MINISTERIAL BRIEFING NOTE

Subject | Additional Waitematā Harbour Crossing | Transport Modelling
Date | 13 September 2018
Briefing number | BRI-1270

Contact(s) for telephone discussion (if required)

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<th>Position</th>
<th>Direct line</th>
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</tr>
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<tbody>
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<td>Brett Gliddon</td>
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Action taken by Office of the Minister

☐ Noted
☐ Seen by Minister
☐ Agreed
☐ Feedback provided
☐ Forwarded to
☐ Needs change [please specify]
☐ Withdrew
☐ Overtaken by events

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13 September 2018

Minister of Transport and Associate Minister of Transport

ADDITIONAL WAITEMATĀ HARBOUR CROSSING (AWHC) - TRANSPORT MODELLING

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 Waitemata 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.
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.
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\(^1\)

**Spreading of peak periods for vehicle traffic**

26. Weekday AHB traffic flow is forecast to increase by 17% (or by 13% with road pricing\(^2\)) 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 AHWC 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 AHWC or related improvements scenario*

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\(^1\) Forecasts from ART3 model October 2017, using i11 growth scenario.

\(^2\) 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
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 to 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

Figure 10: AM Peak PT Mode Share 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.
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 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

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**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

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<th>AM Peak 2 Hour Southbound</th>
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<tr>
<td></td>
<td>Cars</td>
<td>Trucks</td>
</tr>
<tr>
<td>Existing (2016)</td>
<td>17,000</td>
<td>700</td>
</tr>
<tr>
<td>2046 Do Minimum</td>
<td>16,800</td>
<td>1,000</td>
</tr>
<tr>
<td>2046 AWHC LRT Only¹</td>
<td>16,800</td>
<td>1,000</td>
</tr>
<tr>
<td>2046 AWHC Road Only</td>
<td>22,400</td>
<td>1,000</td>
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<tr>
<td>2046 AWHC Road &amp; LRT</td>
<td>22,400</td>
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² 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.
### AHB Annual Average Daily Traffic

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<tr>
<th>Year</th>
<th>All Vehicles</th>
<th>Heavy Commercial Vehicles</th>
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<td>2001</td>
<td>150,608</td>
<td>7,530</td>
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<td>2002</td>
<td>155,258</td>
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<td>2003</td>
<td>162,960</td>
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<td>2009</td>
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<td>157,488</td>
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<td>2011</td>
<td>158,220</td>
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<td>160,590</td>
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<td>162,439</td>
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<td>2015</td>
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<td>2016</td>
<td>172,000</td>
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Source: NZ Transport Agency State Highway Traffic Monitoring

### Do Minimum AHB Forecast Traffic Flow

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<th>2015</th>
<th>2046 No Pricing</th>
<th>2046 Wth Pricing</th>
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<td>AM Southbound</td>
<td>14,780</td>
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<td>9,400</td>
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<td>11,080</td>
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<td>11,200</td>
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<td>PM Peak Southbound</td>
<td>11,220</td>
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<td>16,770</td>
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<td>184,487</td>
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Source: NZ Transport Agency AWHC Route Protection Modelling
2018 Modelling Update

2046 Southbound AM Peak AHB & AWHC Forecast Flows By Mode

2046 AM Peak Southbound Cross Harbour Person Trips by Mode to CBD only
Total person trips using the three harbour crossings (UHB, AHB, AWHC) by mode

NB. The route protection modelling scenario circled in red