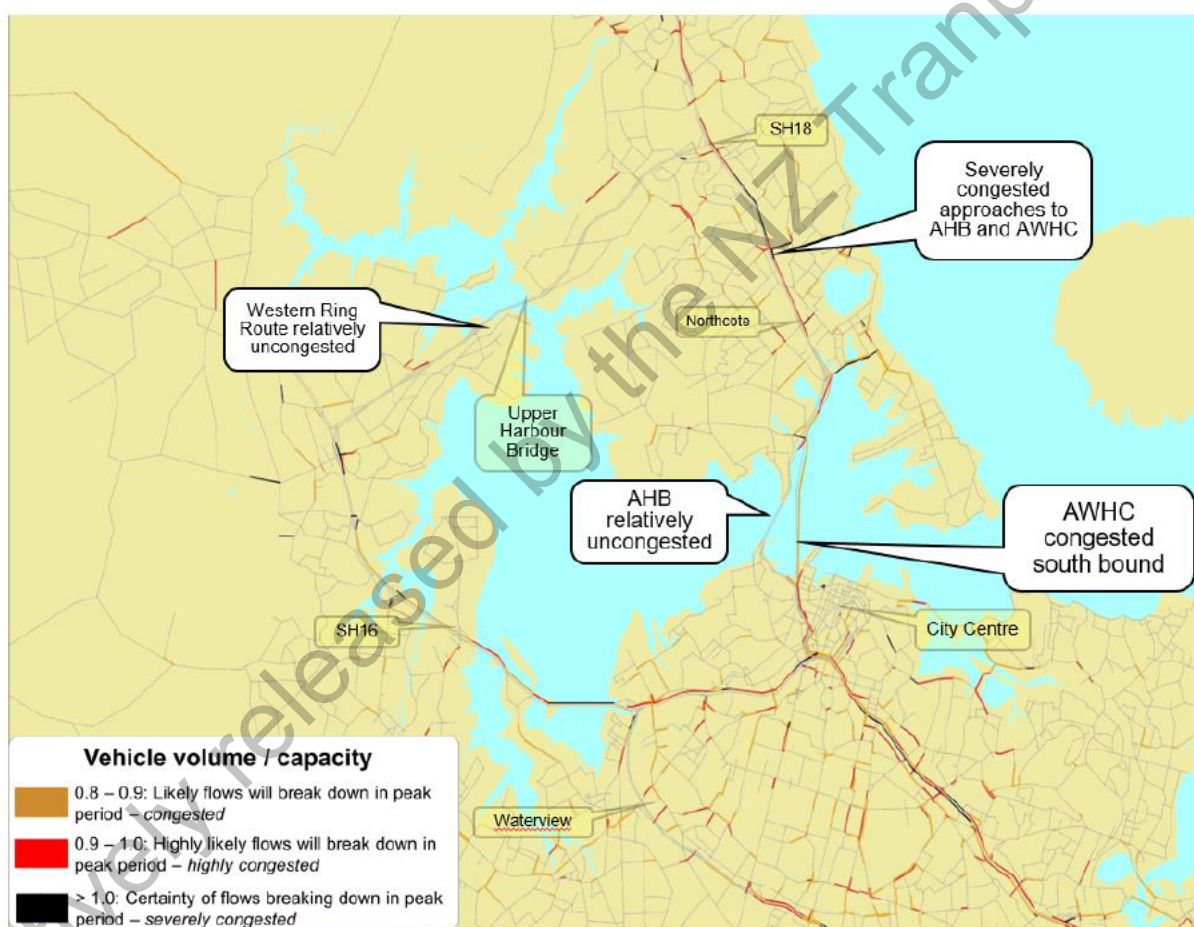


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**Scenario 2: If the AWHC is built as a combined road/LRT crossing, and pricing is implemented what is the impact on network performance?**

- 38. Figure 7 below shows the impact on the road network performance of implementing pricing together with a combined AWHC and LRT crossing.
- 39. Pricing has a significant impact on reducing congestion across the network. However, a road AWHC is forecast continue to experience congestion southbound – down from highly congested in the no pricing scenario. Severe congestion would continue to be experienced on the northern approach to the AWHC between Northcote Road and Constellation Drive.
- 40. This reinforces the need to consider a road AWHC, together with the widening of SH1 from Northcote Road to Constellation Drive, as an integrated project.

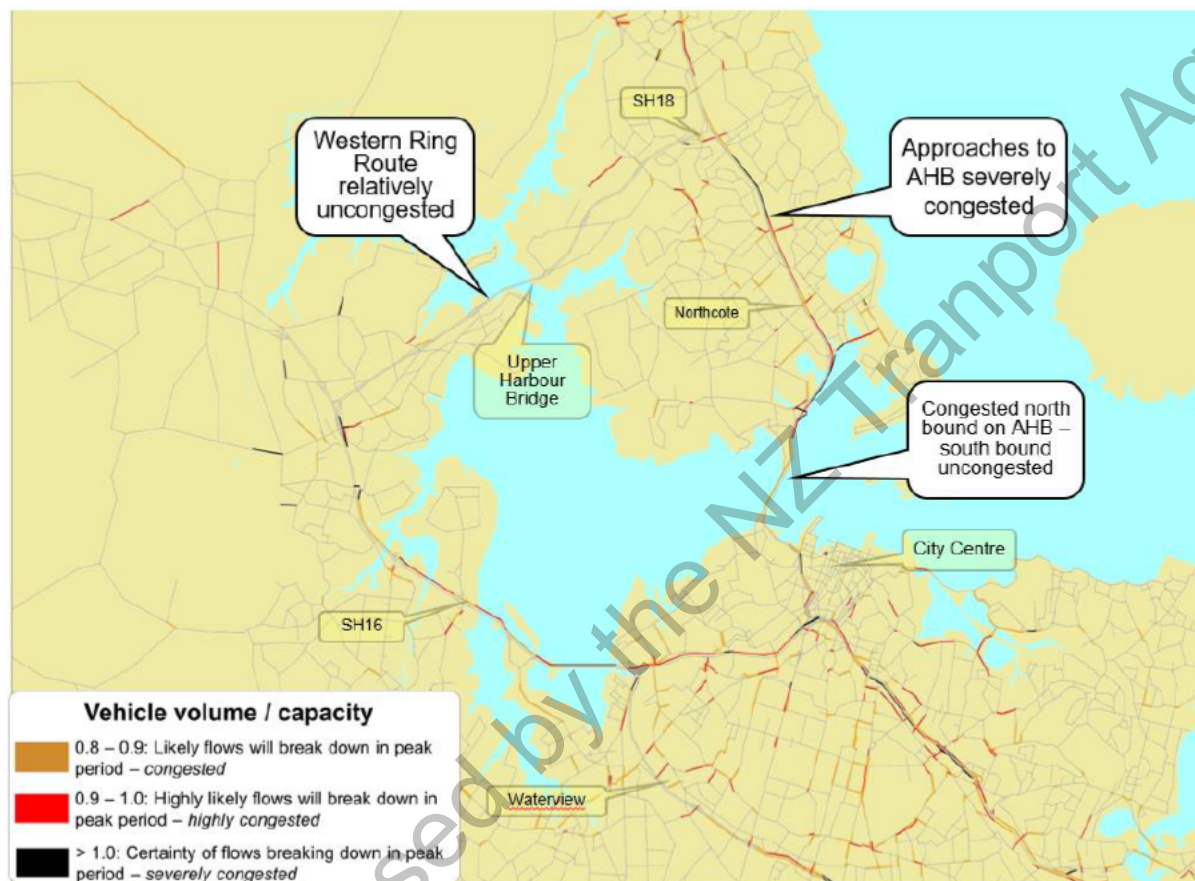
**Figure 7: 2046 AM Peak Period - Forecast road congestion for a combined road and LRT AWHC and with pricing**



### Scenario 3: If the AWHC is LRT only crossing, and pricing is implemented what impact is there on road network performance?

41. Figure 8 shows the impact on the performance of the road network on of a LRT only AWHC and the introduction of congestion pricing.

**Figure 8: 2046 AM Peak Period – Forecast road congestion for a LRT only AWHC and with pricing**



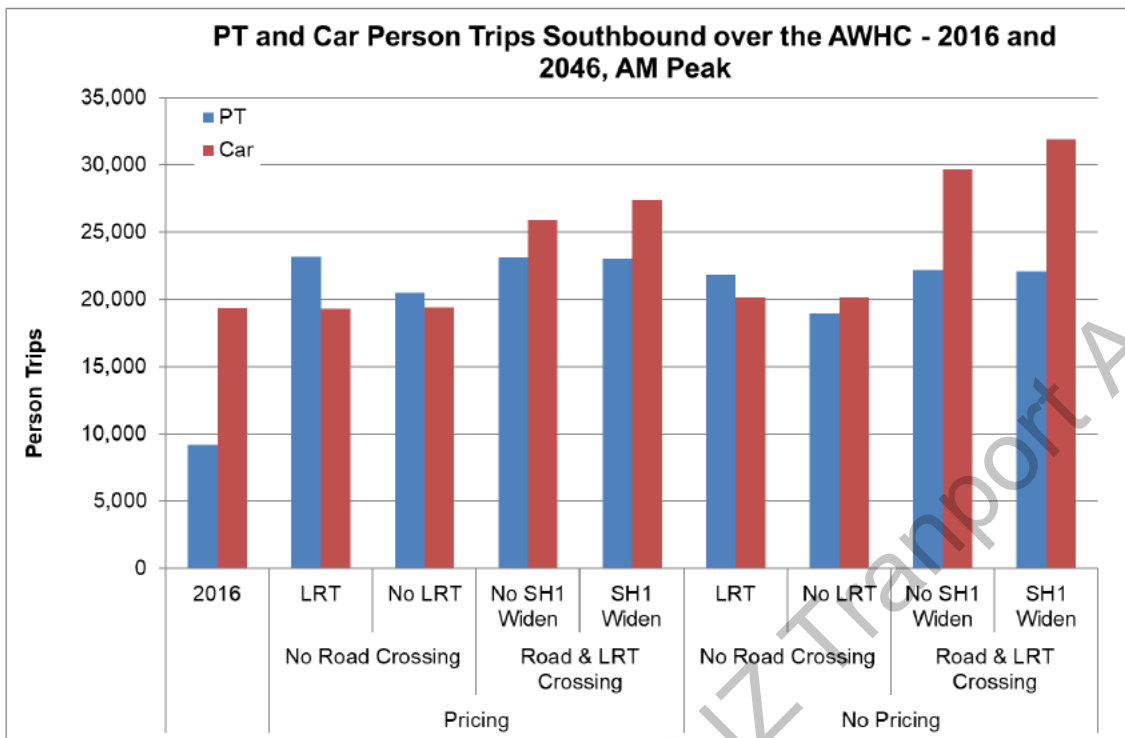
42. Figure 8 shows that the congestion outcomes with a LRT only crossing and pricing are very similar to the congestion outcomes of a combined LRT and vehicle AWHC and pricing – with the AHB experiencing moderate congestion in the morning peak.

### What are the impacts of an AWHC and pricing on mode share?

43. Figure 9 below shows the number of people forecast to travel southbound across all AWHC scenarios.
44. The highest number of PT trips is achieved through a LRT only option with pricing and no road crossing. The highest number of car users would be achieved through a combined road and LRT crossing and no road pricing.

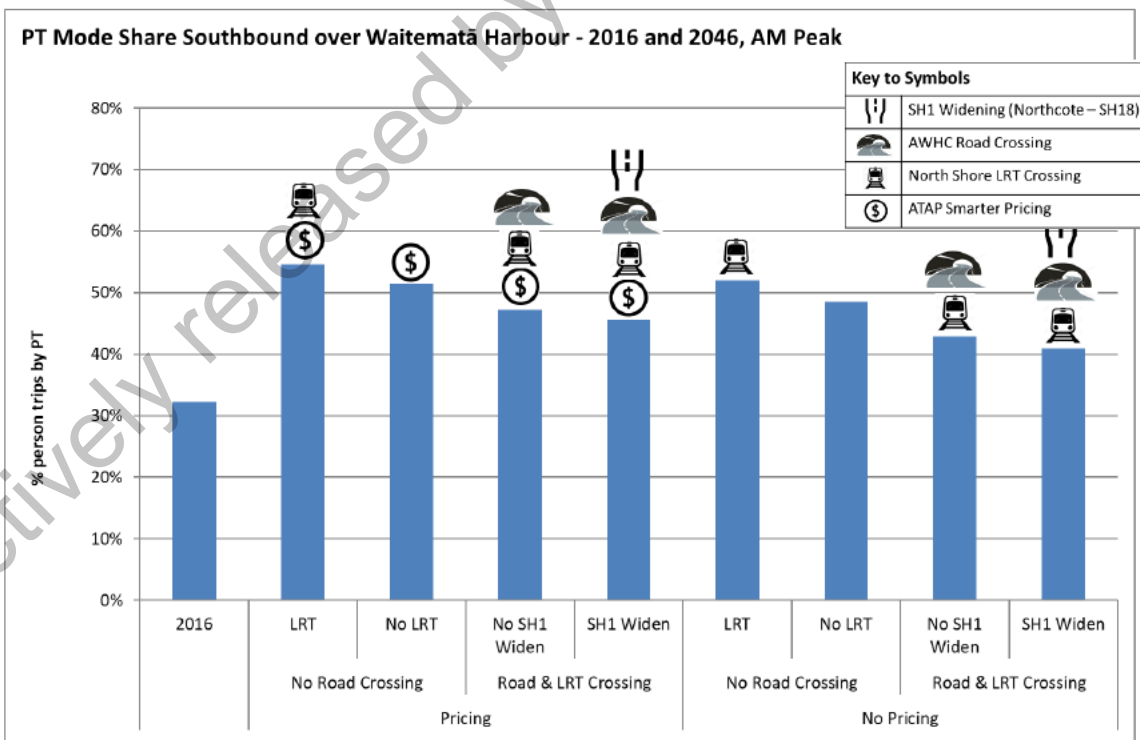


Figure 9: AM Peak Car and PT person trips southbound over the AWHC and AHB



45. Figure 10 below illustrates the change in PT mode share across all AWHC scenarios. The best public transport mode share is delivered by a combination of a LRT only crossing together with road pricing.

Figure 10: AM Peak PT Mode Share southbound over the AWHC and AHB

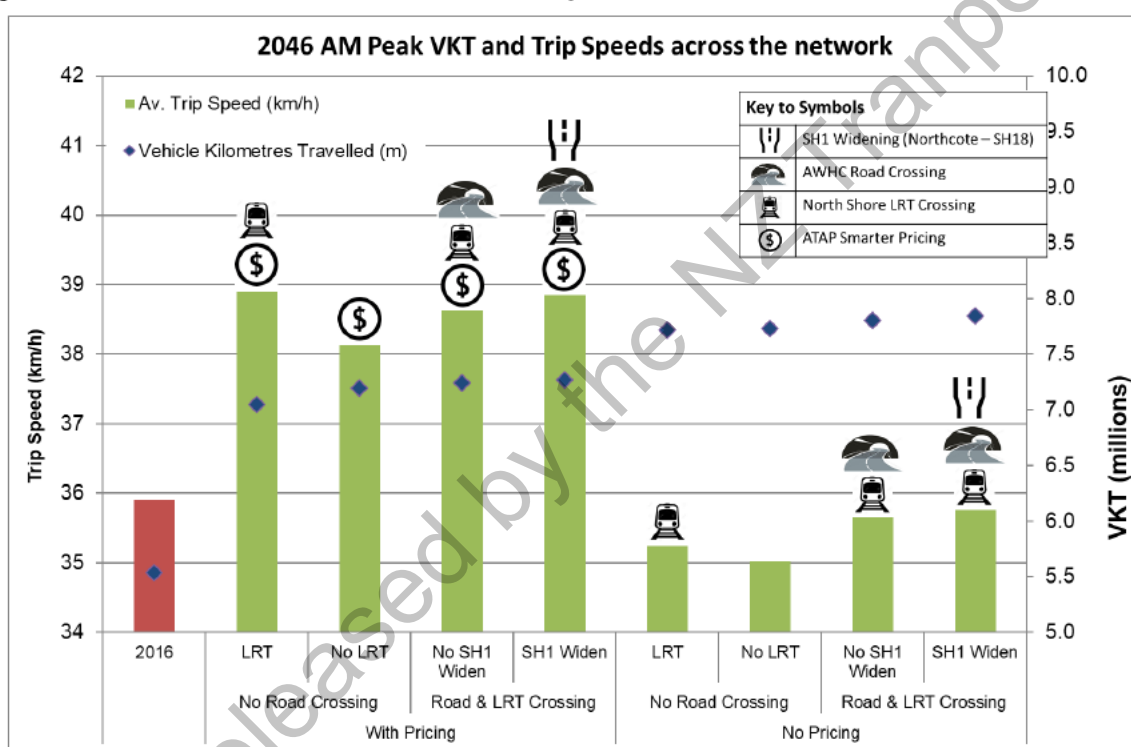




**What are the wider network effects of an AWHC on congestion (as indicated through trip speed) and environmental outcomes? (as indicated through vehicle kilometres travelled)**

- 46. Figure 11 illustrates total VKT and average speeds across the Auckland network under the modelled scenarios.
- 47. Road pricing together with a LRT only crossing has the best outcome in terms of reducing total vehicle kilometres travelled (VKT) on the Auckland network in the AM peak period. Options with pricing deliver an increase in vehicle speeds of about 3 km/h compared to the non-pricing options.
- 48. While the effect of LRT only AWHC options on average speeds across the entire network is less than 1 km/h relative to those with a road AWHC, this is would be achieved at a significant cost saving of an additional road crossing.

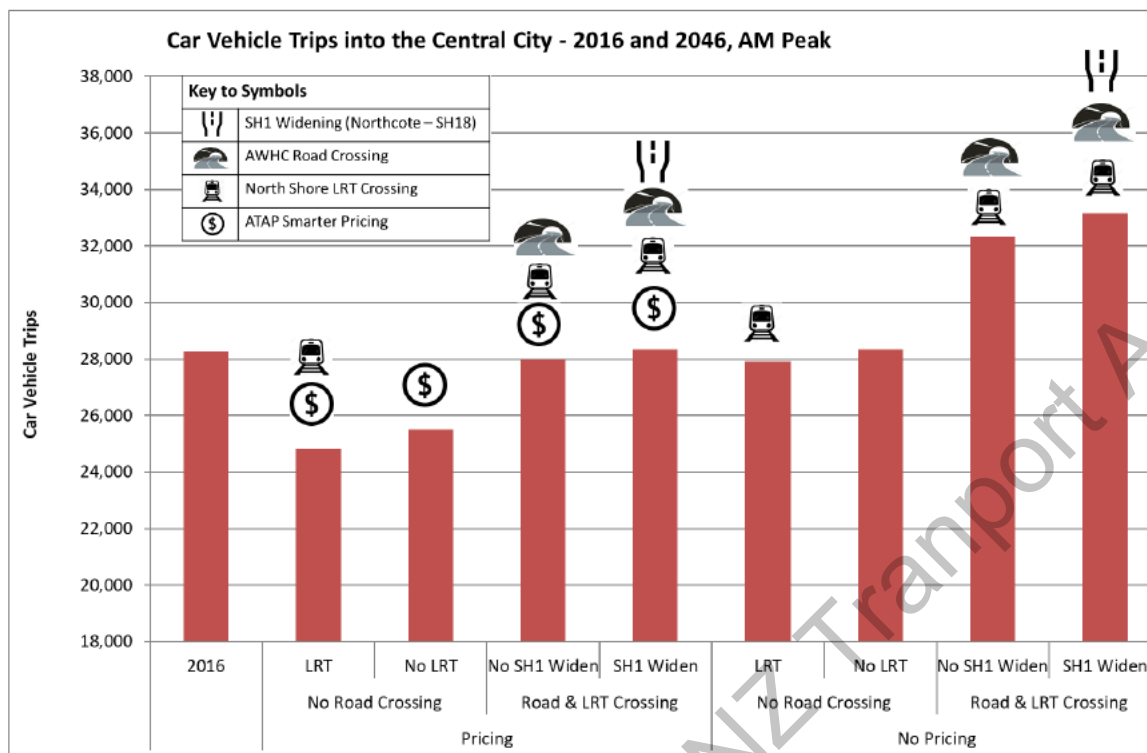
**Figure 11: 2046 AM Peak forecast Vehicle Speeds and VKT across the Road Network**



**What are the impacts of an AWHC on the City Centre?**

- 49. Figure 12 shows the forecast the number of vehicle trips entering the Auckland city centre in the morning peak period under each modelled scenario. A LRT only crossing combined with road pricing delivers the best outcomes for the City Centre in terms of fewer cars entering the City Centre during peak traffic times.
- 50. Road pricing is the main difference affecting vehicle trips into the city centre, regardless of whether an AWHC road crossing is provided. Pricing reduces vehicle trips into the city centre in the AM peak (2 hours) by 3,000–5,000.
- 51. Providing an AWHC road crossing (with pricing) would result in a significant increase of about 3,500 vehicles entering the city centre in the AM peak (2 hours) compared to a light rail-only crossing. This would work against both GPS and Auckland policies to reduce the number of car trips and support a mode shift for trips in urban areas from private vehicles to more efficient, low cost modes like walking, cycling and public transport.

Figure 12: 2046 AM Peak Forecast Vehicle Trips Into the City Centre



## Next Steps

52. The currently proposed next steps are:

- Undertake a business case to:
  - Refine the road and LRT AWHC options (separately and together), their timing and sequencing as well as to provide updated cost information
  - Evaluate the network wide road and public transport infrastructure needs to optimise the benefit of additional harbour crossing capacity
  - Further analysis of the impacts of transport accessibility and resilience of the different options
  - Assess the options against the GPS policy direction
  - Fully assess the options, costs and benefits of freight restrictions
  - Provide the basis for bringing back clear advice on what to deliver – combined road/rail (heavy or light) AWHC or a rail only (heavy or light) AWHC – and when.
- Refine the pricing system as the Congestion Question project advances.

It is recommended that you:

**Note** the contents of this briefing. Additional modelling data is available on request.



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**Brett Gliddon**

General Manager, System Design

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**Hon Phil Twyford, Minister of Transport**

Date: 2018

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**Hon Julie Anne Genter, Associate Minister of Transport**

Date: 2018

**Appendix 1: Modelling Overview – notes and raw data**

**Attachment 1: BRI-1146 (22 February 2018)**

## Appendix 1: Modelling Overview – notes and raw data

53. The modelling presented in this briefing paper was derived from the Auckland Regional Transport model (ART3) in 2017 and reviewed in 2018.
54. All modelling is based on the i11 growth forecast for 2046.
55. The 2018 modelling uses an updated Macro Strategic Model (MSM) Regional Model and has been completed for the AM peak period only.
56. The MSM Regional Model has no constraint on cross harbour bus capacity although Auckland Transport estimates a maximum capacity for buses across the AHB at approx. 18,000 people in 2 hours.
57. Pricing refers to the “smarter pricing” scenario used for ATAP.
58. SH1 widening between Northcote Road and SH18 includes 1 additional lane southbound from SH18 to Northcote Road, 1 additional lane northbound from Tristram Ave to SH18 and south facing motorway on-ramps connecting SH18 to SH1.

### *Commonly used acronyms*

AADT: Annual Average Daily Traffic (includes weekends)

HCV: Heavy Commercial Vehicle (over 3.5 tonnes, includes buses)

AM Peak period: 7am–9am weekday

LRT: Light Rail (compatible with on-street running)

PT: Public Transport

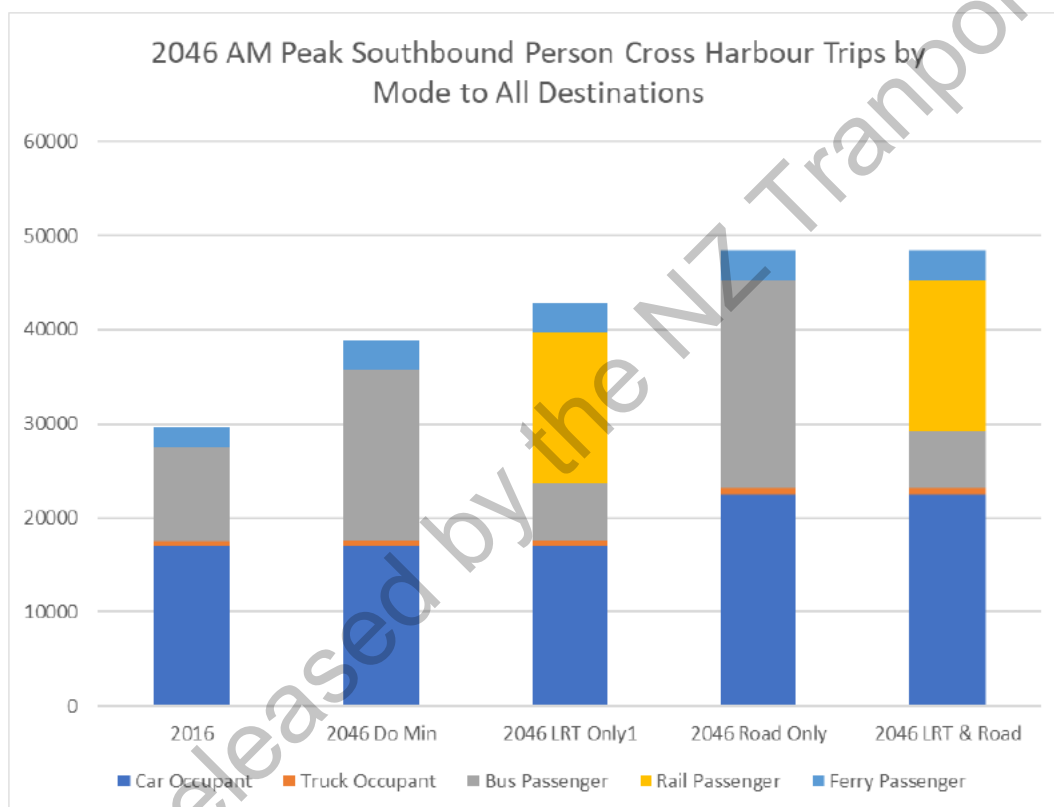
AHB: Auckland Harbour Bridge

UHB: Upper Harbour Bridge



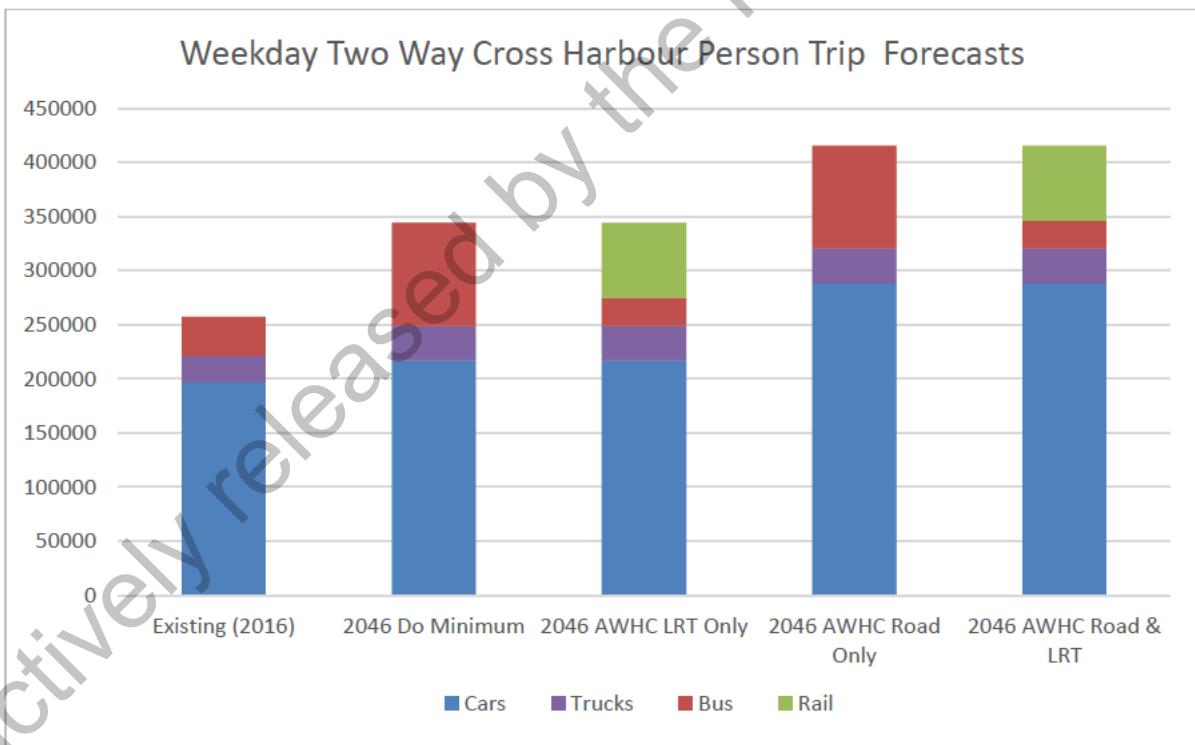
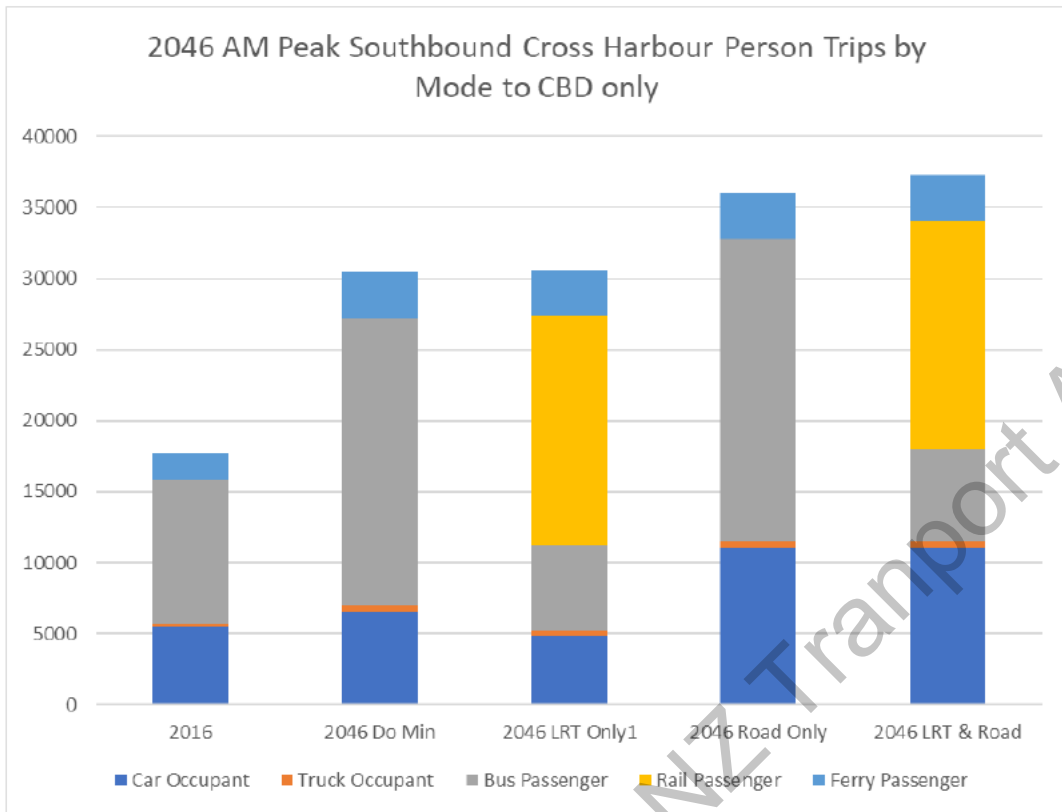
**2017 Modelling Overview – Cross Harbour Person Trip Forecasts<sup>3</sup>**

	AM Peak 2 Hour Southbound				Weekday			
	Cars	Trucks	Bus	Rail	Cars	Trucks	Bus	Rail
Existing (2016)	17,000	700	10,000	0	196,800	24,600	36,000	0
2046 Do Minimum	16,800	1,000	18,000	0	216,900	32,300	95,000	0
2046 AWHC LRT Only <sup>1</sup>	16,800	1,000	6,000	16,000	216,900	32,300	25,900	69,100
2046 AWHC Road Only	22,400	1,000	22,000	0	288,100	32,300	95,000	0
2046 AWHC Road & LRT	22,400	1,000	6,000	16,000	288,100	32,300	25,900	69,100



<sup>3</sup> LRT only scenario was not explicitly modelled in 2017, these forecasts derived from NZTA AWHC route protection modelling with and without rail based on i11 growth.

Car and truck occupancy assumed as 1.2 persons / vehicle.



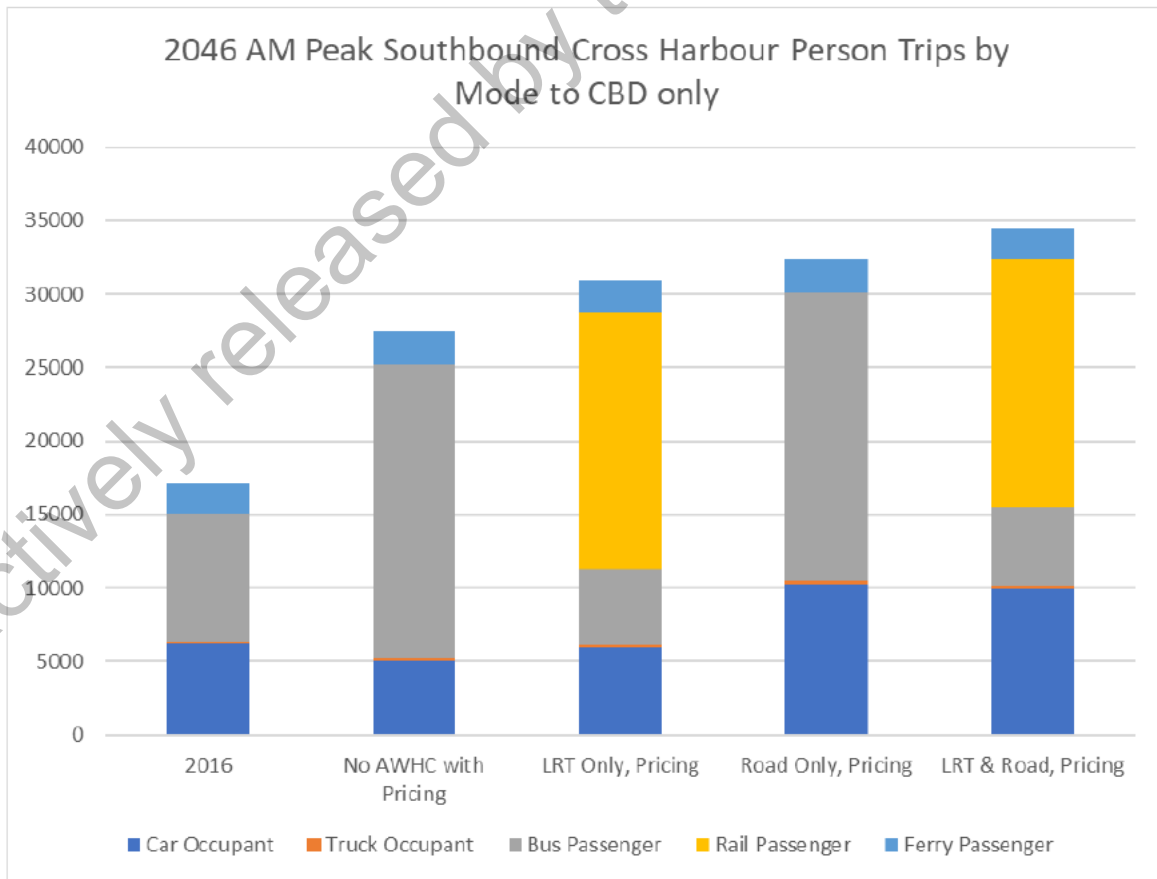
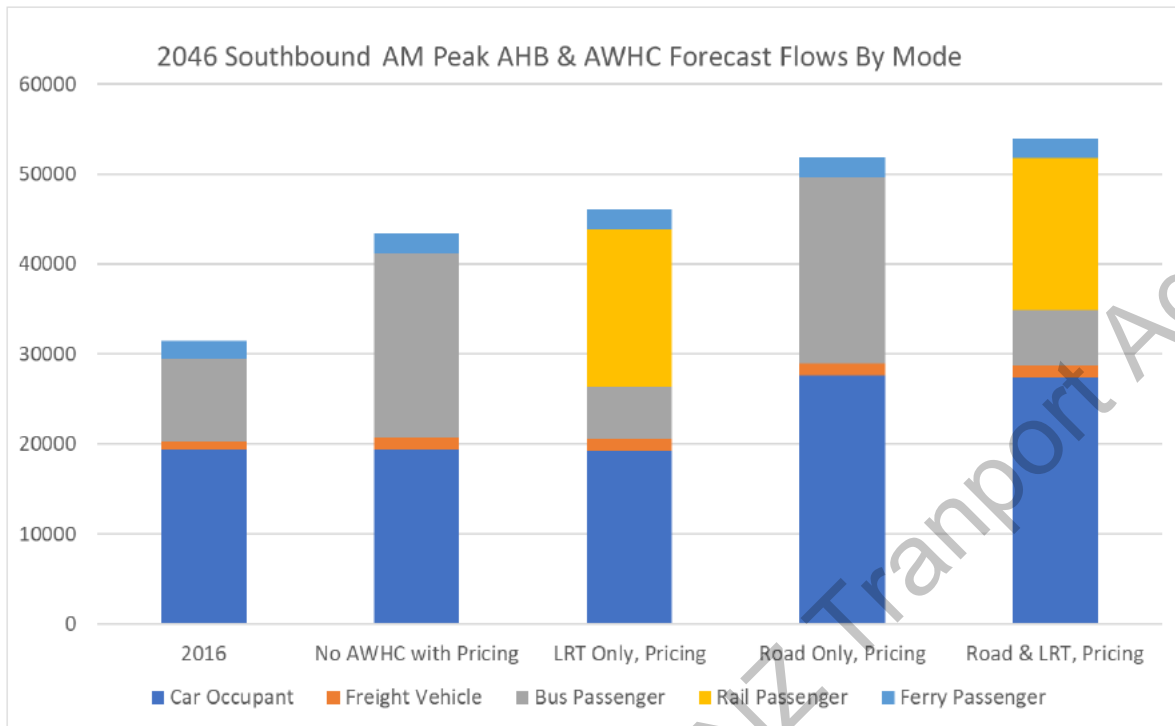
Year	AHB Annual Average Daily Traffic	
	All Vehicles	Heavy Commercial Vehicles
2001	150,608	7,530
2002	155,258	N/A
2003	162,960	8,147
2004	161,990	8,100
2005	166,127	8,305
2006	168,754	8,439
2007	165,154	8,288
2008	152,750	7,745
2009	158,253	7,905
2010	157,488	7,908
2011	158,220	7,910
2012	160,590	7,527
2013	162,439	8,504
2014	164,973	8,600
2015	168,449	9,766
2016	172,000	10,100

Source: NZ Transport Agency State Highway Traffic Monitoring

Time Period	Do Minimum AHB Forecast Traffic Flow		
	2015	2046 No Pricing	2046 With Pricing
AM Southbound	14,780	15,373	14,767
AM Northbound	9,400	11,686	11,702
Interpeak Southbound	11,080	13,412	12,835
Interpeak Northbound	11,200	14,312	13,503
PM Peak Southbound	11,220	11,342	11,409
PM Peak Northbound	16,770	17,254	16,131
Weekday	184,487	216,720	207,592

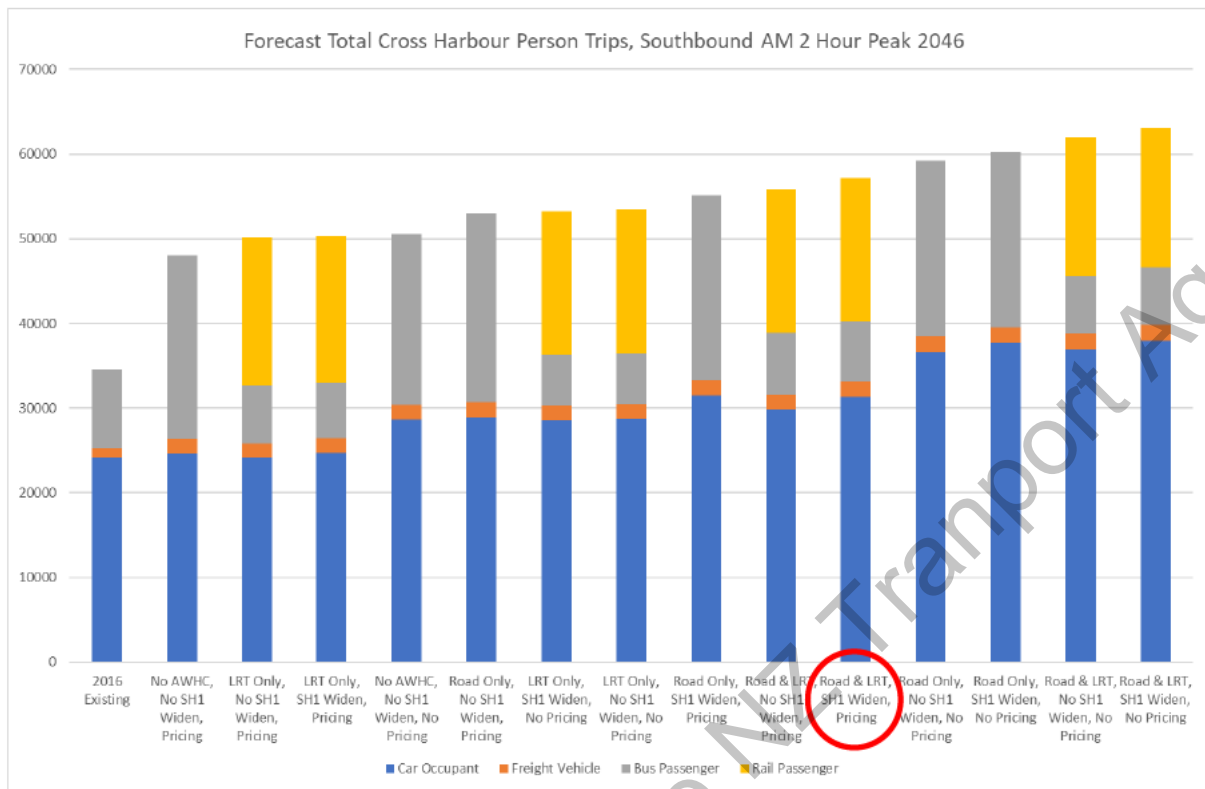
Source: NZ Transport Agency AWHC Route Protection Modelling

2018 Modelling Update





**Total person trips using the three harbour crossings (UHB, AHB, AWHC) by mode**



*NB. The route protection modelling scenario circled in red*

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