NSW GOVERNMENT

Transport for NSW

Beaches Link and Gore Hill Freeway Connection

Chapter 9

Operational traffic and transport

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9 Operational traffic and transport

This chapter outlines the potential traffic and transport impacts arising from the operation of the Beaches Link and Gore Hill Freeway Connection and identifies measures which address these impacts. Potential construction traffic and transport impacts are discussed in Chapter 8 (Construction traffic and transport).

A detailed traffic and transport assessment has been carried out for the project and is included in Appendix F (Technical working paper: Traffic and transport).

The Secretary's environmental assessment requirements as they relate to operational traffic and transport, and where in the environmental impact statement these have been addressed, are detailed in Table 9-1.

Avoiding or minimising impacts has been a key consideration throughout the design and development process for the Beaches Link and Gore Hill Freeway Connection project. A conservative approach has generally been used in the assessments, with potential impacts presented before implementation of environmental management measures. The environmental management measures proposed to minimise the potential impacts in relation to operational traffic and transport are included in Section 9.5.

Table 9-1 Secretary's environmental assessment requirements – operational traffic and transport

Secretary's environmental assessment requirements	Where addressed
2. The Proponent must assess and model the operational transport impacts of the project including, but not necessarily limited to: a. forecast travel demand and traffic volumes (expressed in terms of total numbers and heavy and light vehicle numbers) for the project and the surrounding road, cycle and public transport network, including potential shifts of traffic movements on alternate routes outside the proposal area (such as toll avoidance) and impact of permanent street closures directly attributable to the SSI;	Operational traffic and transport impacts for the project and surrounding network are discussed in **Section 9.4**. Further details on forecast traffic volumes and tolling scenarios and implications is provided in **Appendix F** (Technical working paper: Traffic and transport).
b. accessibility impacts in commercial centres within the vicinity of the project;	Accessibility impacts are discussed in **Chapter 21** (Socio-economics). Forecast 30-minute catchments by road for strategic centres in the vicinity of the project are provided in **Appendix F** (Technical working paper: Traffic and transport).
c. travel time analysis;	An assessment on impacts to travel time is provided in **Section 9.4**.
d. performance of key interchanges and intersections by undertaking a level of service analysis at key locations;	Interchange and intersection performance during operation is discussed in **Section 9.4**.

Secretary's environmental assessment requirements	Where addressed
e. wider transport interactions (local and regional roads, cycling, public and freight transport);	**Chapter 3** (Strategic context and project need) describes the relationship and/or integration of the project with existing and proposed public and freight transport services. **Section 9.1** outlines how the project considers specific transport strategies. **Section 9.4** provides an assessment of future traffic and transport interactions.
f. induced traffic and operational implications for existing and proposed public transport (particularly with respect to strategic bus corridors and bus routes and permanent closure/relocation of bus stops) and consideration of opportunities to improve public transport;	Implications and impacts on public transport are described in **Section 9.4**.
g. impacts on cyclists and pedestrian access and safety;	Impacts on pedestrians and cyclists, including access and safety, are described in **Section 9.4**.
h. property and business access and on street parking; and	Road network changes, operational impacts to parking, and access arrangements are described in **Section 9.4**. Impacts to properties and businesses are detailed in **Chapter 21** (Socio-economics).
i. an explanation for the scope of the modelled area, including justification of the nominated boundaries.	The assessment methodology is summarised in **Section 9.2** and outlined in detail in **Appendix F** (Technical working paper: Traffic and transport).

9.1 Strategic transport planning context

Details regarding the project's compatibility with key Australian Government and State strategic planning and transport policies are provided in Chapter 3 (Strategic context and project need).

A summary of more specific transport strategies relevant to the project are provided below.

9.1.1 North Sydney Integrated Transport Program

The *North Sydney Integrated Transport Program* (NSITP or the North Sydney Program) is a multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and Government Architect of NSW, to guide future integrated transport planning and investment in the North Sydney CBD and interconnected areas over the next 20 years and beyond. Led by Transport for NSW since 2018, it aims to deliver a shared place-based vision for the North Sydney CBD.

The North Sydney Program is being developed to support and facilitate the outcomes envisaged by the *Greater Sydney Region Plan* (Greater Sydney Commission, 2018a) and *Future Transport Strategy 2056* (NSW Government, 2018). The timing for deliverables in the North Sydney Program would be cognisant of the Western Harbour Tunnel and Beaches Link program of works delivery timeframes.

The North Sydney Program considers strategic public transport connections to the North Sydney CBD, land use and public domain objectives, improved pedestrian amenity and safety, road network changes, improved access for cyclists to and through the CBD, convenient interchanges between bus and rail services, management of kerbside access to support business activity across the day, and place outcomes within the CBD. As such, a key focus of the North Sydney Program is to ensure major projects, such as the Western Harbour Tunnel and Beaches Link program of works, integrate with the North Sydney CBD in a manner that supports the globally connected 'Harbour CBD' and enables delivery of befitting place-based outcomes.

The development of the North Sydney Program is ongoing, with validation of the vision for North Sydney currently underway with several scenarios being considered to support the place-based outcomes. As part of the collaboration, the multi-agency group will ensure the future integrated transport network and place-based vision for North Sydney is supported through projects such as the Beaches Link and Gore Hill Freeway Connection project. Further refinements to movement and place outcomes within the North Sydney CBD may occur as part of the North Sydney Program.

To minimise the impact of the Western Harbour Tunnel and Beaches Link program of works on the North Sydney CBD, planning and design to date has been developed to:

- Continue to provide motorway access only via existing major road corridors
- Focus on the utilisation of existing road space to maintain network efficiency and balance the needs of all road users while minimising road widenings
- Ensure operational impacts are minimised (and critical performance issues avoided), by spreading the demand generated by new infrastructure across multiple locations
- Provide network efficiencies and safer outcomes by simplifying network operations, prioritising strategic movements, and minimising conflicts
- Adopt 'movement and place' principles to help reprioritise access and support efficient connections for traffic, pedestrians, and other transport customers.

The proposed network integration works would result in a resilient network that can accommodate key road transport customers, while at the same time promoting walking, cycling and public transport access to and within the North Sydney CBD. In the event that road transport demand is lower or demands otherwise differ as land use and transport developments mature, this approach would also provide flexibility to adjust the future transport network in response to customer needs.

Transport for NSW will continue to work with North Sydney Council and key stakeholders through agreed governance structures to investigate options to improve movement and place outcomes though the North Sydney Program, further leveraging the strategic benefits of the Western Harbour Tunnel and Beaches Link program of works.

9.1.2 Northern Beaches Hospital Precinct Structure Plan

The *Northern Beaches Hospital Precinct Structure Plan* (Northern Beaches Council, 2017b) defines the desired future land uses and consequent multi-modal transport operation and infrastructure requirements to, from and through Frenchs Forest. The plan also acknowledges that a suite of regional transport network upgrades including both public transport and road upgrades would be required to maintain effective transport connections to, from and through Frenchs Forest in the medium to long term.

The project would support the implementation of the plan through supporting medium to long term growth in the area (including a proposed 5360 new dwellings in the next 20 years) by providing a new, safe high-speed road link between the precinct and broader metropolitan Sydney and removing North Sydney and Sydney CBD bound traffic from Warringah Road, thereby improving connectivity and accessibility surrounding the Northern Beaches Hospital. Further details are provided in Section 9.4.6.

9.1.3 Sydney's Bus Future

Sydney's Bus Future (Transport for NSW, 2013a) presents a three-stage approach to improve service outcomes, focusing on improving customer experience, integrating bus services across Sydney and serving future growth. Bus initiatives include the bus rapid transit services for the Northern Beaches (eg Northern Beaches B-Line) to improve capacity and efficiency for bus users.

By reducing network congestion, improving network resilience and increasing reliability in peak periods, the project would make buses a more attractive transport option, supporting and encouraging a mode shift to public transport. The project would also allow new public transport routes to be developed in response to diverse travel demands and future social and economic development, as express buses would be permitted to use the tunnel. The project provides the opportunity to supplement existing services with the opportunity for express buses to use the Beaches Link tunnel to North Sydney, St Leonards and Sydney CBD, as well as to the north-west to employment areas like Macquarie Park via Gore Hill Freeway and Lane Cove Tunnel. There would also be the opportunity for express bus services using the project to interchange with Sydney Trains and the new Sydney Metro at North Sydney and Crows Nest.

The Northern Beaches B-Line began operation in 2017 which provides frequent and more reliable services between the Northern Beaches and Sydney CBD. The project would support the continued operation of the B-Line program along with other existing and proposed bus services by improving travel times and reliability on key routes connecting the Northern Beaches to key centres including Spit Road/Military Road and Warringah Road/Eastern Valley Way.

The reduced vehicle congestion on Warringah Road between Frenchs Forest and Roseville would support the possible implementation of a proposed rapid bus service, similar in nature to the existing B-Line, between Dee Why and Chatswood.

9.1.4 Sydney's Cycling Future

Sydney's Cycling Future (Transport for NSW, 2013b) identifies priority cycleways to improve connection to major centres for trips of up to five kilometres. The strategy also includes walking and cycling projects linking to public transport interchanges and stops. Sydney's Cycling future is identified in the *Future Transport Strategy 2056* (NSW Government, 2018), outlining initiatives such as secure bike storage to increase active transport.

The project would provide a new shared user path along Wakehurst Parkway between Seaforth/North Balgowlah and the developing Northern Beaches Hospital Precinct, improving connectivity to the new strategic centre.

The project would also result in reduced congestion on surface roads, which would contribute to improved conditions for cyclists.

9.1.5 Sydney's Walking Future

Sydney's Walking Future (Transport for NSW, 2013c) is the NSW Government's long-term plan to promote walking as a transport mode throughout Sydney and an integral component in the planning of urban growth precincts and new transport infrastructure. The project would support the objectives of *Sydney's Walking Future* by providing improved pedestrian infrastructure along the Wakehurst Parkway along with new and realigned shared user paths within the proposed new and improved open space and recreation facilities at Balgowlah. Amenity improvements resulting from reduced vehicle congestion would also improve the attractiveness of walking as a transport mode.

9.1.6 Transport for NSW Walking and Cycling Program

The *Walking and Cycling Program 2020-2021* (Transport for NSW, 2019a) supports the walking and cycling outcomes set out in the *Future Transport Strategy 2056* (NSW Government, 2018). The key objectives of the 2020/21 Walking and Cycling Program are to:

- Ensure walking and cycling are the most convenient option for short trips to key destinations and within centres
- Reduce congestion on our roads and public transport networks by delivering projects that encourage walking and cycling mode shift
- Enable efficient, safe and reliable journey times by prioritising infrastructure that supports pedestrian or cycling movement on certain corridors, consistent with the Movement and Place Framework
- Deliver projects that make walking and cycling safe, comfortable and convenient transport modes that are accessible to a wide range of users
- Enable positive health, wellbeing, social and environmental outcomes.

Under the Walking and Cycling Program, key stakeholders can apply for funding for active transport projects. The proposed scope of the project would complement other active transport planning being carried out as part of this program.

9.2 Assessment methodology

9.2.1 Overview

The assessment methodology of operational traffic and transport impacts considered four core components:

- Road traffic
- Public transport
- Pedestrian and cyclists (active transport)
- Maritime traffic.

The method and outputs of assessment for each of these components are summarised in Table 9-2.

Table 9-2 Overview of approach to the operational traffic and transport assessment

Project impacts	Method of assessment	Assessment output
Road traffic	Analysis of road network performance based on strategic traffic forecasting and operational traffic modelling.	Quantitative assessment of road network performance with and without the project.
Local roads and parking	Analysis of changes to local road access arrangements, loss of parking spaces and availability of comparable alternative parking in nearby locations. The analysis considers permanent impacts. Temporary impacts (ie during construction) are considered in Chapter 8 (Construction traffic and transport).	Qualitative assessment of local road changes. Estimate of number of lost parking spaces. Qualitative assessment of the impact of parking overflow to parking in nearby locations.

Project impacts	Method of assessment	Assessment output
Public transport	Analysis of service accessibility (rail and road public transport modes) and service timeliness and efficiency (road public transport mode) based on operational traffic modelling.	Qualitative assessment of service accessibility and semi-quantitative assessment of service timeliness and efficiency (increase or decrease in number of stops or change in stop coverage).
Pedestrians and cyclists (active transport)	Analysis of pedestrian and cycle demands and changes to shared user paths and other pedestrian and cycle facilities.	Semi-quantitative assessment of impacts on pedestrian and cycling networks and accessibility.
Maritime traffic	Analysis of changes in water depths in Middle Harbour with the immersed tube tunnels in place and the potential impact on maritime traffic.	Qualitative assessment of impacts on future waterway navigation and commercial and recreational usage.

9.2.2 Road traffic assessment methodology

The potential impacts of the project on road network performance were assessed through strategic traffic forecasting and operational traffic modelling. The assessment included both regional and local scale modelling which enabled existing and future traffic and transport conditions, and road network performance to be characterised, both with and without the project. An overview of the modelling methodology used in the assessment of the project is provided in Figure 9-1, with further details provided in Appendix F (Technical working: Traffic and transport).

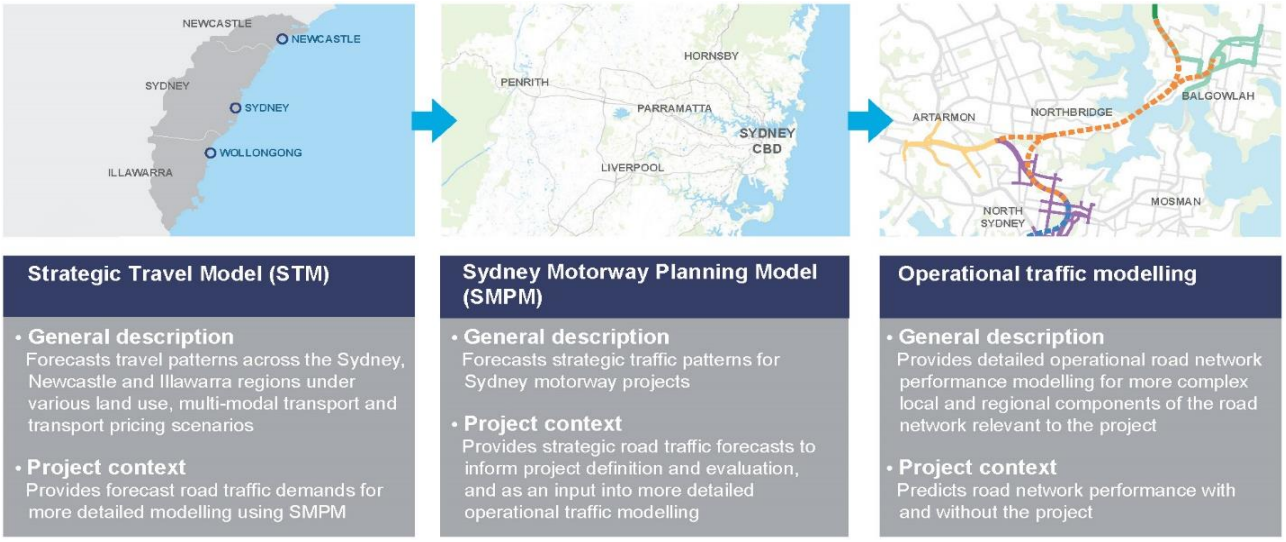


Figure 9-1 Overview of transport modelling approach

Operational traffic modelling scenarios

Future year networks and traffic demand were developed for 2027 (planned year of opening) and 2037 (year of planned opening plus 10 years) to assess the future performance of the project. Future performance was assessed for the AM peak (7am to 9am on a normal working weekday) and PM peak (4pm to 6pm on a normal working weekday) for the following model scenarios:

- Without the project ('Do minimum')
- With the project ('Do something')
- With the project and other planned or proposed projects ('Do something cumulative').

The ‘Do something’ scenario included the Warringah Freeway Upgrade component of the proposed Western Harbour Tunnel and Warringah Freeway Upgrade project, on the basis that the project requires this to function. The modelled operational scenarios are summarised in Table 9-3.

Table 9-3 Operational road traffic modelling scenarios

Scenario	Description	2016	2027	2037
‘Base year’	Developed for calibration purposes and quantification of existing network performance	✓		
‘Do minimum’[1]	Includes approved, under construction and/or recently opened motorway projects (NorthConnex and WestConnex) but without Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, Sydney Gateway and M6 Motorway (Stage 1) projects. Also reflects operational effects of approved, under construction and/or recently completed major projects (eg Sydney Metro City & Southwest and Northern Beaches Hospital road upgrade project).		✓	✓
‘Do something’[1]	Includes NorthConnex, WestConnex, Beaches Link and Gore Hill Freeway Connection and Warringah Freeway Upgrade projects but without Western Harbour Tunnel, Sydney Gateway and M6 Motorway (Stage 1) projects. Also includes Sydney Metro City & Southwest and Northern Beaches Hospital road upgrade project.		✓	✓
‘Do something cumulative’	Traffic model scenario with NorthConnex, WestConnex, Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, Sydney Gateway and M6 Motorway [2, 3] projects. Also includes Sydney Metro City & Southwest and Northern Beaches Hospital road upgrade project.		✓	✓

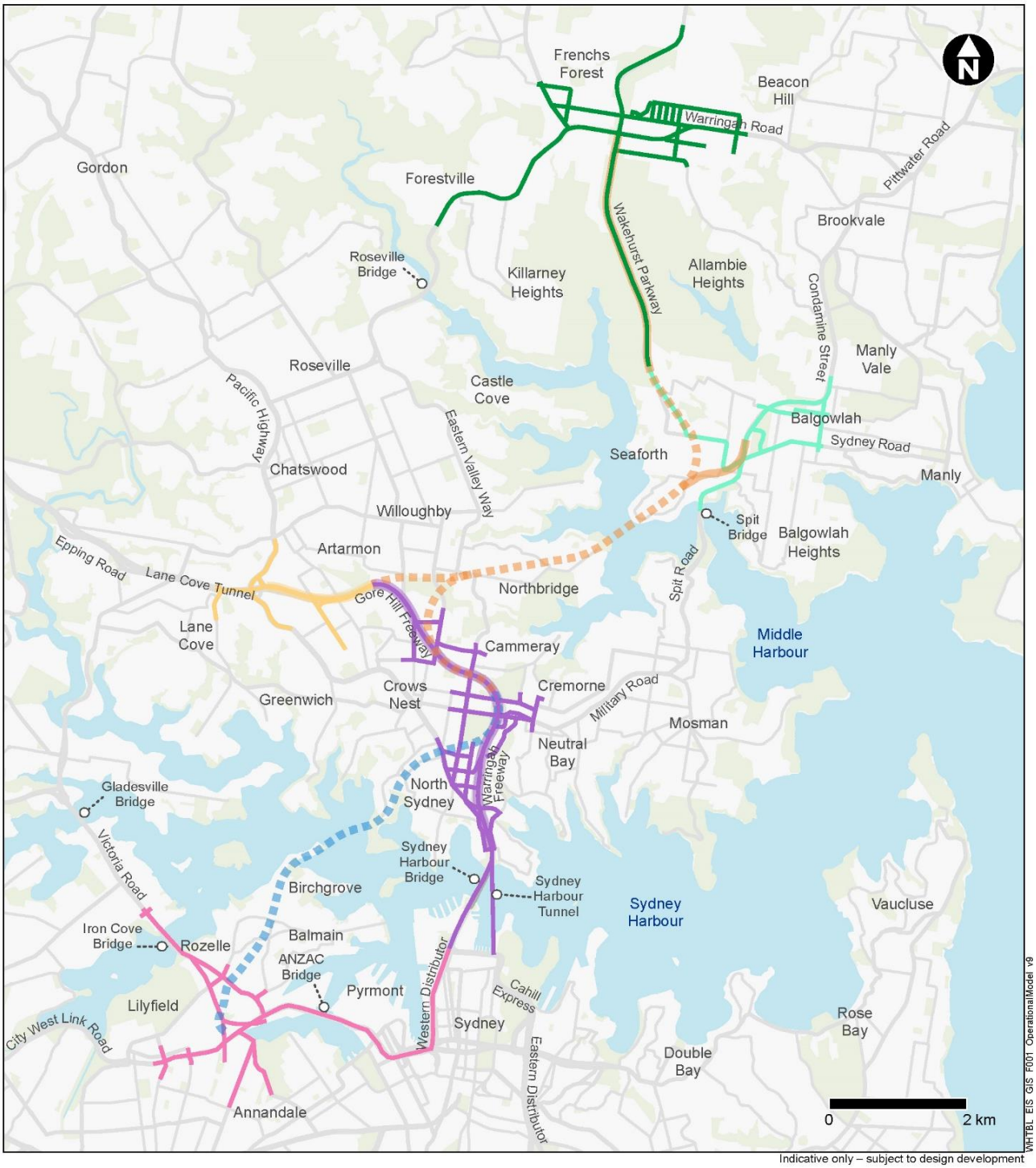
Note 1: The M6 Motorway (Stage 1) and Sydney Gateway projects were not included in the ‘Do minimum’ or ‘Do something’ scenarios as they were not approved projects at the time the modelling and analysis assumptions were confirmed. Since the confirmation of these assumptions for this assessment, the M6 Motorway (Stage 1) and Sydney Gateway projects have been approved. Sensitivity testing has shown that these projects would not have a material impact on the Beaches Link and Gore Hill Freeway Connection project ‘Do minimum’ or ‘Do something’ traffic assessments; they are included in the ‘Do something cumulative’ traffic assessment.
Note 2: M6 Motorway (Stage 1) is considered as part of the 2027 ‘Do something – cumulative’ scenario
Note 3: M6 Motorway (full project) is considered as part of the 2037 ‘Do something – cumulative’ scenario

The 2016 baseline year represents transport network conditions at the time of the traffic and transport assessment. Ongoing and continuous traffic surveys carried out by Transport for NSW indicate that the 2016 baseline year is appropriate for modelling purposes as there is little material difference between 2016 and existing (2020) traffic conditions in the project area.

As outlined in Figure 9-1, the Sydney Motorway Planning Model (SMPM) forecasts strategic traffic patterns for Sydney motorway projects and was used in this assessment. The SMPM is a network-wide model that includes recently completed and future infrastructure projects, and population and employment growth forecasts provided by the Transport for NSW Transport Performance and Analytics division, consistent with demographics released by NSW Department of Planning, Industry and Environment. The project traffic and transport assessment therefore took into consideration planned population and employment demand and growth throughout Sydney over the next 20 years. The SMPM also took into account change in traffic associated with project-related induced demand (new trips), which equates to about 0.3 per cent of additional daily trips in the Sydney metropolitan area in 2037.

A tunnel model for the project was used to assess the future year performance of the proposed road layout within the tunnelled carriageways, including merge and diverge locations and the impact of grades. Four surface interface model areas (Warringah Freeway and surrounds, Gore Hill Freeway and Artarmon, Balgowlah and surrounds, and Frenchs Forest and surrounds) were used to assess 2027 and 2037 road network performance, both with and without the project.

Figure 9-2 shows the operational road traffic model areas for the Western Harbour Tunnel and Beaches Link program of works. All operational road traffic model areas except for the Western Harbour Tunnel, and Rozelle and surrounds (relevant for the Western Harbour Tunnel and Warringah Freeway Upgrade project) were subject to assessment for this project. Cumulative assessment of potential impacts related to operational traffic and transport includes the consideration of potential impacts resulting from the Western Harbour Tunnel and Warringah Freeway Upgrade project.



Legend

Operational features

- Western Harbour Tunnel
- Beaches Link
- Warringah Freeway Upgrade
- Gore Hill Freeway Connection

Operational model areas

- Rozelle and surrounds
- Warringah Freeway and surrounds
- Gore Hill Freeway and Artarmon
- Balgowlah and surrounds
- Frenchs Forest and surrounds

Figure 9-2 Operational road traffic model areas

9.2.3 Assessment criteria

The criteria used to assess road network performance were as follows:

- At a network level – traffic demand, average speed, number of stops (the number of times vehicles within the road network are required to stop during peak periods) and general travel times
- At an intersection level – level of service (LoS) and average delay (expressed in seconds per vehicle).

The assessment criteria for network performance and intersection and midblock level of service is described in detail in Chapter 8 (Construction traffic and transport) and Appendix F (Technical working paper: Traffic and transport).

9.3 Existing environment

The existing traffic and transport environment for the project is described in Chapter 8 (Construction traffic and transport). The existing environment is described within the context of the broader strategic transport network, along with more detailed analysis across of the following local areas:

- Warringah Freeway and surrounds
- Gore Hill Freeway and Artarmon
- Northbridge to Seaforth (Middle Harbour crossing)
- Balgowlah and surrounds
- Frenchs Forest and surrounds.

9.4 Assessment of potential impacts

The operational traffic and transport impacts of the project are outlined below in the context of the broader road network, along with detailed analysis of local area impacts. Impacts are assessed for future year scenarios with the project ('Do something') compared to the scenario without the project ('Do minimum'), as well as the cumulative future year scenario with the addition of the Western Harbour Tunnel and other planned, proposed and recently opened transport projects ('Do something cumulative') as described in Section 9.2.2.

9.4.1 Broader road network

Road network performance

'Do something' scenario

The project is forecast to reduce traffic demands on the existing arterial roads into and out of the Northern Beaches peninsula, with the largest reductions in traffic demand being on the Spit Road and Military Road corridor. In general, users of existing connections to the Northern Beaches peninsula, including Eastern Valley Way and the Spit Road and Military Road corridor, would benefit from reduced congestion and improved road safety, as a result of the project lowering daily traffic demand on existing routes by introducing a new, higher standard of road as an alternative (the project). This is reflected in the forecast travel times for key trips across the network in the AM peak and PM peak, as shown in Figure 9-3 and Figure 9-4.

Overall modelled traffic demand across Middle Harbour with the project in 2037 indicate that:

- Peak period traffic demand on Spit Road and Warringah Road would decrease substantially as a result of the project, by up to 33 per cent and 23 per cent, respectively

- Peak period traffic demand on Mona Vale Road would decrease by up to eight per cent as a result of the project
- Daily traffic demand on Eastern Valley Way would decrease by up to 30 per cent as a result of the project
- Daily traffic demand on Brook Street (north of Merrenburn Avenue) would decrease by up to four per cent (increasing to up to 14 per cent in the 'Do something cumulative' scenario).

It is noted that through changing trip patterns and reduced demand on some routes, the project would provide the opportunity for Transport for NSW network management teams and other stakeholders to investigate further opportunities for local road improvements and adjustments.

The project supports the strategic vision presented in the *Future Transport Strategy 2056* (NSW Government, 2018) for the road network for Greater Sydney by supporting key movements by road for public transport, private vehicles and freight. The reduction in private vehicle travel times would also be reflected in reduced travel times for buses and would increase the size of equivalent public transport catchments, which could be further extended by express buses potentially operating through the Beaches Link tunnel.

Analysis of the 30-minute catchments for the 'Do something' scenarios show that overall the project would substantially increase accessibility from the Northern Beaches to nearby strategic centres, including Chatswood, St Leonards, Macquarie Park and North Sydney. However, the project on its own would not substantially increase the extent of the 30-minute catchments around strategic centres south of Sydney Harbour (but would do so as part of a complementary multi-modal transport strategy including rail, bus, and road projects being delivered by the NSW Government). The Gore Hill Freeway Connection component of the project would facilitate additional traffic travelling through the corridor. This change would represent increased connectivity and capacity in the network, although travel times and speeds (ie the rate of travel) are not expected to improve in this area.

The project would substantially change the volume of traffic travelling on arterial roads in the Greater Sydney Region. Due to the increased accessibility provided by the project, the project would result in an overall increase in traffic demand into and out of the Northern Beaches peninsula. However, trips through the Beaches Link tunnel would be made on a higher standard of road compared to other urban arterial roads. This would have an impact on the number of crashes on the arterial road network, with crashes across the network estimated to reduce by up to 562 incidents per year as a result of the project. A summary of forecast growth at key locations for the 2027 and 2037 is provided in Table 9-4.

'Do something cumulative' scenario

The project when combined with the Western Harbour Tunnel and Warringah Freeway Upgrade project would not result in substantially more traffic travelling into and out of the Northern Beaches peninsula. Under the 'Do something cumulative' scenario demand on Warringah Road, Spit Road/Military Road corridor, Brook Street, and Eastern Valley Way would be further reduced, with more of this traffic travelling via the Beaches Link tunnel. The forecast travel times shown in Figure 9-3 and Figure 9-4 indicate travel times along key routes near the project would be reduced under the 'Do something cumulative' scenario when compared to the 'Do something' scenario, as vehicles travelling south would have the additional option of using the Western Harbour Tunnel.

Overall, the 'Do something cumulative' scenario would increase the accessibility between Manly and the Sydney CBD (and beyond) due to the improved capacity and connectivity across Sydney Harbour provided by the Western Harbour Tunnel, but have limited impact on other centres (compared to the 'Do something' scenario). The 'Do something cumulative' scenario would substantially reduce travel times for private vehicles between the Northern Beaches and destinations south of Sydney Harbour, linking people with jobs, education and services. There would be a similar benefit to bus travel times and a resulting increase in the size of equivalent public transport catchments.

Table 9-4 Modelled daily traffic demands at key locations

Road	Location	Direction	'Do minimum 2027'	'Do something 2027'	'Do something cumulative 2027'	'Do minimum 2037'	'Do something 2037'	'Do something cumulative 2037'
Spit Road	Spit Bridge	Combined	74,500	48,500	46,500	80,000	52,000	49,500
Warringah Road	Roseville Bridge	Combined	83,000	62,000	61,500	87,000	66,000	65,500
Mona Vale Road	St Ives Showground	Combined	59,500	54,500	53,000	62,500	56,500	55,500
Beaches Link tunnel	Killarney Heights	Combined	N/A	58,000	64,000	N/A	64,500	71,500
Eastern Valley Way	Castle Cove	Combined	33,000	21,000	20,000	35,500	25,000	25,500
Brook Street	Naremburn (north of Merreburn Avenue)	Combined	35,500	33,500	29,000	37,500	36,000	32,500

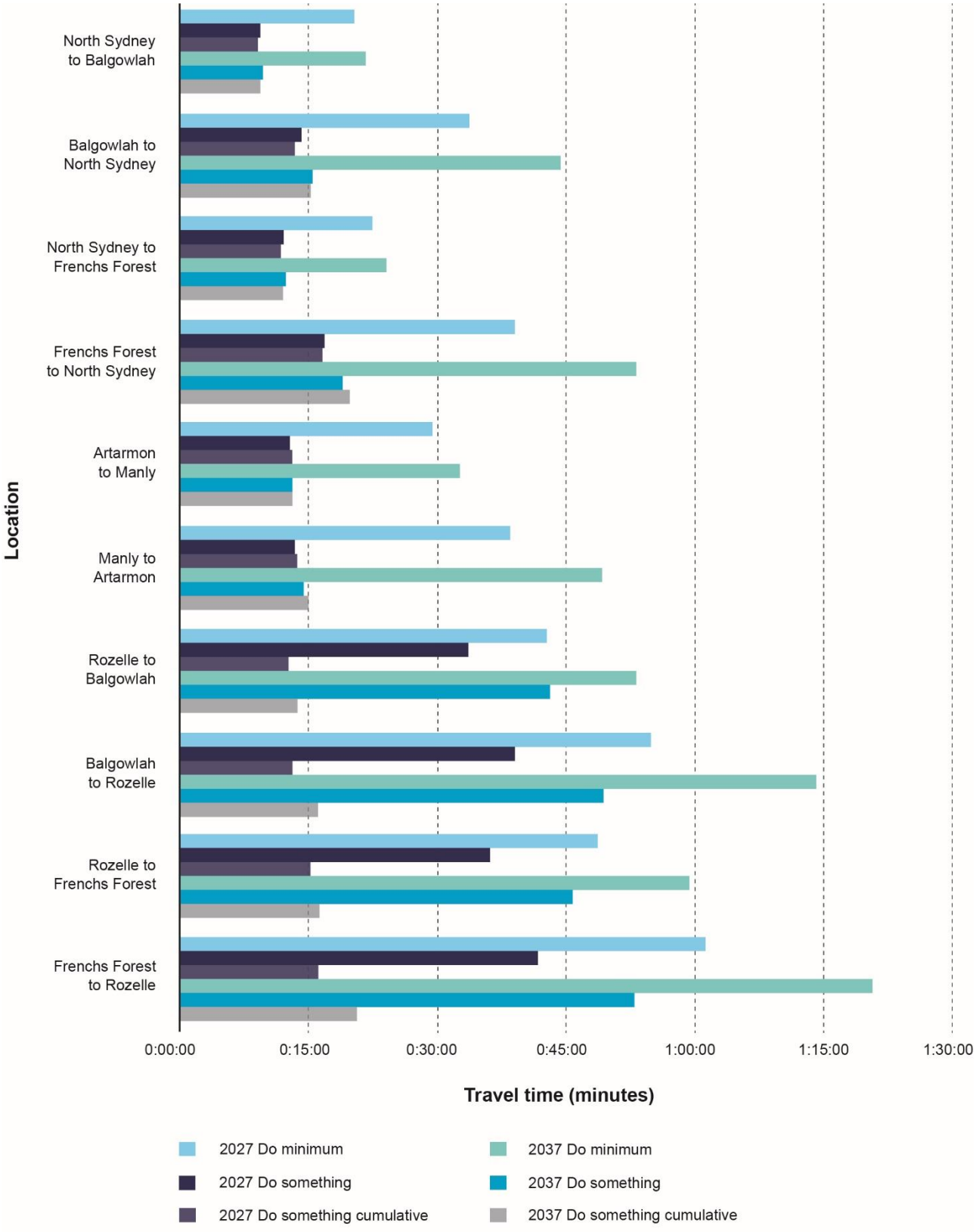


Figure 9-3 Forecast AM peak period (8am-9am) travel times along key road network corridors

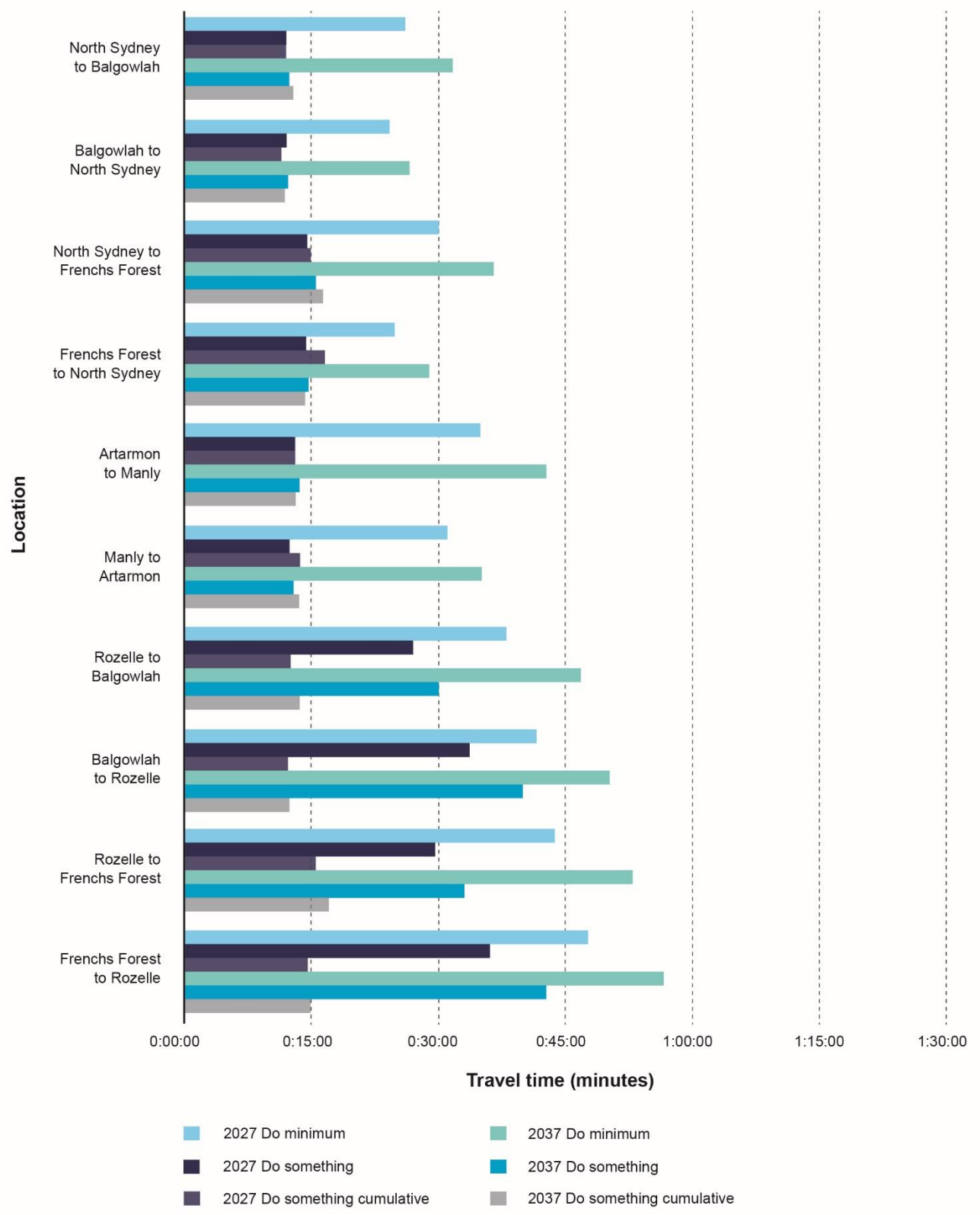


Figure 9-4 Forecast PM peak period (5pm-6pm) travel times along key road network corridors

Heavy vehicles and freight

As outlined in Chapter 8 (Construction traffic and transport), the largest portion of truck movements into and out of the Northern Beaches peninsula in 2016 occurred via Mona Vale Road, likely due to lower congestion and its proximity to the M1 Pacific Motorway and industrial areas in Mona Vale, Warriewood, Belrose and Terrey Hills. Conversely, Spit Road and Military Road carried lower volumes of heavy vehicles due to access restrictions for large articulated trucks and persistent congestion on this route.

The project would result in most heavy vehicle trips on the existing arterial road network to and from the Northern Beaches peninsula transferring to the project, with the largest proportional reductions in traffic volumes being on Spit Road/Military Road corridor. Analysis of the modelled forecast heavy vehicle demands crossing Middle Harbour under the 'Do something' scenario shows:

- Peak period heavy vehicle demand on Spit Road/Military Road corridor and Warringah Road would decrease substantially as a result of the project, by up to 74 per cent and 62 per cent, respectively
- Peak period heavy vehicle demand on Mona Vale Road would decrease by up to 35 per cent as a result of the project
- Peak period of heavy vehicle demand into and out of the Northern Beaches would not change substantially as a result of the project.

While the project would not generally change the heavy vehicle demand travelling into and out of the Northern Beaches peninsula, it would substantially reduce the travel times of these freight trips and increase their productivity. The movement of heavy vehicle trips from surface arterial roads to the motorway tunnels would increase the amenity of the existing arterial road network to and from the Northern Beaches peninsula. This movement would also reduce interactions between general traffic, heavy vehicles, public transport vehicles, pedestrians and cyclists. This reduced interaction would improve road safety and reduce the severity of crashes on the arterial road network.

9.4.2 Warringah Freeway and surrounds

Road network performance

'Do something' scenario

Key outcomes of the modelled future road network performance in the Warringah Freeway and surrounds area under the 'Do something' scenario include:

- Peak period travel demand is forecast to increase by up to two per cent by 2037
- Average travel speeds through the Warringah Freeway and surrounds area would decrease by up to six per cent in the AM peak, but increase by up to 23 per cent in the PM peak
- The number of stops during peak periods is forecast to increase in the AM peak by up to 29 per cent, indicating that the additional demand facilitated by the project could increase localised delays. This is due to the transfer of traffic from existing surface roads to the project, which would increase the rate of demand on the Sydney Harbour Bridge and Sydney Harbour Tunnel. In the absence of the capacity and connectivity upgrades provided by the Western Harbour Tunnel under the 'Do something cumulative' scenario, this increase in demand would increase delays on the existing harbour crossings, with upstream effects on adjacent network connections
- In the PM peak the project would provide additional capacity for outbound traffic crossing Sydney Harbour and leaving the Lower North Shore, relieving existing corridors including Military Road and Eastern Valley Way. As a result, there would be substantial improvements in terms of average network speed and number of stops.

'Do something cumulative' scenario

The introduction of the Western Harbour Tunnel would generally result in improved network performance in the Warringah Freeway and surrounds area when compared with the 'Do something' scenario. Key outcomes of the modelled road network performance in the Warringah Freeway and surrounds area, under the 'Do something cumulative' scenario (compared with the 'Do something' scenario) includes:

- Peak period travel demand through the Warringah Freeway and surrounds area would increase by up to 15 per cent by 2037 as a result of the introduction of the Western Harbour Tunnel
- The project would result in a greater portion of forecast demand being able to travel during the AM peak
- Average travel speeds through the Warringah Freeway and surrounds area would improve by up to 30 per cent as a result of the introduction of the Western Harbour Tunnel
- The number of stops during peak periods would substantially decrease as a result of the introduction of the Western Harbour Tunnel, particularly in the AM peak.

Overall, the Western Harbour Tunnel and Beaches Link program of works would improve network capacity and connectivity across Sydney Harbour. It would reduce demand and delays on Sydney Harbour Bridge and Sydney Harbour Tunnel and improve network performance throughout the Warringah Freeway and surrounds area during peak periods.

Traffic travel times

'Do something' scenario

Modelled travel times during AM and PM peaks for key routes through the Warringah Freeway and surrounds area are presented in Table 9-5.

The modelled travel times under the 'Do something' scenario show:

- AM peak travel times from the Warringah Freeway to the Cahill Expressway would increase as a result of the project due to increased inbound demand on the Sydney Harbour Bridge and Sydney Harbour Tunnel. In the absence of the capacity and connectivity upgrades provided by the Western Harbour Tunnel, this increase in demand would increase delays on the existing harbour crossings and upstream motorway corridor
- PM peak travel times for the majority of routes along the Warringah Freeway would remain similar or improve as a result of the project, due to the additional outbound capacity and simplification of weaving and merging arrangements provided as part of the Warringah Freeway Upgrade.

'Do something cumulative' scenario

The introduction of the Western Harbour Tunnel would generally result in improved travel times when compared to the 'Do something' scenario. Analysis of modelled travel times for routes through the Warringah Freeway and surrounds area under the 'Do something cumulative' scenario (refer to Table 9-5) predicts:

- Travel times along Warringah Freeway would generally improve due to the transfer of trips to Western Harbour Tunnel, with some of this traffic travelling directly between Beaches Link and Western Harbour Tunnel. This would relieve capacity constraints on the Warringah Freeway, Sydney Harbour Bridge, and Sydney Harbour Tunnel both northbound and southbound
- Localised increases in travel times for local trips within North Sydney such as the Miller Street corridor, as a result of changes to traffic patterns and access arrangements to, from and within North Sydney.

Table 9-5 Modelled AM peak (8am–9am) and PM peak (5pm–6pm) traffic travel times for key routes through the Warringah Freeway and surrounds area

Route/ Peak period	Direction	Do minimum 2027'	Do something 2027'	Do something cumulative 2027'	Do minimum 2037'	Do something 2037'	Do something cumulative 2037'
Sydney Harbour Bridge to Warringah Freeway/Falcon Street interchange							
AM peak	Northbound	04:40	05:47	03:33	04:51	04:56	04:12
	Southbound	04:03	04:06	04:07	04:02	04:13	04:06
PM peak	Northbound	04:02	03:26	03:25	07:51	04:51	03:28
	Southbound	06:09	04:44	04:37	05:02	04:41	04:33
Sydney Harbour Tunnel to Warringah Freeway/Falcon Street interchange							
AM peak	Northbound	03:55	11:50	03:31	04:08	12:07	04:27
	Southbound	04:03	04:17	04:27	04:02	04:18	04:26
PM peak	Northbound	03:57	03:22	03:24	07:36	03:25	03:31
	Southbound	14:54	05:52	05:28	14:59	07:41	05:35
Sydney Harbour Bridge to Gore Hill Freeway/Pacific Highway interchange							
AM peak	Northbound	06:13	07:41	05:26	06:16	06:45	05:29
	Southbound	13:35	13:29	08:02	15:22	13:46	07:54
PM peak	Northbound	05:35	05:26	05:21	06:45	06:53	05:24
	Southbound	13:56	06:18	06:10	17:31	07:28	06:10
Sydney Harbour Tunnel to Gore Hill Freeway/Pacific Highway interchange							
AM peak	Northbound	05:26	16:21	05:18	05:30	17:03	05:23
	Southbound	11:39	11:20	07:59	12:37	11:30	08:08
PM peak	Northbound	05:28	05:17	05:12	06:46	05:22	05:14
	Southbound	25:21	07:23	07:00	30:09	13:50	07:07
Berry Street to Amherst Street via Miller Street							
AM peak	Northbound	03:42	03:56	04:06	03:53	04:07	04:03
	Southbound	04:25	04:04	06:01	05:43	04:05	07:01
PM peak	Northbound	03:52	04:39	04:46	03:50	01:22	05:14
	Southbound	05:01	05:30	04:35	08:39	05:01	05:37

Intersection performance

'Do something' scenario

Modelled intersection performance for key intersections in the Warringah Freeway and surrounds area under the 'Do something' scenario is presented in Table 9-6 and indicates:

- Average delays around some local intersections along Berry Street and Pacific Highway could increase by around 30 to 40 seconds from additional traffic using these intersections as a result of the project
- Intersection performance along Brook Street near the Warringah Freeway would improve substantially during the AM peak as a result of the project. This is due to the changes in access to Brook Street from the Warringah Freeway, which under the Warringah Freeway Upgrade would be limited to trips from the Sydney Harbour Bridge and Berry Street. In the PM peak, localised congestion on the Warringah Freeway may continue to impact the efficiency of this interchange
- Intersections along the Pacific Highway would experience increased delays at some locations in the AM peak as a result of the project. This is due to the changes to traffic patterns and access arrangements to, from and within North Sydney as a result of the Warringah Freeway Upgrade
- The intersection of Ben Boyd Road and Military Road has the potential to experience longer delays as a result of the Warringah Freeway Upgrade project, due to the reconfiguration of Warringah Freeway, which would change the accessibility of the Ernest Street ramps to and from the Warringah Freeway. Traffic that currently uses the Ourimbah Road corridor as an alternative to Military Road would no longer be able to access all the same destinations that are currently accessible from Ernest Street.

Although the project would generally improve network performance for roads within and around North Sydney, it would not resolve existing localised performance issues at several intersections. The proposed road integration works and resulting improved traffic performance in the North Sydney area have been developed in the context of the growing North Sydney CBD environment.

While there would be some localised delays at some intersections at peak times, this would be offset by the substantial travel time benefits provided by the project at the broader network level.

The project seeks to maintain an appropriate level of traffic movement within the Warringah Freeway and surrounds area while also preserving capacity and connectivity for other customers whose needs conflict with traffic, particularly pedestrians.

Options to further improve traffic performance at intersections throughout the area have been investigated. However, these alternative options would result in further impacts on other customers. The proposed works are therefore considered to provide an equitable and balanced outcome from the perspective of maintaining a balanced and integrated transport network through North Sydney.

Further refinements to movement and place outcomes within the North Sydney CBD may occur as part of works associated with the North Sydney Program, an ongoing multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW to guide future integrated transport planning and investment in the North Sydney CBD and interconnected areas (see Section 9.1.1 for more information).

'Do something cumulative' scenario

The introduction of the Western Harbour Tunnel would generally result in improved intersection performance when compared to the 'Do something' scenario. Modelled intersection performance under the 'Do something cumulative' scenario is presented in Table 9-6. Overall:

- Most intersections would perform similarly to the 'Do something' scenario
- Some intersections on the Pacific Highway, Walker Street, Miller Street and Berry Street could experience increased localised delays with the introduction of the Western Harbour Tunnel due to increased demand and changes to local traffic patterns
- Intersections along the Falcon Street and Military Road corridor would generally perform marginally better with the introduction of the Western Harbour Tunnel, as trips from the Pittwater Road corridor bypassing the Sydney CBD would avoid Spit Road/Military Road and use the direct connection from the project to Western Harbour Tunnel.

Although some traffic would be impacted by an increase in localised intersection delays, road users would generally benefit from substantial overall travel time savings on the broader network (eg via the Beaches Link and Gore Hill Freeway Connection project, Western Harbour Tunnel, ANZAC Bridge, and Sydney Harbour Bridge). Traffic impacted at individual intersections in the North Sydney area is therefore still anticipated to receive a substantial net benefit due to the broader connectivity and efficiency improvements.

As discussed above, further refinements to movement and place outcomes within the North Sydney CBD may occur as part of works associated with the North Sydney Program.

Table 9-6 Modelled intersection performance on the Warringah Freeway and surrounds area (AM peak (8am–9am) and PM peak (5pm–6pm) during operation in 2027 and 2037)

Intersection/ peak period	Do minimum 2027 LoS (average delay in seconds)	Do something 2027 LoS (average delay in seconds)	Do something cumulative 2027 LoS (average delay in seconds)	Do minimum 2037 LoS (average delay in seconds)	Do something 2037 LoS (average delay in seconds)	Do something cumulative 2037 LoS (average delay in seconds)
Willoughby Road/Gore Hill Freeway interchange						
AM peak	**F (>100)**	B (27)	A (9)	**F (>100)**	B (21)	A (10)
PM peak	C (38)	A (10)	A (11)	**F (76)**	A (10)	A (11)
Brook Street/Warringah Freeway on ramp						
AM peak	**F (>100)**	A (13)	A (8)	**F (>100)**	**E (70)**	**E (64)**
PM peak	B (14)	A (9)	A (<5)	B (17)	**F (92)**	B (25)
Brook Street/Warringah Freeway off ramp						
AM peak	**E (61)**	B (21)	A (9)	**E (67)**	A (9)	B (16)
PM peak	B (22)	B (17)	B (17)	B (20)	**F (87)**	C (29)
Brook Street/Merrenburn Avenue						
AM peak	**F (>100)**	C (31)	B (26)	**F (>100)**	**E (70)**	D (50)
PM peak	A (11)	D (53)	B (17)	A (13)	**E (59)**	C (39)

Intersection/ peak period	Do minimum 2027 LoS (average delay in seconds)	Do something 2027 LoS (average delay in seconds)	Do something cumulative 2027 LoS (average delay in seconds)	Do minimum 2037 LoS (average delay in seconds)	Do something 2037 LoS (average delay in seconds)	Do something cumulative 2037 LoS (average delay in seconds)
Amherst Street/West Street						
AM peak	A (5)	A (7)	D (50)	A (5)	**F (>100)**	**F (>100)**
PM peak	A (9)	**F (89)**	D (43)	A (14)	**F (>100)**	**F (73)**
Amherst Street/Miller Street						
AM peak	B (21)	C (38)	C (42)	B (20)	**E (58)**	D (44)
PM peak	C (29)	D (47)	D (43)	C (31)	D (52)	D (48)
Miller Street/Warringah Freeway on ramp						
AM peak	A (7)	A (<5)	A (<5)	A (6)	A (<5)	A (5)
PM peak	A (6)	A (6)	A (6)	A (6)	A (6)	A (7)
Miller Street/Warringah Freeway off ramp						
AM peak	A (12)	A (5)	A (8)	A (13)	A (5)	A (8)
PM peak	B (15)	A (9)	A (7)	B (15)	A (9)	A (8)
Miller Street/Ernest Street						
AM peak	B (25)	D (44)	C (42)	C (32)	C (40)	C (41)
PM peak	C (41)	C (36)	C (34)	D (43)	C (35)	C (39)
Miller Street/Falcon Street						
AM peak	C (35)	B (27)	C (30)	C (38)	B (25)	D (44)
PM peak	D (44)	**F (82)**	C (38)	D 49)	**F (95)**	D (48)
Ernest Street/Warringah Freeway on ramp						
AM peak	A (5)	B (19)	C (28)	A (5)	D (48)	C (34)
PM peak	B (15)	A (12)	A (13)	B (15)	A (12)	A (13)
Ernest Street/Warringah Freeway off ramp (off ramp in PM, on ramp AM)						
AM peak	A (5)	B (19)	B (28)	A (5)	D (48)	C (34)
PM peak	B (17)	A (13)	A (14)	B (17)	A (14)	B (15)
Falcon Street/Warringah Freeway ramps						
AM peak	C (29)	C (36)	C (42)	B (15)	D (45)	D (51)
PM peak	**F (72)**	**E (70)**	D (52)	**F (>100)**	**E (68)**	**E (60)**
Watson Street/Military Road						
AM peak	B (18)	C (38)	C (28)	B (26)	C (37)	C (30)
PM peak	D (46)	D (50)	C (37)	**E (59)**	D (46)	C (38)

Intersection/ peak period	Do minimum 2027 LoS (average delay in seconds)	Do something 2027 LoS (average delay in seconds)	Do something cumulative 2027 LoS (average delay in seconds)	Do minimum 2037 LoS (average delay in seconds)	Do something 2037 LoS (average delay in seconds)	Do something cumulative 2037 LoS (average delay in seconds)
Military Road/Ben Boyd Road						
AM peak	B (15)	D (47)	D (47)	B (23)	D (44)	D (43)
PM peak	D (54)	**E (65)**	D (55)	**E (70)**	**F (>100)**	**F (83)**
Falcon Street/Merlin Street						
AM peak	B (24)	D (46)	C (39)	C (32)	D (47)	D (54)
PM peak	**F (>100)**	**F (94)**	**F (83)**	**F (>100)**	**F (93)**	**F (88)**
Berry Street/Walker Street						
AM peak	C (29)	**F (76)**	C (41)	C (39)	D (46)	D (50)
PM peak	D (44)	**F (82)**	**E (69)**	**F (73)**	**F (81)**	**F (74)**
Berry Street/Miller Street						
AM peak	D (55)	D (49)	**E (58)**	**E (69)**	C (39)	**E (57)**
PM peak	D (46)	C (35)	D (54)	**F (70)**	**F (76)**	**E (63)**
Mount Street/Arthur Street						
AM peak	D (46)	D (46)	B (18)	**E (59)**	C (33)	C (33)
PM peak	D (49)	B (17)	B (21)	**F (92)**	B (18)	**F (>100)**
Mount Street/Walker Street						
AM peak	C (36)	D (47)	C (35)	D (48)	C (41)	D (43)
PM peak	C (32)	D (47)	**F (78)**	**F (75)**	**E (59)**	**F (96)**
Pacific Highway/High Street/Arthur Street						
AM peak	B (19)	**E (57)**	B (18)	C (38)	D (45)	B (19)
PM peak	D (46)	A (14)	B (16)	**E (61)**	B (23)	B (21)
Pacific Highway/Walker Street/Blue Street						
AM peak	C (36)	D (55)	C (33)	**E (65)**	D (49)	C (32)
PM peak	D (40)	**E (65)**	D (54)	**F (80)**	**F (79)**	**E (60)**
Pacific Highway/Miller Street/Mount Street						
AM peak	C (38)	**F (79)**	**E (62)**	C (41)	**F (72)**	**E (62)**
PM peak	C (41)	**E (57)**	D (50)	**E (58)**	**F (78)**	**E (66)**
Pacific Highway/Berry Street						
AM peak	**E (56)**	B (17)	**E (60)**	D (52)	B (16)	**E (60)**
PM peak	B (23)	B (15)	**F (85)**	**E (56)**	C (34)	**F (87)**

Intersection/ peak period	Do minimum 2027 LoS (average delay in seconds)	Do something 2027 LoS (average delay in seconds)	Do something cumulative 2027 LoS (average delay in seconds)	Do minimum 2037 LoS (average delay in seconds)	Do something 2037 LoS (average delay in seconds)	Do something cumulative 2037 LoS (average delay in seconds)
Pacific Highway/Bay Road						
AM peak	D (55)	B (23)	D (42)	**F (77)**	B (23)	**F (88)**
PM peak	B (15)	B (22)	B (27)	C (41)	C (40)	C (33)
Miller Street/McLaren Street						
AM peak	B (23)	C (40)	**E (56)**	**F (72)**	C (42)	**E (62)**
PM peak	B (21)	C (39)	C (37)	D (55)	**F (76)**	D (50)
Miller Street/Ridge Street						
AM peak	C (38)	C (33)	**E (63)**	D (53)	D (45)	**E (70)**
PM peak	C (40)	B (15)	B (21)	**F (91)**	**E (57)**	C (39)
Miller Street/Carlow Street						
AM peak	A (13)	A (8)	B (15)	A (13)	A (8)	C (28)
PM peak	A (8)	A (6)	A (7)	B (19)	D (55)	A (7)
High Street/Clark Road						
AM peak	B (18)	C (32)	C (36)	D (55)	C (37)	C (38)
PM peak		D (50)	D (56)	**F (97)**	D (52)	**E (65)**
High Street/Alfred Street North						
AM peak	A (13)	D (49)	B (19)	**E (62)**	C (32)	B (18)
PM peak	**F (>100)**	C (41)	C (42)	**F (>100)**	C (42)	D (46)
Mount Street/Alfred Street North						
AM peak	A (<5)	B (16)	B (14)	A (<5)	B (16)	A (14)
PM peak	A (12)	A (14)	A (12)	A (10)	A (14)	A (13)
Ernest Street/Ben Boyd Road						
AM peak	A (12)	A (11)	B (18)	A (12)	B (14)	B (26)
PM peak	D (44)	A (10)	A (10)	**F (94)**	C (38)	D (46)
Pedestrian crossing at Military Road						
AM peak	A (6)	A (<5)	A (5)	A (5)	A (<5)	A (6)
PM peak	B (27)	A (5)	A (<5)	C (34)	A (5)	A (5)

Note: Cells shaded in dark grey denote an unsatisfactory LoS E or F

Road network changes and access arrangements

'Do something' scenario

The project would connect directly via on and off ramps to the Warringah Freeway at Cammeray, north of Ernest Street Bridge. The project would also connect to the Western Harbour Tunnel via a direct underground connection in the Warringah Freeway and surrounds area.

The remaining road network changes in the Warringah Freeway and surrounds area, including connection to North Sydney, Bradfield Highway and Cahill Expressway would be associated with the Warringah Freeway Upgrade component of the Western Harbour Tunnel and Warringah Freeway Upgrade project (subject to separate assessment and approval), which is required for the project to be operational.

The Warringah Freeway Upgrade is proposed to substantially improve the safety and efficiency of the motorway and arterial road interfaces. The upgrade would involve extensive upgrades to surface roads and existing connections that would:

- Connect and integrate with the Western Harbour Tunnel and Beaches Link
- Improve wayfinding and separate traffic on the freeway based on trip function (through traffic, traffic for arterial distribution and traffic for local destinations).

The upgrades would include the removal of the existing tidal flow arrangements on the Warringah Freeway, while the existing tidal flow arrangements on the Sydney Harbour Bridge would not be affected by the project. The upgraded Warringah Freeway would simplify traffic flow and improve wayfinding by providing the following traffic lanes:

- A northbound outer carriageway comprising:
  - An outer western carriageway, carrying northbound traffic from the Sydney Harbour Bridge to the Beaches Link northbound on ramp and facilitating local distribution to local destinations such as North Sydney and Crows Nest
  - Inner western carriageways, carrying northbound traffic from the Sydney Harbour Bridge and Sydney Harbour Tunnel
- A central carriageway carrying northbound and southbound motorway traffic between the Western Harbour Tunnel, Gore Hill Freeway and Willoughby Road
- A southbound outer carriageway comprising:
  - Inner eastern carriageways carrying southbound traffic to the Sydney Harbour Tunnel and for facilitating distribution to local destinations such as Neutral Bay
  - An outer eastern carriageway, carrying southbound traffic for the Sydney Harbour Bridge (both the Bradfield Highway and Cahill Expressway) and for distribution to local destinations such as North Sydney and Kirribilli
  - A dedicated bus lane between Miller Street, Cammeray and the Sydney Harbour Bridge, Milsons Point which would carry southbound buses and other permitted bus lane vehicles.

Following the upgrades, connections between the upgraded Warringah Freeway and the arterial road network would be provided at all existing interchange locations. However, changes to existing Warringah Freeway accesses would be carried out as part of the Warringah Freeway Upgrade project at Falcon Street, Miller Street, Brook Street, Berry Street and Alfred Street North.

Figure 9-5 provides an overview of these connections and their associated access arrangements.

Further details of access arrangements following the completed upgrading of the Warringah Freeway as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project is provided in Section 7.4.4 of Appendix F (Technical working paper: Traffic and transport).

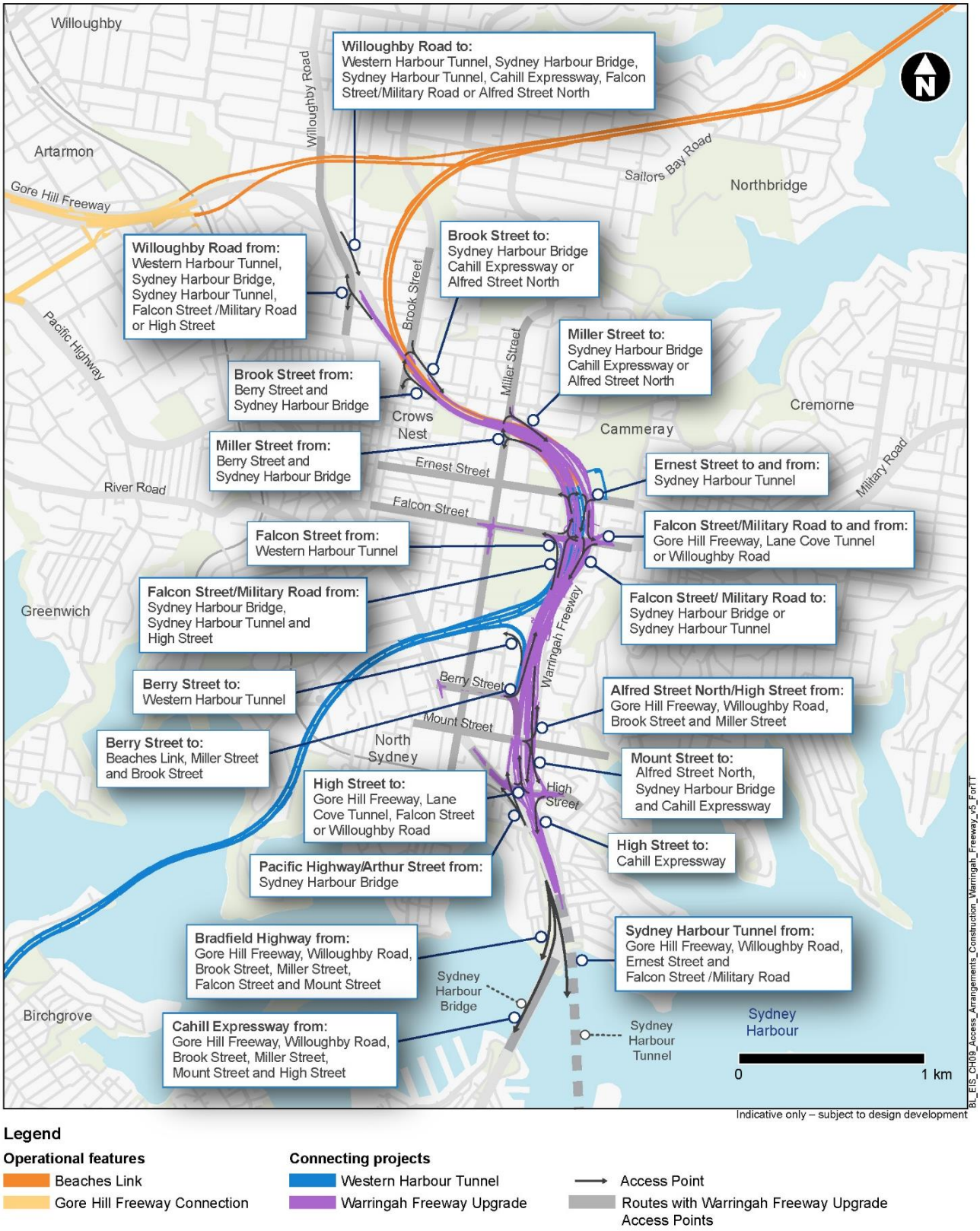


Figure 9-5 Access arrangements upon completion of construction works at the Warringah Freeway

'Do something cumulative' scenario

In the 'Do something cumulative' scenario, the Western Harbour Tunnel would connect to North Sydney via an on ramp from Berry Street for vehicles travelling southbound and via an off ramp to Falcon Street for vehicles travelling north.

Additional access restrictions and local road changes under the 'Do something cumulative' scenario would be as follows:

- The existing Falcon Street westbound off ramp from the Warringah Freeway would be converted to the northbound off ramp from Western Harbour Tunnel, thereby removing connectivity between the Warringah Freeway and Sydney Harbour Tunnel northbound and Falcon Street westbound. Adjacent interchanges north and south of Falcon Street would provide similar connectivity
- Berry Street east of Walker Street would be reconfigured with the provision of two traffic lanes connecting to the Western Harbour Tunnel, one traffic lane providing connection to the Warringah Freeway northbound and Arthur Street southbound, and one traffic lane connecting to Arthur Street southbound only.

In general, these access restrictions would result in minor increases in travel distance and time for the affected trips. However, these changes would result in improved traffic performance and reduced congestion through the North Sydney road network and would contribute to a road network arrangement that balances the needs of all customers including public transport passengers, pedestrians and cyclists.

Impacts on public transport

'Do something' scenario

In the 'Do something' scenario, modelled future bus travel times for key routes through the Warringah Freeway and surrounds area indicate the following:

- Travel times on bus routes through North Sydney may incur localised impacts due to changed traffic patterns at the perimeter of North Sydney CBD
- Travel times for southbound buses through North Sydney via Pacific Highway and Berry Street would improve due to the changes to the arrangements at the intersection of Berry Street and Miller Street, which would simplify signal phasing and remove the existing conflict between right turning buses and pedestrians
- Travel times for buses from Gore Hill Freeway to the Sydney Harbour Bridge would improve substantially, particularly southbound in the AM and PM peaks. This is due to the reconfiguration of the southbound bus lane between Miller Street and the Cahill Expressway, which would be separated from the general traffic lanes, thereby removing two existing weave movements between buses and cars. Buses would no longer be required to merge from left to right to access the bus lane from the north and cars would no longer be able to cross the bus lane between Falcon Street and the Cahill Expressway
- Travel times for buses to and from Falcon Street would generally improve as a result of the upgrade of this interchange and reconfiguration of the southbound bus lane, which removes the existing conflict with general traffic, and as a result of the reduction in traffic demand to the Willoughby Road and Falcon Street ramps, which would otherwise cause increasing congestion, blocking access to the northbound bus off ramp to Falcon Street.

As part of the Warringah Freeway Upgrade, a new dedicated southbound bus lane on the Warringah Freeway would extend from Miller Street to the Sydney Harbour Bridge, with new bus lane connections at Falcon Street and Mount Street. This would remove direct interaction between buses and general traffic on the approach to the Sydney Harbour Bridge, thereby improving southbound bus operations on the Warringah Freeway.

Bus lanes at the Falcon Street interchange would be maintained with the diverging diamond configuration, which would support the Northern Beaches B-Line and other bus services.

The northbound bus only lane that operates during the weekday AM peak on Arthur Street would also be removed as part of the upgrade, however bus services would have the ability to access the Sydney Harbour Bridge via the general traffic lanes provided.

The Warringah Freeway Upgrade would also relocate existing bus layover facilities on the Warringah Freeway north of Ernest Street to within a widened section of the motorway near Cammeray Golf Course and on the Cahill Expressway south of High Street. Similar layover space would be provided as per the existing arrangement.

Overall, the impacts of the project on buses would be generally positive, with travel time savings for the high-demand bus routes from Gore Hill Freeway and Military Road corridors, although in some instances there is the potential for some marginal localised increases in bus travel times through the North Sydney CBD area.

'Do something cumulative' scenario

Under the 'Do something cumulative' scenario, the modelled future bus travel times in the Warringah Freeway and surrounds area indicates the following:

- Bus travel times through North Sydney could experience some localised delays that may occur during the busiest peak periods as a result of the introduction of the Western Harbour Tunnel
- Bus travel times along the Warringah Freeway would generally improve compared to the 'Do something' scenario, due to the reduction of demand on Warringah Freeway caused by trips transferring to the project and Western Harbour Tunnel
- Bus travel times for trips travelling between Warringah Freeway and Military Road would remain largely unchanged compared to the 'Do something' scenario. The introduction of the Western Harbour Tunnel would not substantially change traffic conditions for these routes, which would retain the same level of priority.

Impacts on active transport

'Do something' scenario

The changes to the active transport network within the Warringah Freeway and surrounds area would be due to the Warringah Freeway Upgrade component of the Western Harbour Tunnel and Warringah Freeway Upgrade project. This would include:

- A new shared user path would be provided on the southern side of the High Street bridge and signalised pedestrian crossings at the Alfred Street North/High Street intersection
- A new shared user bridge to the north of Ernest Street at Cammeray, connecting Cammeray Golf Course with ANZAC Park, would provide the same pedestrian and cycle connectivity as the existing shared user path and cycleway on the Ernest Street bridge
- Replacement of the Ridge Street bridge with a wider structure with dedicated cycle lanes and a pedestrian path and replacement of the Falcon Street shared user bridge with a new structure
- Consolidating pedestrian crossings into a central median shared user path at the Falcon Street interchange
- Improved pedestrian crossings at the Falcon Street interchange ramp connections and increased pedestrian safety with fencing along the footpath
- A new dedicated cycleway on the eastern side of Warringah Freeway between Miller Street and Falcon Street
- The pedestrian and cycle underpass on the eastern side of the Falcon Street Bridge would be permanently removed. The alternative route via Military Road would result in users having to travel an additional 380 metres, increasing their travel time. However, existing pedestrian and

cyclist volumes at this underpass are low and the overall impacts of the closure are expected to be minor.

'Do something cumulative' scenario

There would be no additional impacts on the active transport network under the 'Do something cumulative' scenario when compared to the 'Do something' scenario.

9.4.3 Gore Hill Freeway and Artarmon

Road network performance

'Do something' scenario

Key outcomes of the modelled road network performance in the Gore Hill Freeway and Artarmon area under the 'Do something' scenario include:

- Peak period traffic demand through the Gore Hill Freeway and Artarmon area would increase by up to 13 per cent by 2037
- Average travel speeds would improve by up to 19 per cent in the AM peak by 2037 due to the conversion of the existing eastbound T2 transit lane to a general traffic lane, but would not change substantially in the PM peak
- The number of stops would remain generally similar to the 'Do minimum' scenario, except during the 2037 AM peak, when they would reduce substantially. This is due to the conversion of the existing eastbound T2 transit lane to a general traffic lane, providing additional capacity in the AM peak to meet forecast demand.

Under the 'Do something' scenario, the Gore Hill Freeway Connection component of the project in Artarmon would facilitate additional traffic travelling through the corridor at a generally similar or reduced level of delay. This change would represent increased connectivity and capacity in the network, with the rate of travel expected to remain similar or increase slightly when compared to 'Do minimum' scenario.

The project would also substantially increase accessibility for the Northern Beaches to nearby strategic centres such as Chatswood, St Leonards and Macquarie Park, through improved connectivity via Reserve Road and the Gore Hill Freeway. In addition, the project would provide the opportunity for express bus services in the Beaches Link tunnel between the Northern Beaches and strategic centres, via the Gore Hill Freeway, such as Macquarie Park.

'Do something cumulative' scenario

Key outcomes of the assessment of the Gore Hill Freeway and Artarmon area under the 'Do something cumulative' scenario (when compared with the 'Do Something' scenario) include:

- Peak period traffic demand through the area would increase by up to 2.5 per cent by 2037
- Average travel speeds through the area would not substantially change in the AM peak when compared to the 'Do something' scenario, but would decrease by up to seven per cent in the PM peak due to increased traffic demand on the Gore Hill Freeway generated by the Western Harbour Tunnel
- The number of stops would not materially change in the AM peak but increase in the PM peak when compared to a 'Do minimum' scenario. This is also due to the increased traffic volumes heading west from Gore Hill Freeway, which would require increased priority at the intersection of Epping Road and Longueville Road so that queues from this intersection do not interfere with the operation of the Gore Hill Freeway. This change to intersection operation would increase queues on Longueville Road and Parklands Avenue.

Network performance measures for the Gore Hill Freeway and Artarmon study area indicate that the network integration works associated with the project would facilitate additional traffic travelling through the corridor while maintaining a similar level of overall network performance. The introduction of Western Harbour Tunnel would increase demand in the area, marginally reducing network speeds during PM peaks. The additional regional connectivity from the Artarmon area added by the Western Harbour Tunnel and Beaches Link program of works would create only localised residual impacts to traffic through the Artarmon area.

Traffic travel times

'Do something' scenario

Modelled travel times during AM and PM peaks for key routes through the Gore Hill Freeway are presented in Table 9-7.

Travel times along the Gore Hill Freeway through Artarmon are not predicted to change substantially under the 'Do something' scenario, with the exception of westbound trips from Gore Hill Freeway to the Lane Cove Tunnel, which would marginally improve in the AM peak due to the reduction in traffic volumes from the Reserve Road interchange to the Lane Cove Tunnel.

'Do something cumulative' scenario

Table 9-7 indicates travel times along the Gore Hill Freeway through Artarmon would not change substantially as a consequence of the 'Do something cumulative' scenario (when compared with the 'Do something' scenario), with the exception of the westbound travel to Longueville Road in the PM peak, which would experience a relatively minor increase. Additional traffic demand as a result of the introduction of the Western Harbour Tunnel would mean that delays at the intersection of Epping Road and Longueville Road would need to be managed to avoid propagation to Gore Hill Freeway.

Table 9-7 Modelled AM peak (8am–9am) and PM peak (5pm–6pm) traffic travel times for key routes through the Gore Hill Freeway and Artarmon area

Route/ Peak period	Direction	Do minimum 2027'	Do something 2027'	Do something cumulative 2027'	Do minimum 2037'	Do something 2037'	Do something cumulative 2037'
Longueville Road to Gore Hill Freeway							
AM peak	Eastbound	01:28	01:28	01:29	01:24	01:28	01:29
	Westbound	01:24	01:22	01:23	01:28	01:22	01:23
PM peak	Eastbound	01:26	01:26	01:26	01:25	01:26	01:27
	Westbound	01:23	01:23	01:23	01:23	01:23	02:02
Lane Cove Tunnel to Gore Hill Freeway							
AM peak	Eastbound	01:18	01:16	01:16	01:24	01:17	01:17
	Westbound	01:17	01:17	01:18	02:16	01:18	01:18
PM peak	Eastbound	01:22	01:16	01:16	01:23	01:16	01:18
	Westbound	01:12	01:17	01:17	01:12	01:17	01:17

Intersection performance

'Do something' scenario

Modelled intersection performance for key intersections in the Gore Hill Freeway and Artarmon area under the 'Do something' scenario is presented in Table 9-8, and indicate the following:

- The intersection of Epping Road, Longueville Road and Parklands Avenue would continue to operate with substantial delays during AM peak and PM peak due to continued high levels of traffic demand. As a result, queues extending on Parklands Avenue and Longueville Road may increase as priority is given to the east–west movements through this intersection
- The intersection of Longueville Road and Pacific Highway would operate satisfactorily as a result of the project, indicating that additional traffic volumes at the intersection of Epping Road and Longueville Road would not impact on performance at this adjacent intersection
- The Gore Hill Freeway/Reserve Road interchange would continue to operate at a similar or improved level of service with the project in operation due to the proposed capacity and traffic signal operation upgrades.

Overall, the project would result in increased demand through the Gore Hill Freeway and Artarmon area and would facilitate this additional travel without substantially increasing delays at critical intersections on the arterial road network.

'Do something cumulative' scenario

Modelled intersection performance for key intersections in the Gore Hill Freeway and Artarmon area under the 'Do something cumulative' scenario is presented in Table 9-8, and indicate the following:

- The Epping Road/Longueville Road/Parklands Avenue intersection would continue to operate at a poor level of service as a result of continued high traffic demand through this intersection
- Increased delays from the Epping Road/Longueville Road intersection are likely to result in increased localised delays at the Longueville Road/Pacific Highway intersection during the PM peak
- The Gore Hill Freeway/Reserve Road interchange would continue to operate at capacity during the PM peak, with the potential for increased queuing due to the increased traffic demand in the corridor. This has the potential to increase delays at adjacent intersections along Reserve Road, with the intersection at Dickson Road and Reserve Road operating at LoS F.

Increased traffic demand would result in some increased delays at intersections in the Gore Hill Freeway and Artarmon area. These intersections could be optimised to ensure the Gore Hill Freeway would continue to operate satisfactorily, however a consequence of this optimisation would be longer delays on side streets and surface roads during peak periods.

Although traffic may be impacted by an increase in localised intersection delays under the 'Do something cumulative' scenario, strategic modelling indicates that road users would benefit from substantial travel time savings on the broader network (eg via Western Harbour Tunnel and improved efficiency of the Warringah Freeway and beyond). Consequently, road users who travel on and around the Gore Hill Freeway would still benefit from the construction of the Western Harbour Tunnel due to the increased connectivity to the area and on the surrounding broader road network.

Table 9-8 Modelled intersection performance on the Gore Hill Freeway and Artarmon area (AM peak (8am–9am) and PM peak (5pm–6pm) during operation in 2027 and 2037)

Intersection/ peak period	'Do minimum 2027 LoS (average delay in seconds)	'Do something 2027 LoS (average delay in seconds)	'Do something cumulative 2027' LoS (average delay in seconds)	'Do minimum 2037 LoS (average delay in seconds)	'Do something 2037 LoS (average delay in seconds)	'Do something cumulative 2037 LoS (average delay in seconds)
Epping Road/Longueville Road/Parkland Avenue						
AM peak	D (52)	F (73)	F (75)	F (83)	F (74)	F (77)
PM peak	F (80)	E (66)	F (81)	F (87)	F (71)	F (>100)
Longueville Road/Pacific Highway						
AM peak	C (40)	D (49)	C (39)	D (54)	C (33)	C (38)
PM peak	C (42)	C (38)	D (45)	D (49)	C (42)	F (86)
Pacific Highway/Howarth Road/Norton Lane						
AM peak	B (20)	A (8)	A (10)	B (28)	A (9)	A (11)
PM peak	A (42)	A (38)	A (45)	A (49)	A (42)	A (86)
Pacific Highway/Gore Hill Freeway interchange						
AM peak	B (29)	C (32)	B (25)	C (41)	B (24)	B (25)
PM peak	C (29)	B (17)	B (29)	B (23)	B (17)	B (29)
Reserve Road/Gore Hill Freeway interchange						
AM peak	E (61)	D (46)	D (52)	D (47)	D (55)	E (60)
PM peak	D (29)	D (17)	D (29)	E (23)	D (17)	D (29)
Reserve Road/Dickson Road						
AM peak	A (14)	B (21)	B (24)	B (19)	B (29)	B (27)
PM peak	F (73)	D (50)	F (87)	F (85)	E (66)	F (95)
Reserve Road/Barton Road						
AM peak	E (69)	F (87)	F (77)	F (>100)	F (84)	F (85)
PM peak	F (>100)	E (69)	F (>100)	F (>100)	F (>100)	F (>100)

Note: Cells shaded in dark grey denote an unsatisfactory LoS E or F

Road network changes and access arrangements

'Do something' scenario

At its western end, the project would connect to the Gore Hill Freeway at Artarmon, west of the T1 North Shore and Western line and T9 Northern line. The connection would include:

- Eastbound on ramps to Beaches Link from the Lane Cove Tunnel, Epping Road, and Reserve Road, providing three access points from Artarmon and beyond
- Westbound off ramps from Beaches Link onto Reserve Road and the Lane Cove Tunnel, providing access points to Artarmon and beyond.

The Gore Hill Freeway Connection component of the project would also involve local road changes to integrate the project with the existing road network as follows:

- Dickson Avenue east of Reserve Road would be converted to a cul-de-sac, and property access from Reserve Road would be removed to accommodate the westbound off ramp onto Reserve Road. Access to properties would be provided via Hesky Lane and the surrounding road network, such as Taylor Lane, Cleg Street, Herbert Street and Waltham Street. Access to Dickson Avenue west of Reserve Road would be maintained
- The Reserve Road/Dickson Avenue intersection would be modified to accommodate the westbound off ramp onto Reserve Road
- Lambs Road would be disconnected from the road network between Punch Street and Cleg Street to facilitate the installation of tunnel support facilities. Lambs Road would connect directly onto Cleg Street at its northern end while a cul-de-sac would be installed on Punch Street at its eastern end. Vehicles would be redirected from Lambs Road to Punch Street and Herbert Street. This would not substantially increase the travel time, with the additional distance is limited to around 480 metres
- Traffic signals would be provided for the Pacific Highway/Dickson Avenue intersection to increase safety and connectivity.

Additional capacity would be provided at the Reserve Road bridge where the existing footpaths would be converted to traffic lanes, a new footpath would be constructed on the eastern side of the bridge and the T2 transit lanes on the Gore Hill Freeway in both directions would be removed.

Twenty five on-street parking spaces removed on Lambs Road and Punch Street during construction would not be reinstated. About 10 on-street parking spaces for cars and six on-street parking spaces for motorcycles would also be removed at the Pacific Highway/Dickson Avenue intersection during construction and would not be reinstated. Given the availability of parking on surrounding streets this impact is anticipated to be absorbed by the surrounding network.

Beaches Link operational facilities including the motorway control centre at the Gore Hill Freeway would provide sufficient off-street parking for staff and would therefore avoid any additional on-street parking demand as a result of the project. Therefore, there would be no additional impacts on parking once the project is operational.

These network changes and access arrangements are shown in Figure 9-6.

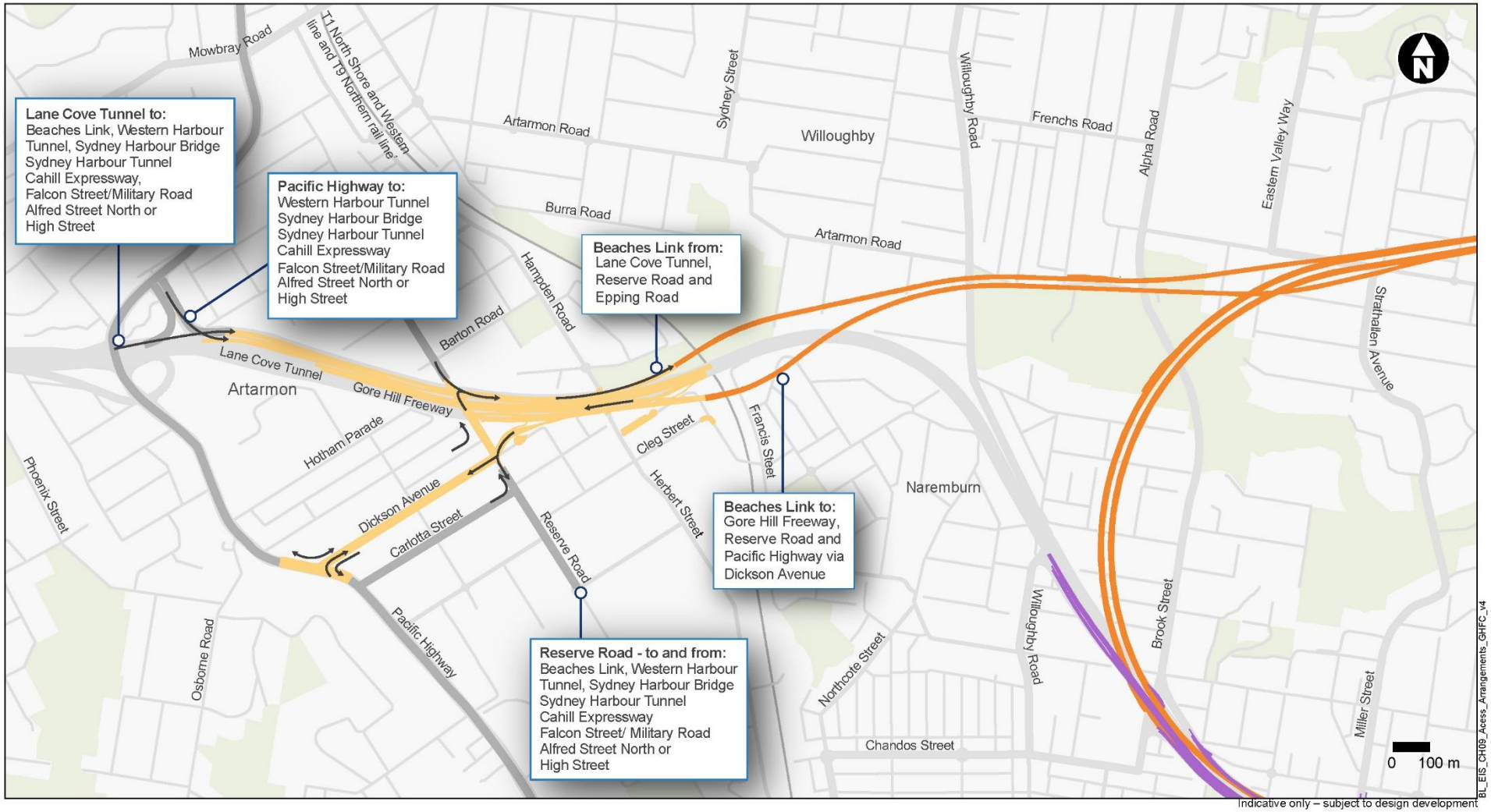


Figure 9-6 Access arrangements upon completion of construction works at Gore Hill Freeway

'Do something cumulative' scenario

There would be no additional road network changes within the Gore Hill Freeway and Artarmon area under the 'Do something cumulative' scenario compared to the 'Do something' scenario.

Impacts on public transport

'Do something' scenario

The existing T2 transit lanes in the area would be converted to general traffic lanes as part of the project. Forecast bus travel times for key routes through the Gore Hill Freeway and Artarmon area indicate that the conversion of the T2 transit lanes would not have a material impact on travel times during the AM and PM peaks towards the Sydney CBD (Lane Cove Tunnel to Gore Hill Freeway).

The project also offers the opportunity for express bus services in the Beaches Link tunnel between the Northern Beaches and strategic centres (such as Macquarie Park) via the Gore Hill Freeway.

The southbound bus stop on Pacific Highway would be permanently relocated once traffic signals are provided for the Pacific Highway/Dickson Avenue intersection. The bus stop would be relocated within 50 metres of its existing location and only minor impacts are therefore anticipated given the minor increase in travel distance.

'Do something cumulative' scenario

Forecast bus travel times for key routes through the Gore Hill Freeway and Artarmon area indicate that bus travel times would not change substantially under the 'Do something cumulative' scenario, and increased traffic flows through the area would not materially impact bus travel times for key routes.

Impacts on active transport

'Do something' scenario

The following pedestrian and cyclist infrastructure would be provided as part of the project:

- The existing shared user path on the southern side of the Gore Hill Freeway would be replaced in areas directly impacted by the project between the T1 North Shore and Western line and T9 Northern line. Pedestrian fencing would be installed along the northern side of the shared user path to improve safety of the active transport network
- The existing pedestrian footpath along the eastern side of the Reserve Road bridge would be replaced, maintaining existing connectivity.

'Do something cumulative' scenario

There would be no additional changes to the active transport network within the Gore Hill Freeway and Artarmon area under the 'Do something cumulative' scenario when compared to the 'Do something' scenario.

9.4.4 Northbridge to Seaforth (Middle Harbour crossing – maritime traffic)

There would be no operational impacts on maritime movements and activities as a result of the project.

The project would result in a reduction in water depth of around 10 metres at some locations within the proposed harbour crossing. This is not expected to have an impact on navigation, given the current depth is typically greater than 20 metres chart datum at the crossing location, and vessels in this part of the harbour are already constrained by shallow water depths downstream, with the maximum water depth at the entrance to Middle Harbour being around 3.5 metres at low tide to 5.1 metres at high tide below chart datum.

Moorings impacted during construction would be reinstated as close as practical to their current locations.

9.4.5 Balgowlah and surrounds

Road network performance

'Do something' scenario

Key outcomes of the modelled road network performance in the Balgowlah and surrounds area under the 'Do something scenario' include:

- Peak period traffic demand would increase by up to 15 per cent by 2037
- Average travel speeds would improve by up to 77 per cent in the AM peak and 49 per cent in the PM peak by 2037 due to the shift in traffic demand to the project road network. The transfer of this demand from surface arterial roads to the project would reduce congestion and improve travel speeds for local trips
- The number of stops would reduce substantially by up to 56 per cent in the AM peak and 22 per cent in the PM peak. This is due to the reduction in traffic on the surface roads, particularly through the intersection of Manly Road and Sydney Road, which is the primary source of delays in the area.

The assessment indicates that the operation of the project would facilitate additional traffic travelling through the corridor within the Balgowlah and surrounds area at greatly reduced levels of delay, and would benefit both regional and local trips. This would result in improved travel times on key routes through the area as a result of the project.

'Do something cumulative' scenario

Key outcomes of the modelled road network performance in the Balgowlah and surrounds area under the 'Do something cumulative' scenario (when compared with the 'Do something' scenario) include:

- Peak period traffic demand would not substantially change
- Average travel speeds would not substantially change.

Network performance measures for the Balgowlah and surrounds area indicate that the project would facilitate additional traffic through the area. Extending connectivity further with the inclusion of the Western Harbour Tunnel would result in similar travel times and speeds to the 'Do something' scenario.

Traffic travel times

'Do something' scenario

Modelled travel times during AM and PM peaks for key routes through the Balgowlah and surrounds area are presented in Table 9-9. Analysis of the modelled general traffic travel times indicates that performance on most key routes throughout the modelled area is expected to improve as a result of the project.

'Do something cumulative' scenario

Table 9-9 indicates there would be minimal change in general traffic travel times as a result of the introduction of Western Harbour Tunnel when compared to the 'Do something' scenario.

Table 9-9 Modelled AM peak (8am–9am) and PM peak (5pm–6pm) traffic travel times for key routes through Balgowlah and surrounds area

Route/ Peak period	Direction	Do minimum 2027'	Do something 2027'	Do something cumulative 2027'	Do minimum 2037'	Do something 2037'	Do something cumulative 2037'
Spit Bridge to Burnt Bridge Creek Deviation/Condamine Street							
AM peak	Northbound	03:09	03:27	03:25	04:08	03:29	03:28
	Southbound	06:15	03:44	03:48	11:46	03:38	03:40
PM peak	Northbound	05:24	03:54	04:00	05:48	04:00	03:47
	Southbound	07:49	05:41	04:57	11:12	05:13	05:10
Spit Bridge to Wakehurst Parkway/Judith Street (via Frenchs Forest Road)							
AM peak	Northbound	05:55	06:23	06:33	06:47	06:03	05:58
	Southbound	07:37	06:31	06:36	09:22	06:30	06:30
PM peak	Northbound	09:57	08:28	07:17	10:19	08:13	07:39
	Southbound	14:19	14:05	14:16	16:07	14:20	14:23

Intersection performance

'Do something' scenario

Modelled intersection performance for key intersections in the Balgowlah and surrounds area under the 'Do something' scenario is presented in Table 9-10, and indicates:

- Demand at the roundabout-controlled Frenchs Forest Road/Sydney Road intersection would continue to exceed capacity, resulting in relatively poor performance during PM peak periods
- The intersection of Sydney Road, Manly Road and Burnt Bridge Creek Deviation would improve in the AM peak but continue to operate at a poor level of service during the PM peak, when average delays would be comparable to those under the 'Do minimum' scenario. The proximity of this intersection to the Frenchs Forest Road/Sydney Road intersection would result in queues from each intersection impacting the capacity and performance of the other
- All other intersections would operate at similar level of service to those under the 'Do minimum' scenario.

Analysis of the modelled general traffic travel times indicates that travel times on most key routes throughout the modelled area are expected to improve as a result of the project. While some intersections would continue to experience a poor level of service, when combined with the above travel time benefits, the project would result in an overall improvement to network performance.

'Do something cumulative' scenario

Modelled intersection performance in the Balgowlah and surrounds area under the 'Do something cumulative' scenario is presented in Table 9-10 and indicates:

- Most intersections in the area would generally continue to operate at a similar level of delay when compared to the 'Do something' scenario
- Reduced traffic volumes from Spit Road associated with the introduction of the Western Harbour Tunnel would reduce the extent of queueing at the roundabout of Sydney Road and Frenchs Forest Road. This would reduce the impact on adjacent intersections,

including Sydney Road/Manly Road/Burnt Bridge Creek Deviation and Sydney Road/Maretimo Street during the PM peak.

Table 9-10 Modelled intersection performance on the Balgowlah and surrounds area(AM peak (8am–9am) and PM peak (5pm–6pm) during operation in 2027 and 2037)

Intersection/ peak period	'Do minimum 2027' LoS (average delay in seconds)	'Do something 2027' LoS (average delay in seconds)	'Do something cumulative 2027 LoS (average delay in seconds)	'Do minimum 2037' LoS (average delay in seconds)	'Do something 2037' LoS (average delay in seconds)	'Do something cumulative 2037' LoS (average delay in seconds)
Sydney Road/Manly Road/Burnt Bridge Creek Deviation						
AM peak	D (48)	B (26)	B (28)	**E (68)**	B (27)	B (26)
PM peak	**F (93)**	**F (86)**	**E (62)**	**F (>100)**	**F (93)**	**F (73)**
Frenchs Forest Road/Sydney Road						
AM peak	B (21)	B (29)	B (25)	C (32)	B (28)	C (40)
PM peak	**F (>100)**	**F (>100)**	**F (>100)**	**F (>100)**	**F (>100)**	**F (>100)**
Sydney Road/Condamine Street						
AM peak	C (33)	B (24)	B (23)	B (26)	C (29)	B (26)
PM peak	C (33)	C (39)	C (42)	C (40)	D (48)	D (45)
Condamine Street/Burnt Bridge Creek Deviation						
AM peak	B (19)	B (31)	C (32)	C (32)	C (38)	C (36)
PM peak	B (17)	C (35)	C (40)	B (16)	C (38)	C (41)
Access Road/Sydney Road/Maretimo Street						
AM peak	A (10)	B (23)	C (29)	A (9)	B (28)	B (27)
PM peak	A (9)	B (20)	B (20)	C (30)	B (27)	C (30)
Access Road/Burnt Bridge Creek Deviation						
AM peak	N/A	A (11)	A (10)	N/A	A (14)	A (14)
PM peak	N/A	A (11)	A (11)	N/A	A (12)	A (11)

Note: Cells shaded in dark grey denote an unsatisfactory LoS E or F

Road network changes and access arrangements

'Do something' scenario

In the 'Do something' scenario, the project would connect to Burnt Bridge Creek Deviation at Balgowlah, just north of its intersection with Sydney Road. This would include a two-lane southbound on ramp and a three-lane northbound off ramp. Local road changes would be required to integrate the project with the existing road network as follows:

- Provision of a new access road in Balgowlah, providing local access and connectivity to the new open space and recreation facilities and connecting the tunnel portals/Burnt Bridge Creek Deviation and Sydney Road. The new access road would accommodate travel in either direction

- A new intersection with traffic signals connecting the new access road with Burnt Bridge Creek Deviation and the tunnel portals adjacent to the northern end of Dudley Street. This would include right turn lanes into the new access road from the Beaches Link off ramp and left turn lanes out of the new access road to the Beaches Link on ramp and Burnt Bridge Creek Deviation southbound. Non-tunnel northbound traffic on Burnt Bridge Creek Deviation would bypass these traffic signals
- A new signalised intersection would be provided at the southern end of the new access road to accommodate its connection with Sydney Road. Traffic movements north-south (and vice versa) through the intersection between Maretimo Street and the access road would not be permitted. The new intersection would include a pedestrian crossing across the new access road on the northern side of Sydney Road. Pedestrian connectivity between the new open space and recreation facilities, the Northern Beaches Secondary College – Balgowlah Boys Campus and Maretimo Street would be provided via the existing pedestrian bridge to the west of the new access road and would continue to provide north-south connectivity for pedestrians in the area. Pedestrian connectivity across Sydney Road to and from Maretimo Street would not be provided at the intersection
- Relocating the existing cul-de-sac at Dudley Street further south to accommodate construction of the new tunnel portals and the associated realignment of Burnt Bridge Creek Deviation.

Potential access impacts associated with the relocation of the cul-de-sac on Dudley Street are expected to be minor given remaining properties would still be accessible from Dudley Street.

Surface connections at Balgowlah would attract traffic demand from both east and west of Burnt Bridge Creek Deviation. The additional traffic from North Balgowlah could cross at Kitchener Street to access the new access road from Sydney Road east. This could increase traffic volumes on local roads between Kitchener Street and Sydney Road. Local area traffic management would assist in minimising increased traffic on local roads. Local area traffic management on Wanganella Street, Rickard Street and West Street could result in traffic using Woodland Street and Condamine Street instead, which would be more appropriate to the function of these roads. Local traffic management measures proposed would be discussed further and agreed with Northern Beaches Council during detailed design.

'Do something cumulative' scenario

There would be no additional road network changes within Balgowlah and surrounds under the 'Do something cumulative' scenario (when compared to the 'Do something' scenario).

Impacts on public transport

'Do something' scenario

In the 'Do something' scenario, bus travel times would be maintained or improved as a result of the project, as existing bus priority in the area would be maintained and traffic congestion reduced in the Balgowlah and surrounds area.

'Do something cumulative' scenario

In the 'Do something cumulative' scenario bus travel times may increase marginally along Frenchs Forest Road during the PM peak as a result of the increased traffic travelling through the Sydney Road/Frenchs Forest Road roundabout, when compared to the 'Do something' scenario.

All other bus routes would be generally unaffected by the changes in traffic as a result of the 'Do something cumulative' scenario when compared to the 'Do something' scenario.

Impacts on active transport

'Do something' scenario

Pedestrian and cyclist facilities provided as part of the 'Do something' scenario would generally improve the extent of the overall active transport network in Balgowlah and surrounds. The following is proposed as part of the project:

- New shared user paths would be provided along the eastern side of the new access road
- A portion of the existing shared user path along Burnt Bridge Creek within the existing golf course would require minor adjustment due to a localised adjustment of the creek alignment
- The existing box culvert crossing of Burnt Bridge Creek Deviation and adjacent pedestrian underpass beneath Burnt Bridge Creek Deviation would both be extended under the realigned road, maintaining existing connectivity across the widened Burnt Bridge Creek Deviation. This would connect to the existing shared user path at Dudley Street. Pedestrian fencing would be provided along the outside of the shared user path and the realigned section of Burnt Bridge Creek Deviation
- New signal controlled pedestrian crossings across the new access road at its interfaces with Sydney Road and Burnt Bridge Creek deviation would maintain connectivity to the existing Balgowlah Oval from Northern Beaches Secondary College – Balgowlah Boys Campus
- An at grade signalised crossing of the access road would provide access to the intersections of the Burnt Bridge Creek Deviation and the new public car park within the open space and recreation facilities area at Balgowlah.

The final layout of the new and improved open space and recreation facilities at Balgowlah including shared user paths are subject to a dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council to give the community an opportunity to provide input (refer to Chapter 6 (Construction work) for further details). This consultation would be separate to the consultation for the environmental impact statement. This process would start after the environmental impact statement public exhibition period and well in advance of construction starting. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space.

'Do something cumulative' scenario

There would be no additional changes to the active transport network under the 'Do something cumulative' scenario when compared to the 'Do something' scenario.

9.4.6 Frenchs Forest and surrounds

Road network performance

Northern Beaches Hospital road upgrade project

The assessment of the Frenchs Forest and surrounds area without the project includes the road network performance benefits from the recently completed Northern Beaches Hospital road upgrade project. 'Do minimum 2027' results indicate that:

- Peak period traffic demand through the area is forecast to increase by 10 per cent
- Overall network speeds would be improved by up to 40 per cent
- Travel speeds along Warringah Road and other key corridors would be improved by more than 50 per cent in some cases.

The results of the 'Do minimum 2037' scenario illustrate similar benefits, but also indicate that continued long-term background demand growth in the area would reduce road network performance over time. Between 2027 and 2037:

- Demand is forecast to increase by an additional five per cent
- Network speeds would consequently reduce by around five to 10 per cent.

Overall, the 'Do minimum' results indicate that despite continuous growth in background demand over the next 20 years, network performance in the area would still be substantially improved when compared to existing conditions, due to the Northern Beaches Hospital road upgrade project.

'Do something' scenario

Key outcomes of the modelled road network performance in the Frenchs Forest and surrounds area under the 'Do something' scenario includes the following:

- Peak period traffic demand through the Frenchs Forest and surrounds area would increase by up to 10 per cent by 2037
- Average travel speeds through the Frenchs Forest and surrounds area may decrease by up to 13 per cent. This is primarily a consequence of the change in traffic patterns and demand as a result of the project. A substantial proportion of traffic that currently travels east–west along Warringah Road would travel from east to south and from south to east along Wakehurst Parkway and Warringah Road and through the intersection of Warringah Road and Wakehurst Parkway instead of passing through the underpass. Similarly, southbound traffic on Forest Way that would turn right onto Warringah Road would instead turn left, then right from Warringah Road to Wakehurst Parkway, increasing localised delays at the intersection of Warringah Road and Wakehurst Parkway
- The number of stops would increase by up to 26 per cent as a result of the project due to the change in the pattern of demand with more trips travelling through surface road intersections rather than through the underpass.

The new underpasses at Forest Way and Wakehurst Parkway would not be impacted for the main east/west traffic route on Warringah Road. However, the changes to traffic patterns associated with the project would generally result in increased localised delays on the Warringah Road surface lanes between Forest Way and Wakehurst Parkway and reduced travel speeds through the area. This would be due to the change in the pattern of traffic demand from mostly east and west to mostly east and south, reflecting a change in the main southbound route from Warringah Road to Wakehurst Parkway and the new motorway tunnels introduced by the project. This would transfer traffic demand from a largely grade-separated movement through several additional intersections, resulting in localised delays.

Although some localised delays may be experienced during peak periods, broader modelling indicates that most road users would benefit from substantial travel time savings on the broader network due to the strategic benefits provided by Beaches Link.

'Do something cumulative' scenario

Key outcomes of the modelled road network performance in the Frenchs Forest and surrounds area, under the 'Do something cumulative' scenario (compared with the 'Do something' scenario) includes the following:

- AM and PM peak period traffic demand would increase marginally by up to two per cent
- Average travel speeds through the area could decrease by as much as 12 per cent, largely due to additional demand and redistribution of traffic from Warringah Road (Roseville Bridge) to the project. This would increase the volume of traffic through the intersection of Warringah Road and Wakehurst Parkway, and reduce the volume travelling through the underpass along Warringah Road

- The number of stops would increase under the 'Do something cumulative' scenario by up to 15 per cent. This would be a consequence of the small distribution of traffic from the Warringah Road grade separation to the Warringah Road and Wakehurst Parkway intersection.

There would not be a substantial increase in overall travel demand, but the additional redistribution of demand from Warringah Road to the project would result in some additional localised delay through the network. This is a result of these trips being transferred from the Warringah Road grade separation to the Warringah Road and Wakehurst Parkway surface intersection, which would be operating at capacity.

The strategic benefits of the project are expected to substantially offset localised impacts. The potential localised increases in travel times on the key corridors of Warringah Road and Wakehurst Parkway within the area are expected to be less than five minutes. Conversely, average travel time savings between key centres, eg Dee Why to and from Macquarie Park, are expected to be around 20 minutes. In this example, a 15-minute net saving would be created by the project providing new high capacity connectivity and reducing congestion on existing regional routes.

Notwithstanding this, Transport for NSW is continuing to investigate options to mitigate potential localised network performance issues in the area, and further leverage the overall benefits and opportunities of the project. This work is cognisant of and reliant on the outcomes of the ongoing implementation of the *Northern Beaches Hospital Precinct Structure Plan* (Northern Beaches Council, 2017b), which highlights that future precinct development beyond Stage 1 of the development is dependent on further delivery of improved transport infrastructure and a continued modal shift from private to public transport (refer to Section 9.1.2).

Traffic travel times

'Do something' scenario

Modelled travel times during the AM and PM peaks for key routes through the Frenchs Forest and surrounds area are presented in Table 9-11.

The modelled travel times under the 'Do something' scenario show the following:

- Overall travel times for general traffic on Warringah Road and Forest Way would remain generally unaffected by the project, indicating that potentially increased delays at the intersections along Wakehurst Parkway would not impact east–west trips
- In the AM peak, southbound travel times along Wakehurst Parkway would increase as a result of the project due to the change in traffic pattern that would increase the volumes of traffic turning right from Warringah Road to Wakehurst Parkway, conflicting with the increase in southbound traffic on Wakehurst Parkway
- In the PM peak, travel times for general traffic along Wakehurst Parkway would remain comparable or would improve as a result of the project because the primary southbound movements in the PM peak do not conflict as they do in the AM peak and would have additional capacity provided on Wakehurst Parkway south of Warringah Road.

Overall, traffic modelling predicts that potentially increased localised delays at intersections would be offset by the broader improvement in connectivity and reduction in congestion created by the project.

'Do something cumulative' scenario

Table 9-11 indicates travel times would generally be maintained following the introduction of the Western Harbour Tunnel. There would, however, be some changes, including:

- Increased travel times on Wakehurst Parkway southbound through the area
- Increased demand at the intersections with Frenchs Forest Road and Warringah Road that would create localised delays during the busiest peak periods in 2037.

Table 9-11 Modelled AM peak (8am–9am) and PM peak (5pm–6pm) traffic travel times for key routes through the Frenchs Forest and surrounds area

Route/ Peak period	Direction	Do minimum 2027'	Do something 2027'	Do something cumulative 2027'	Do minimum 2037'	Do something 2037'	Do something cumulative 2037'
Wakehurst Parkway/Judith Street to Wakehurst Parkway/Dreadnought Road							
AM peak	Northbound	04:27	04:17	04:11	06:59	04:27	04:00
	Southbound	04:29	09:13	10:07	05:05	07:36	10:14
PM peak	Northbound	04:37	05:35	06:15	07:02	05:30	05:39
	Southbound	04:10	03:20	03:40	04:04	03:24	09:12
Warringah Road/Forestville Avenue to Ellis Road/Warringah Road							
AM peak	Eastbound	05:25	05:26	05:21	05:24	05:22	06:39
	Westbound	05:55	05:24	05:30	06:11	05:53	06:13
PM peak	Eastbound	06:05	06:09	05:58	06:22	06:42	06:21
	Westbound	05:15	05:24	05:19	05:36	05:15	05:24

Intersection performance

'Do something' scenario

Modelled future performance for key intersections in the Frenchs Forest and surrounds area under the 'Do something' scenario is presented in Table 9-12. Changes to traffic patterns and demand would result in the following intersections operating at a relatively poor level of service during peak hours, when compared to the scenario without the project:

- Wakehurst Parkway and Frenchs Forest Road East (particularly during the AM peak)
- Wakehurst Parkway and Warringah Road
- Warringah Road and Hilmer Street (due to queues from Wakehurst Parkway) (during 2037 PM peak only).

These intersections would experience increased localised delays as a result of the changes in traffic patterns that would arise from the project. However, the project would reduce congestion and delays at intersections along the broader Warringah Road corridor due to the substantial reductions in traffic volumes along Warringah Road to the west of Forest Way.

'Do something cumulative' scenario

Modelled future performance for key intersections in the Frenchs Forest and surrounds area under the 'Do something cumulative' scenario is presented in Table 9-12 and indicate the following when compared with the 'Do something' scenario:

- The intersections of Wakehurst Parkway and Warringah Road, and Wakehurst Parkway and Frenchs Forest Road East would operate with higher average delays due to the redistribution of traffic from Warringah Road to the project
- Delays at the Forest Way/Naree Road intersection would increase as a result of the increase in demand through the area.

The 'Do something cumulative' scenario would result in increased localised delays at intersections when compared with the 'Do something' scenario, primarily as a result of the redistribution of traffic from Warringah Road to the project, but also due to an increase in forecast demand through the area created by the Western Harbour Tunnel.

Although there would be an increase in localised intersection delays, road users would generally benefit from substantial overall travel time savings on the broader network (eg via the project, Warringah Road, Wakehurst Parkway and beyond, particularly through the connectivity to Western Harbour Tunnel). Consequently, traffic impacted at individual intersections in the area is still anticipated to receive a substantial net benefit due to the broader connectivity and efficiency improvements.

Table 9-12 Modelled intersection performance on the Frenchs Forest and surrounds area (AM peak (8am–9am) and PM peak (5pm–6pm) during operation in 2027 and 2037)

Intersection/ peak period	'Do minimum 2027' LoS (average delay in seconds)	'Do something 2027' LoS (average delay in seconds)	'Do something cumulative 2027 LoS (average delay in seconds)	'Do minimum 2037' LoS (average delay in seconds)	'Do something 2037' LoS (average delay in seconds)	'Do something cumulative 2037' LoS (average delay in seconds)
Wakehurst Parkway/Frenchs Forest Road East						
AM peak	D (44)	**F (>100)**	**F (>100)**	**E (66)**	**F (86)**	**F (>100)**
PM peak	D (46)	D (45)	D (45)	D (46)	C (43)	**F (98)**
Warringah Road/Allambie Road						
AM peak	D (44)	D (50)	D (54)	D (46)	D (51)	D (50)
PM peak	D (46)	D (52)	D (50)	D (49)	D (52)	D (48)
Wakehurst Parkway/Warringah Road						
AM peak	**E (58)**	**F (93)**	**F (94)**	**F (78)**	**F (73)**	**F (81)**
PM peak	C (33)	**F (75)**	**F (86)**	C (41)	**E (59)**	**E (60)**
Warringah Road/Hilmer Street						
AM peak	A (14)	B (18)	C (35)	C (38)	D (50)	D (57)
PM peak	A (12)	B (17)	B (21)	A (13)	**F (88)**	**F (73)**
Warringah Road/Forest Way						
AM peak	B (18)	A (15)	B (18)	B (21)	B (16)	B (26)
PM peak	B (24)	B (24)	C (33)	B (26)	C (31)	B (24)
Forest Way/Naree Road						
AM peak	B (24)	D (56)	D (57)	C (36)	D (54)	**E (69)**
PM peak	B (19)	B (28)	B (24)	B (27)	B (28)	D (53)
Warringah Road/Brown Street/Currie Road						
AM peak	B (20)	B (16)	B (17)	B (23)	B (18)	B (17)
PM peak	A (10)	A (9)	A (9)	A (11)	A (9)	A (10)
Warringah Road/Starkey Street						
AM peak	B (23)	B (20)	B (21)	B (26)	B (21)	B (25)
PM peak	B (20)	B (20)	B (18)	B (19)	B (20)	B (19)

Intersection/ peak period	'Do minimum 2027' LoS (average delay in seconds)	'Do something 2027' LoS (average delay in seconds)	'Do something cumulative 2027 LoS (average delay in seconds)	'Do minimum 2037' LoS (average delay in seconds)	'Do something 2037' LoS (average delay in seconds)	'Do something cumulative 2037' LoS (average delay in seconds)
Warringah Road/Darley Street						
AM peak	B (28)	B (27)	B (29)	C (30)	B (26)	B (26)
PM peak	B (19)	B (17)	B (15)	B (19)	B (19)	B (15)
Warringah Road/Forestville Avenue						
AM peak	A (10)	A (14)	A (14)	A (14)	A (14)	A (14)
PM peak	C (35)	B (29)	B (21)	D (46)	C (35)	C (34)

Note: Cells shaded in dark grey denote an unsatisfactory LoS E and F

Road network changes and access arrangements

'Do something' scenario

In the 'Do something' scenario, the project would connect to Wakehurst Parkway at Killarney Heights, north of Kirkwood Street. This connection would include a two-lane southbound on ramp and a two-lane northbound off ramp. This would involve minor local road changes to the intersections of Wakehurst Parkway with Kirkwood Street, Fitzpatrick/Aquatic Drive, Warringah Road and Frenchs Forest Road East and Frenchs Forest Road West to integrate the project with the existing surface road network as follows:

- Provision of additional capacity on Wakehurst Parkway, which would be upgraded to two lanes in each direction between the tunnel portal and Warringah Road
- Removal of the right turn movement from Wakehurst Parkway northbound onto Frenchs Forest Road eastbound, resulting in an additional travel distance of up to 1.3 kilometres via Warringah Road and Allambie Road for affected trips
- Alterations to line marking, adjustments to medians and asphalt resurfacing along local roads.

Given the minimal changes required to local roads, these impacts would be considered minor.

'Do something cumulative' scenario

There would be no additional road network changes within the Frenchs Forest and surrounds area under the 'Do something cumulative' scenario, when compared to the 'Do something' scenario.

Impacts on public transport

'Do something' scenario

In the 'Do something' scenario, bus travel times for key routes through the Frenchs Forest and surrounds area would not be materially impacted by the project. Regional and local buses that are serviced by the Warringah Road and Eastern Valley Way corridors would benefit from improved travel times and reliability as a result of reduced traffic demand and congestion on these roads as a result of the project.

Four new dedicated bus bays and two associated shared user path underpasses would be provided along Wakehurst Parkway, improving bus safety and reducing conflict between stopped buses and general traffic.

'Do something cumulative' scenario

In the 'Do something cumulative' scenario, bus travel times would generally be maintained during the PM peak, compared to the 'Do something' scenario. In the AM peak, when compared with the 'Do something' scenario, there would be some localised impacts on travel times due to the increased demand created by the Western Harbour Tunnel, with increased intersection delays along Warringah Road and Wakehurst Parkway.

The 'Do something cumulative' scenario would reduce traffic demand heading to the Sydney CBD and employment centres like Macquarie Park via the alternative Warringah Road and Eastern Valley Way corridors to the west and south of Frenchs Forest. Both corridors carry regional and local buses, and these services would benefit from improved travel times and reliability as result of reduced congestion.

Impacts on active transport

'Do something' scenario

Under the 'Do something' scenario, the following changes to the active transport network within the Frenchs Forest and surrounds area would be carried out as part of the project:

- A new shared user path on the eastern side of Wakehurst Parkway from the northern end of Kirkwood Street to Warringah Road
- A new shared user underpass beneath Wakehurst Parkway near Yarraman Avenue
- A new shared user bridge over the drainage culvert and fauna underpass (constructed as part of the Northern Beaches Hospital road upgrade project) on the eastern side of Wakehurst Parkway about 150 metres south of Warringah Road
- Three new shared user underpasses beneath Wakehurst Parkway, connecting Garigal National Park and Manly Dam Reserve
- Replacement of the existing pedestrian bridge with a new longer pedestrian bridge over Wakehurst Parkway, about 350 metres south of Warringah Road.

The modified and new pedestrian and cycle crossings proposed would improve the safety and connectivity of the active transport network to, from, and within the Frenchs Forest and surrounds area.

'Do something cumulative' scenario

There would be no additional changes to the active transport network under the 'Do something cumulative' scenario when compared to the 'Do something' scenario.

9.5 Environmental management measures

Environmental management measures relating to operational traffic and transport impacts are outlined in Table 9-13.

Table 9-13 Environmental management measures – operational traffic and transport

Ref	Phase	Impact	Environmental management measures	Location*
OT1	Operation	Operational traffic	A review of operational network performance will be carried out 12 months and five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections. The assessment will be based on updated traffic data at the time and the methodology used will be comparable with that used in Appendix F (Technical working paper: Traffic and transport) of the environmental impact statement. Where required, additional feasible and reasonable mitigation measures will be identified in consultation with Department of Planning, Industry and Environment and the relevant council to manage any additional traffic performance impacts identified during the review of operational network performance.	BL/GHF
OT2	Operation	Impacts on local roads	Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network. Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable.	BL/GHF

*BL = Beaches Link, GHF = Gore Hill Freeway Connection