8 Traffic and transport

This chapter provides a summary of the potential traffic and transport impacts from the construction and operation of the project, and how the desired performance outcomes would be met. An overview of this chapter is provided in **Table 8-1**. The full assessment of traffic and transport impacts is provided in **Appendix D** (Traffic and transport technical report).

Table 8-1 – Chapter overview

Chapter overview	Section
An overview of the assessment approach including the study area, the traffic forecasting and modelling methodology and the assessment criteria	**Section 8.1**
An outline of the existing traffic and transport environment within the study area	**Section 8.2**
A summary of the existing road network performance in the 2014/15 'base case' scenario	**Section 8.3**
An overview of the key potential traffic and transport impacts during construction of the project	**Section 8.4**
A summary of key findings for forecast conditions on the future road network without the project	**Section 8.5**
An overview of high level patterns across parallel strategic corridors within and external to the study area to examine how traffic may shift between alternative parallel routes or corridors through the study area	**Section 8.6**
A summary of key findings for forecast conditions on the future road network with the project in the future forecast years (2026 and 2036), including the Sydney metropolitan road network, the F6 Extension Stage 1 motorway and the modelled network around the President Avenue intersection and the St Peters interchange	**Section 8.7**
An overview of key findings for forecast conditions on the future road network in the 2036 ' cumulative' scenario	**Section 8.8**
An outline of the traffic and transport management and mitigation measures for the construction and operational phases of the project	**Section 8.9**
An environmental risk analysis for key forecast traffic and transport impacts	**Section 8.10**

Table 8-2 sets out the SEARs relevant to traffic and transport and identifies where the requirements have been addressed in this EIS.

Table 8-2 SEARs - Traffic and transport

SEARs	Where addressed in this EIS
1. The Proponent must assess construction transport and traffic (network, vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	
• a considered approach to route identification, including for spoil haulage, and scheduling of transport movements, particularly outside standard construction hours;	**Section 8.4.4**
• the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements);	**Section 8.4.4**
• construction worker parking;	**Section 8.4.5**
• the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking demand and arrangements including adequate parking for sports games);	**Section 8.4.3 and 8.4.4**
• access constraints and impacts on public transport, pedestrians and cyclists;	**Section 8.4.5**
• how construction of the project affects the condition and capacity of, and the need to close, divert or otherwise reconfigure elements of the local road, cycle and pedestrian network and public carparks;	**Section 8.4.5**
• details on construction scheduling and management to maintain traffic capacity along President Avenue and sports field parking during construction.	**Section 8.4.5**

SEARs	Where addressed in this EIS
• details of how construction and scheduling of works would be coordinated in regard to public events and cumulative traffic impacts resulting from concurrent work on the project and other major projects, under or preparing for or commencing construction in the vicinity of the proposal;	**Section 8.4.5**
• alternatives to road transport of construction spoil including rail options as well as potential re-use in proposed fill areas or in association with Resource Recovery Exceptions (if obtained from the EPA) to minimise traffic impacts on the road network; and	**Chapter 5** **Chapter 21**
• the likely risks of the project to public safety, paying particular attention to recreational users of open space in the area including Rockdale Bicentennial Park, Memorial Fields, Ilinden Sports Centre, Scarborough Park north, Barton Park and the Kogarah Golf Course.	**Section 8.4.5**
2. The Proponent must assess and model the operational transport impacts of the project including, but not necessarily limited to:	**Section 8.7**
• 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 networks; including potential shifts of traffic movements on alternate routes inside and outside the proposal area (such as toll avoidance) and impact of any permanent road closures directly attributable to the SSI;	**Section 8.7**
• impacts on access to and parking for commercial centres and health and education facilities within the vicinity of the project;	**Section 8.7**
• travel time analysis;	**Section 8.7**
• performance of key interchanges and intersections by undertaking a level of service analysis at key locations;	**Section 8.7**
• wider transport interactions (local and regional roads, cycling, public and freight transport);	**Section 8.7**
• 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;	**Section 8.7**
• impacts on cyclists and pedestrian access and safety;	**Section 8.7**
• opportunities for active transport, including new and integrated cycling and pedestrian elements connecting to surrounding networks;	**Section 8.7**
• property and business access and on street parking; and	**Section 8.7**
• an explanation for the scope of the modelled area, including justification of the nominated boundaries.	**Section 8.1**
3. The operational transport impact assessment must consider both operation of the Project (Stage 1) in isolation and as part of the overall F6 Extension Proposal, the WestConnex projects and other relevant motorway projects.	**Section 8.1** **Section 8.7**

8.1 Assessment approach

8.1.1 Relevant guidelines and policies

The following guidelines were followed in carrying out the assessment of traffic and transport impacts presented in **Appendix D** (Traffic and transport technical report):

- *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads 2013)
- *Traffic Modelling Guidelines* (Roads and Maritime 2013)
- *Guide to Traffic Generating Developments Version 2.2* (NSW Roads and Traffic Authority (RTA) 2002).

8.1.2 Traffic forecasting and modelling

Traffic modelling for the project was undertaken to make best use of the available data, trends and future projections to determine base (existing) conditions and make realistic predictions about the future traffic conditions for the project and the surrounding road network (in terms of estimating travel demand and traffic volumes). These predictions about future traffic conditions were then used to assess the operational performance of the road network, in scenarios with and without the project.

Traffic modelling for the project included metropolitan area network modelling (strategic modelling) and local level operational modelling. This approach included:

- Strategic modelling – an analysis of changes to traffic that may occur at a metropolitan or 'strategic' level, including scenarios without the project and with the project, as well as other major road network and public transport developments, and factors such as changes in land use patterns and major developments
- Operational traffic network performance modelling – a more detailed analysis of changes to traffic conditions that occur on individual roads and intersections.

These two types of traffic models and their use in developing traffic demand forecasts and assessing the traffic impacts from the project are summarised in the following sections and described in detail in Chapter 4 of **Appendix D** (Traffic and transport technical report).

Study area

The study area for the traffic and transport assessment for the project broadly encompasses an area extending from St Peters in the north to Kogarah in the south, as shown in **Figure 8-1**. The extent of the study area and the areas requiring operational modelling assessment were determined through analysis of forecast traffic flow differences as a result of the project, derived from the Sydney Strategic Motorway Planning Model (version 1) (SMPM), a strategic traffic model that covers the Sydney metropolitan area.

The extents of the operational model areas generally encompasses roads where the forecast largest local impact would occur during the AM and PM peak hours. These are generally around the interface points between the project and the surface road network, namely the President Avenue intersection and the St Peters interchange. Further justification of the operational modelling areas is contained in Annexure A of **Appendix D** (Traffic and transport technical report).

High level patterns across parallel strategic corridors within and external to the study area to examine how traffic may shift between alternative parallel routes or corridors through the study area are also assessed through a screenline analysis (see **section 8.6**).

LEGEND

- Traffic study area boundary
- New M5 surface road
- New M5 tunnel
- Road
- Waterway
- Railway line
- Parks and recreation

Figure 8-1 Study area for the traffic and transport assessment

Traffic modelling and forecasting approach

To ensure the modelling is as representative as possible, a staged approach was used to develop the traffic model:

- Stage 1 – Traffic demand forecasts were developed taking into consideration a number of factors including but not limited to: historical demands (traffic counts and surveys), current and future mode choice factors, toll behaviour factors, land use projections (population and employment locations) and induced demand
- Stage 2 – Future year traffic demands were developed for scenarios with and without the project. This provides an analysis of the projected future (2026 and 2036) year traffic demands based on the information derived from Stage 1
- Stage 3 – The operational impact of the project was assessed by applying the anticipated impact of the 'With project' scenarios to the 'Without project' scenarios to determine the impacts of the project.

A summary of each stage is provided in the following sections. A detailed description of the traffic forecasting and modelling approach is included in section 4.2 of **Appendix D** (Traffic and transport technical report).

Stage 1 – Traffic demand forecasting

Sydney Strategic Motorway Project Model

The SMPM is a strategic model that is developed and operated by Roads and Maritime. The SMPM uses data from across the Sydney metropolitan area and provides a platform to understand changes in future weekday travel patterns under different land use, transport infrastructure and pricing scenarios. The SMPM includes:

- Anticipated changes and upgrades to the road network for the modelled Sydney metropolitan area
- Anticipated future land uses as a basis for estimating future travel demand for light and heavy vehicles
- Accommodation of different motorist behaviours, including mode choice and willingness to pay a toll to save travel time
- Induced traffic.

The key objective of the SMPM demand modelling was to forecast traffic demand and growth in traffic volumes on key roads in the study area, based on expected population and employment changes and proposed road network improvements. From this, the forecast growth in travel demand and traffic volumes on the road network were derived for each traffic modelling scenario for application in the more detailed operational modelling.

A detailed description of the traffic demand forecasting modelling approach, including the SMPM structure and data inputs, is provided in section 4.2.1 of **Appendix D** (Traffic and transport technical report).

Traffic modelling scenarios

Table 8-3 outlines the seven traffic modelling scenarios that were used to inform the assessment of the traffic and transport related impacts of the project. The scenarios were modelled in the SMPM by combining forecast future year demands with future road networks.

All future scenarios with and without the project ('Do minimum', 'Do something' and 'Cumulative') assume that other on-going improvements would be made to the broader transport network including some new infrastructure and intersection improvements to improve capacity and to cater for forecast traffic growth.

No operational 'Cumulative' scenario is required for 2026 as no additional projects, not already considered in the 2026 'Do something' scenario, are expected to have a significant impact on traffic volumes in the study area.

Table 8-3 Traffic modelling scenarios

Modelling scenario	Model year	Existing road network	F6 Extension Stage 1	Kogarah to Loftus	NorthConnex	WestConnex program of works	Sydney Gateway	Western Harbour Tunnel	Beaches Link	Impact measured
Base case	2014/ 2015	✓								N/A
Construction	2021	✓								Construction impacts on the existing road network.
Operation 'Do minimum'	2026	✓			✓	✓	✓			Consequence of not proceeding with the project on the existing network.
Operation 'Do something'	2026	✓	✓		✓	✓	✓			Operational impacts associated with the completion of the project
Operation 'Do minimum'	2036	✓			✓	✓	✓			Consequence of not proceeding with the project on the existing network.
Operation 'Do something'	2036	✓	✓		✓	✓	✓			Operational impacts associated with the completion of the project.
Operation 'Cumulative'	2036	✓	✓	✓	✓	✓	✓	✓	✓	Operational impacts associated with the operation of the project, and proposed future motorway projects.

Stage 2 – Future year traffic demand for operational assessment

The SMPM was used to generate base and future year traffic demand for the weekday AM and PM peak hours. From this, the forecast growth in travel demand and traffic volumes on the road network were derived for each scenario for application in the more detailed operational modelling.

This growth in travel demand and traffic volumes was then applied to the balanced estimation of intersection turning movements, derived from traffic surveys undertaken on the road network, which was then used to create the traffic flows used in the future year operational modelling (consistent with practices described in Roads and Maritime modelling guidelines).

This approach makes the best use of observed traffic count data as the basis for future year travel demand and traffic volumes and patterns, providing the most accurate representation of how the modelled increase in future traffic would affect existing observed network travel demands and the resultant network operation.

Stage 3 – Operational traffic modelling assessment

Interchanges and surrounding road network

While the SMPM provides strategic travel demand forecasts across the Sydney metropolitan area, more detailed operational models were required to evaluate operational impacts on the surrounding road network in the study area. The extents of the operational model areas generally covered roads where the forecast change in traffic volumes (with and without the project) would likely cause a substantial impact on the operation of the road network.

The operational modelling area is divided into three locations:

- The President Avenue intersection and the surrounding road network
- The mainline tunnels of the project
- The St Peters interchange and surrounding road network.

The type of operational traffic model used to assess the project traffic and transport impacts at each of the three locations listed above was selected based on the size and the composition (i.e. the number of intersections) of the road network at each location, as follows:

- The study area surrounding the President Avenue intersection extends from Jubilee Avenue in the south to Cooks River in the north, and from Princes Highway in the west to Grand Parade in the east. The area encompasses more than 50 intersections. Two separate models were developed for the area surrounding the President Avenue intersection:
    - A VISUM model was developed to cover the wider area around the President Avenue intersection. This model uses Intersection Capacity Analysis (ICA) to assign traffic routes in response to congestion and considers a range of intersection characteristics (e.g. number of lanes / lane usage, signal timings, hierarchy of priorities, traffic turning volumes and composition, and gap acceptance and follow up times) as well as having the capacity to model queuing
    - A Vissim microsimulation model was developed for the President Avenue corridor to assess the localised operational impacts on the entry and exit ramps, and a number of key intersections such as Princes Highway and President Avenue. This model uses the results of the VISUM model, taking into account forecast route choice changes in the wider area
- The mainline tunnels between St Peters Interchange and President Avenue intersection were assessed using a Vissim microsimulation model
- Paramics microsimulation was used to assess impacts around the St Peters interchange as the study area is relatively small (based on analysis of forecast SMPM traffic volume differences) and microsimulation captures the operational impacts at the entry and exit ramps. The Paramics model used in the assessment of WestConnex M4-M5 Link impacts (M4-M5 Link: Traffic and transport technical report, August 2017) formed the basis for the assessment but was adapted for the project.

A detailed description of the operational models is provided in section 4.2.3 of **Appendix D** (Traffic and transport technical report).

Base year model development – operational

Base year models that replicate existing traffic conditions for the operational modelling areas around the President Avenue intersection and the St Peters interchange were developed, calibrated and validated to simulate the operation of the existing road network under present day traffic demands. The base year model extents at each of the interchange locations are shown in **Figure 8-2** and **Figure 8-3**. A detailed description of the calibration and validation process for the base year models is provided in section 4.2.3 of **Appendix D** (Traffic and transport technical report).

Future year model development – operational

Following the calibration and validation of the AM and PM peak period base year simulation models, future year networks and traffic demands were developed for 2026 and 2036 to assess the future performance of the road networks in the operational traffic modelling study areas.

The forecast traffic demand and growth in traffic volumes on key roads in the project area forecast in the SMPM was used to grow the demands from the base year (2014/2015) to the relevant future year in the operational models (2026 or 2036). While the operational traffic models forecast three to four hour peak periods, SMPM forecasts typical one hour peak (AM and PM) volumes. To reflect typical traffic demand profiles on either side of the peak hours, the forecast one hour volumes derived from the SMPM were extrapolated across the two to four hour peak periods for the operational traffic models.

In some cases, the forecast one hour future demand derived from the SMPM would exceed the physical road capacity. Where this is the case, the calculated future excess demand is distributed into the hours before and after the peak hour in the operational models to correspond with anticipated peak spreading, effectively predicting longer peak periods in future scenarios at some locations.

Construction traffic modelling and assessment

Based on the planned construction activities described in **Chapter 7** (Construction), a worst-case construction traffic scenario was assumed to be the period of spoil removal from tunnel construction during 2021. The current road network surrounding the construction sites and the road network associated with the New M5 project currently under construction is assumed for the road network in the construction scenario.

Base year construction models were developed in LinSig[1] as the impact of relatively small volume changes associated with the addition of construction-related vehicles is more easily identified in detailed intersection models such as those prepared using LinSig than the detailed models prepared for the operational modelling. This is a similar approach to that used in the previous motorway project construction impact assessments (e.g. M4 East, New M5 and M4-M5 Link). The construction models were calibrated in a similar manner to that described for the operational models.

AM and PM peak hour VISUM operational models were developed for 2021 to assess the future performance of the road network during construction. In a similar way to the future operational demand volumes, the growth forecast by the SMPM was used to derive the background traffic demand for 2021.

Construction traffic was then added to the background traffic demand. Construction traffic was based on the proposed construction methodology, including estimates of the number of heavy and light construction vehicles that would be generated by the project and the traffic routes to and from the various construction ancillary facilities (see **Chapter 7** (Construction) for further detail about construction traffic volumes and routes). The forecast performance of the intersections in the vicinity of the construction ancillary facilities was then calculated.

[1] LinSig is a software tool that allows traffic engineers to model traffic signals and their effect on traffic capacities and queuing.

Figure 8-2 President Avenue intersection operational model boundaries (VISUM and Vissim)

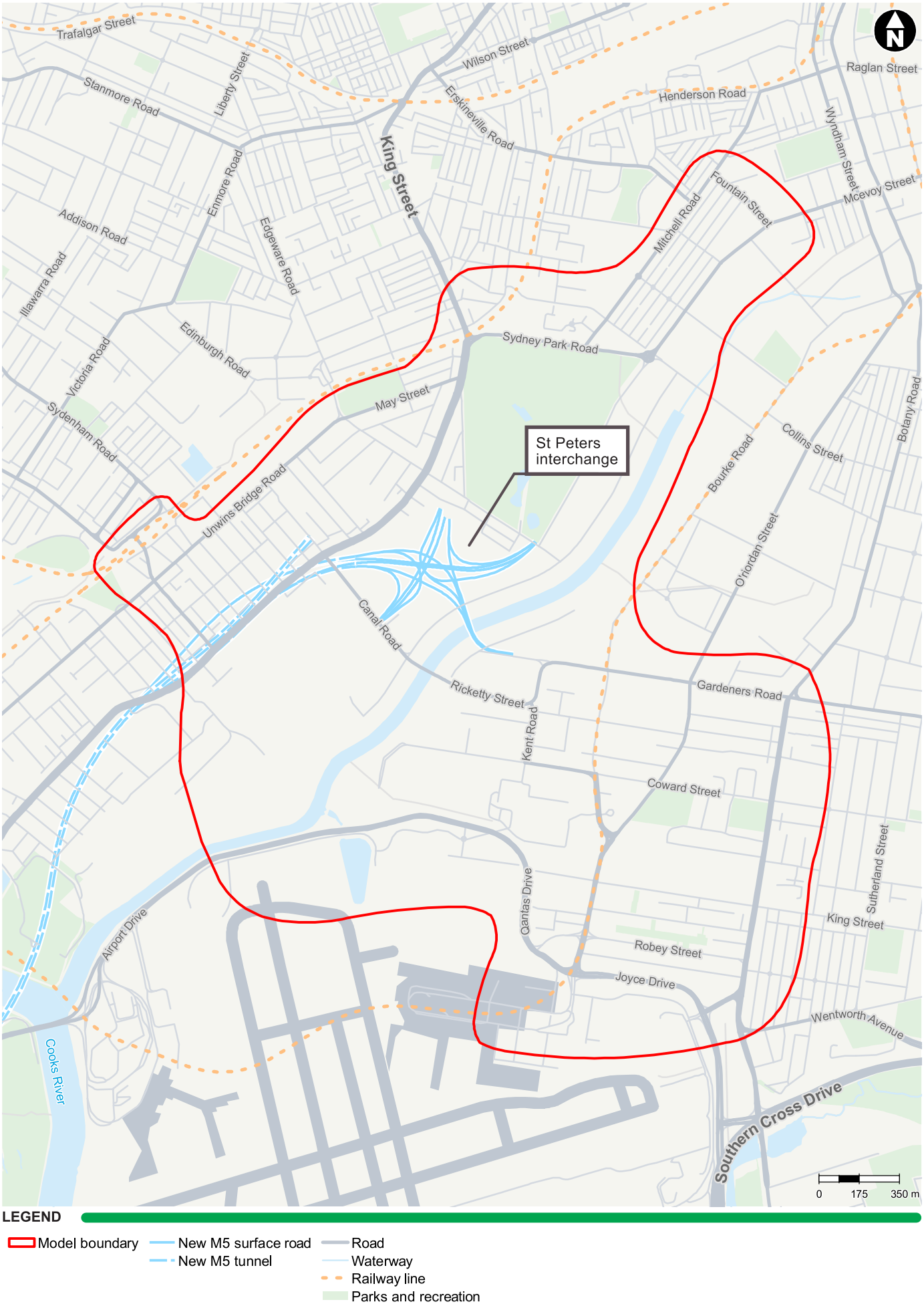


Figure 8-3 St Peters interchange operational model boundaries

8.1.3 Assessment criteria

Traffic operational performance can be assessed in several ways, including:

- At a network level, including total distance travelled and total time travelled within the modelled network
- For single-point assessment:
  - At a mid-block level (i.e. the volume of vehicles crossing an arbitrary line at a chosen point some distance away from an intersection), showing changes to travel routes and potential traffic and transport impacts (adverse and beneficial) as a result of these changes
  - At an intersection level, showing changes to the performance of intersections, which are typically constraining elements of urban road networks.

The operation of the modelled road network as a whole is regarded as being of prime importance, as this takes into account that there may be certain locations (i.e. an intersection) where there may be improvement, while others may deteriorate in performance.

Motorway intersection network performance

Microsimulation software was selected for detailed network and intersection analysis due to its ability to model individual vehicle interactions, traffic signal effects, overtaking manoeuvres, and queuing. For detailed network and intersection analysis, modelling parameters collected and reported for the AM and PM peak hours include:

- Total vehicle demand – number of vehicles wanting to use the modelled network
- Vehicle kilometres travelled – total distance travelled by vehicles travelling through the modelled network
- Vehicle time travelled approaching and in network – the total time taken by vehicles to enter and drive through the modelled network
- Total vehicles arrived – the number of vehicles completing their journey on the network
- Average speed of vehicles – the average speed at which vehicles travel through the network. Calculated by dividing the vehicle kilometres travelled (VKT) by the vehicle time travelled. Generally, the higher the speed, the better the network operates
- Travel time for typical cross-network trips – the time taken by vehicles to travel between two points in the network. Used as a comparison of how the network is performing, although with changes in the network, vehicles can take different routes between points
- Unreleased demand at the end of peak hour (microsimulation only) – the number of vehicles unable to enter the model due to congestion extending back to model entry points. The number of 'unreleased' vehicles is an indication of the effectiveness of the network. Generally, the lower the number of unreleased vehicles, the better the network is able to accommodate travel demand.

Level of service

Level of service (LoS) is a measure to describe the operational conditions and efficiency of a roadway or intersection as perceived by motorists and/or passengers, and generally includes:

- Speed and travel time
- Freedom to manoeuvre
- Traffic interruptions
- Comfort and convenience
- Road safety.

LoS is measured on a scale from A to F, with A representing optimal operating conditions and F representing worst operating conditions. Typically, assessment of a roadway or intersection is generally required when conditions fall below LoS D, however in general, users of the surface road network in the study area experience LoS E and LoS F frequently during the AM and PM peak periods.

Motorway levels of service

The level of service for freeway or motorway sections where the design speed is greater than 70 kilometres per hour, is calculated from the vehicle density, which is the traffic volume divided by the average passenger car speed. Density is measured in passenger car units (PCU[2]) per kilometre per lane (PCU/km/ln). The assessment of level of service for the mainline tunnels used these density measurements.

The level of service for freeway or motorway sections where the design speed is 70 kilometres per hour or less, mainly on entry and exit ramps, is calculated from the volume over capacity (V/C) ratio, which is the traffic volume divided by the capacity of the roadway. The assessment of level of service for the entry and exit ramps used these V/C ratios.

Due to the existing congested traffic conditions experienced on the surface road network in the study area during peak periods, network performance and intersection LoS are reported for the surface road network instead of mid-block LoS.

Intersection levels of service

Average delay is commonly used to assess the operational performance of intersections, with LoS used as an index. A summary of the intersection LoS criteria is shown in **Table 8-4**.

For the purpose of analysing intersection performance in this assessment, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed. This allows for an assessment of the intersections within the modelled network, irrespective of any downstream queuing that would mask the actual operation of the intersection.

Similar to the mid-block performance measures, common practice suggests that when intersection performance falls to LoS D, investigations should be initiated to determine if suitable remediation can be provided. However, limited road capacity and high demand during peak periods mean that LoS E and LoS F are regularly experienced by motorists at pinch points on the existing strategic road network in the study area, generally during the AM and PM peak periods.

Table 8-4 Level of service criteria for intersections

LoS	Average delay / vehicle (sec/veh)	Traffic signals / roundabouts	Give way and stop signs
A	≤ 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents would cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: *Guide to Traffic Generating Developments*, RTA 2002

[2] PCU = passenger car unit. This accounts for the amount of road space differing types of vehicles use, with heavy vehicles or buses taking up more space than cars or light commercial vehicles.

8.2 Existing environment

8.2.1 Introduction

This section provides an overview of the existing traffic and transport environment within the study area. A detailed description of the existing traffic and transport environment is included in Chapter 5 of **Appendix D** (Traffic and transport technical report).

This overview includes the areas around the President Avenue intersection, the St Peters interchange and the corridor between the two. All data presented in this section represents the base case or existing traffic and transport conditions and is founded on the latest publicly available information.

8.2.2 Existing road network constraints within the study area

There are a number of constraints that restrict access in the study area, including:

- Topographical constraints to network development

  Limited waterway crossings between southern Sydney and areas of Sydney to the north and west are a key constraint on accessibility. Wolli Creek and the Cooks River create natural 'pinch points' between the project area and other parts of Greater Sydney to the north and west, given the constrained number and capacity of roads traversing these waterways as well as the complexity of expanding capacity.

  The pinch points include:

  – Marsh Street at the crossing of Cooks River (Giovanni Brunetti Bridge)

  – General Holmes Drive at Cooks River (Endeavour Bridge)

  – Princes Highway at Cooks River (Princes Highway Bridge)

  These topographical constraints create a funnelling effect where through traffic competes with local traffic for limited driving space on those roads. The result is long journey times and weakened network resilience, particularly during the AM and PM peak periods.

- Local road congestion where different trip types converge

  The current road hierarchy does not efficiently separate competing traffic movements, with through traffic using the same roads as local traffic. This contributes to congestion, resulting in:

  – Long and unreliable through journeys

  – Inefficient and unreliable local journeys

  – Low resilience on the road network linking southern Sydney and the Sydney CBD

  This is particularly apparent on local and arterial roads surrounding the Princes Highway. Congestion on the Princes Highway currently results in displacement of traffic onto sub-arterial and other lower-order roads, with those roads subsequently performing the role of the arterial road network, a task for which they were not designed.

  The volume of heavy vehicles on The Grand Parade often exceeds the Princes Highway. The proportion of heavy vehicles on West Botany Street and The Grand Parade also often exceed that on Princes Highway, with heavy vehicles making up around seven per cent of total vehicles on West Botany Street and around 13 per cent of total vehicles on The Grand Parade, at locations close to President Avenue.

8.2.3 President Avenue intersection

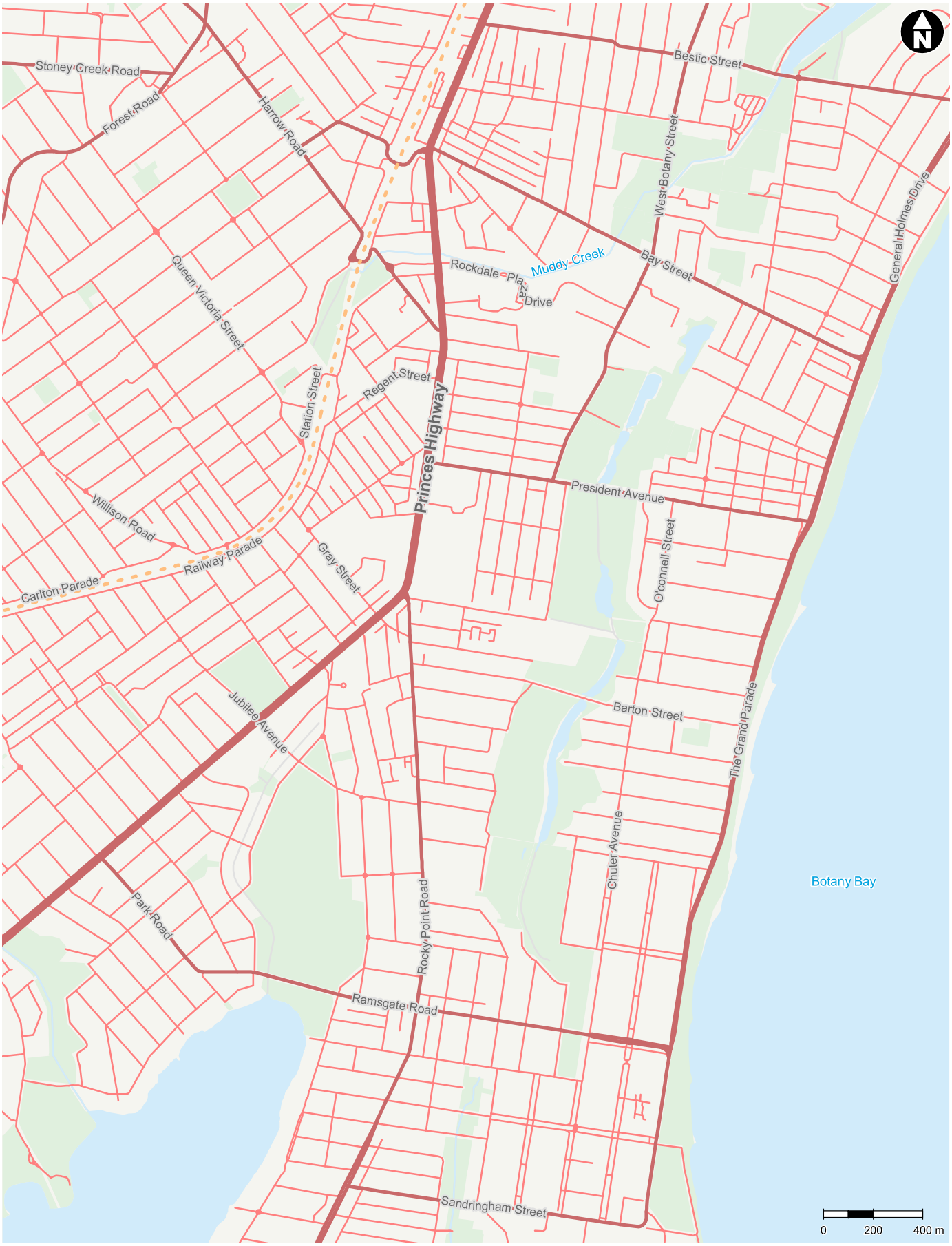
The southern connection of the project to the surface road network would be at President Avenue, Kogarah, within the existing F6 reserved corridor and within an area of Rockdale Bicentennial Park. President Avenue was identified as the best option for this connection for a number of reasons, including motorway gradient considerations, connectivity with the arterial road network including the Princes Highway and Grand Parade, and the ability to locate the intersection within the existing F6 reserved corridor, therefore minimising impacts on land and property.

In addition to Rockdale Bicentennial Park, other existing land uses in the vicinity of the proposed interchange include the Ilinden Sports Centre located immediately west of Rockdale Bicentennial Park, Scarborough Park south of President Avenue, low to medium-density residential streets in the suburbs of Rockdale, Brighton-Le-Sands, Kogarah, and Monterey, local and arterial roads, and several local and regional centres including Rockdale, Brighton-Le-Sands and Kogarah Town Centres as well as St George Hospital. Commercial and light industrial land uses are present along West Botany Street north of President Avenue.

In the wider surrounding area, the Illawarra and South Coast Line rail is located west of the proposed interchange, and there is residential land use within the surrounding suburbs of Sans Souci, Allawah, Bexley and Kyeemagh. The Kogarah TAFE, Rockdale Plaza and the restaurants / cafes along The Grand Parade are also key trip attractors in the area.

The key roads in the vicinity of the President Avenue intersection and surrounds are shown in

Figure 8-4 and include the Princes Highway, The Grand Parade, President Avenue, West Botany Street and Bay Street. A description of each of these key roads is provided in section 5.3 of **Appendix D** (Traffic and transport technical report).



LEGEND

- Arterial road
- Subarterial road
- Local road
- Waterway
- Railway line
- Parks and recreation

Figure 8-4 Road network around the President Avenue intersection

Modes of travel

Travel mode share for Statistical Areas Level 3 (SA3s) in 2015/16 have been used. SA3s are geographical areas used by the Australian Bureau of Statistics and other agencies for the output of data. The area around the President Avenue intersection site is located in the Kogarah – Rockdale SA3. Travel mode share for this SA3 compared with the Sydney Greater Metropolitan Area (Sydney GMA) is shown in **Table 8-5**.

The Kogarah - Rockdale SA3 has a travel mode share similar to that of the Sydney GMA. The most noticeable difference is that there are a higher proportion of rail trips for the Kogarah – Rockdale SA3 which has a rail mode share of 11 per cent compared with the Sydney GMA rail mode share of six per cent. This is a reflection of transport connections provided by the Sydney Trains T4 Eastern Suburbs and Illawarra Line which services the Kogarah – Rockdale SA3.

Table 8-5 Average weekday travel mode share for Kogarah – Rockdale SA3 and Sydney GMA

Area	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Kogarah – Rockdale SA3	44%	22%	66%	11%	6%	14%	2%
Sydney GMA	48%	21%	69%	6%	6%	17%	2%

Source: Transport for NSW (TfNSW), Household Travel Survey: Sydney 2015/16 data, accessed via Statistical Area Level 3 (SA3) Viz & Sydney SMA Regions Viz

Public transport services

Rail services

The area around the President Avenue intersection is served by the Sydney Trains T4 Eastern Suburbs and Illawarra Line. The closest station to the President Avenue intersection site is Kogarah Station, which is located just over one kilometre to the west of the future interchange.

Table 8-6 shows the train services at Kogarah Station. There is a train every 10 minutes to the Sydney CBD in the AM peak and from the Sydney CBD in the PM peak.

Table 8-6 Weekday rail service frequency

Station	Line	AM peak1		PM peak2	
		No. services	Average frequency (mins)	No. services	Average frequency (mins)
Kogarah	T4 Eastern Suburbs & Illawarra Line	12	10	12	10

Notes: [1]7.00 am–9.00 am to city, [2]4.00 pm–6.00 pm from city
Source: Sydney Trains, 2017

Bus services

Bus services around the President Avenue intersection site and surrounds are provided by State Transit and Transdev NSW bus operators. The bus routes servicing the President Avenue intersection site and surrounds are shown in **Figure 8-5** (State Transit) and **Figure 8-6** (Transdev NSW). The bus routes provide a mixture of regional connections between activity centres, and local connections that complement the rail service provision.

The bus routes operating in the vicinity of the President Avenue intersection are summarised in **Appendix D** (Traffic and transport technical report).

In addition to the train services from Arncliffe, International Airport and Wolli Creek stations, bus route 422 also travels to the Sydney CBD with frequencies of 30 minutes at Kogarah in the AM and PM peaks. Two loop services provide a local area connection for the suburbs of Kyeemagh and Dolls Point to Rockdale Station. The bus routes also provide connections to Bondi Junction to the east, Sans Souci and Miranda to the south, Hurstville to the west, and Kingsgrove, Roselands and Burwood to the north-west.

To provide an indication of the on-time performance of bus services in the President Avenue interchange area, available service running time data for bus route 410 (Bondi Junction to Rockdale) was reviewed for March and October 2017. The available data indicated that services outside of the AM and PM peak periods were generally able to operate about five minutes or less within the scheduled time. However, during the worst AM and PM peak hours, services ran on average around 10 or more minutes late.

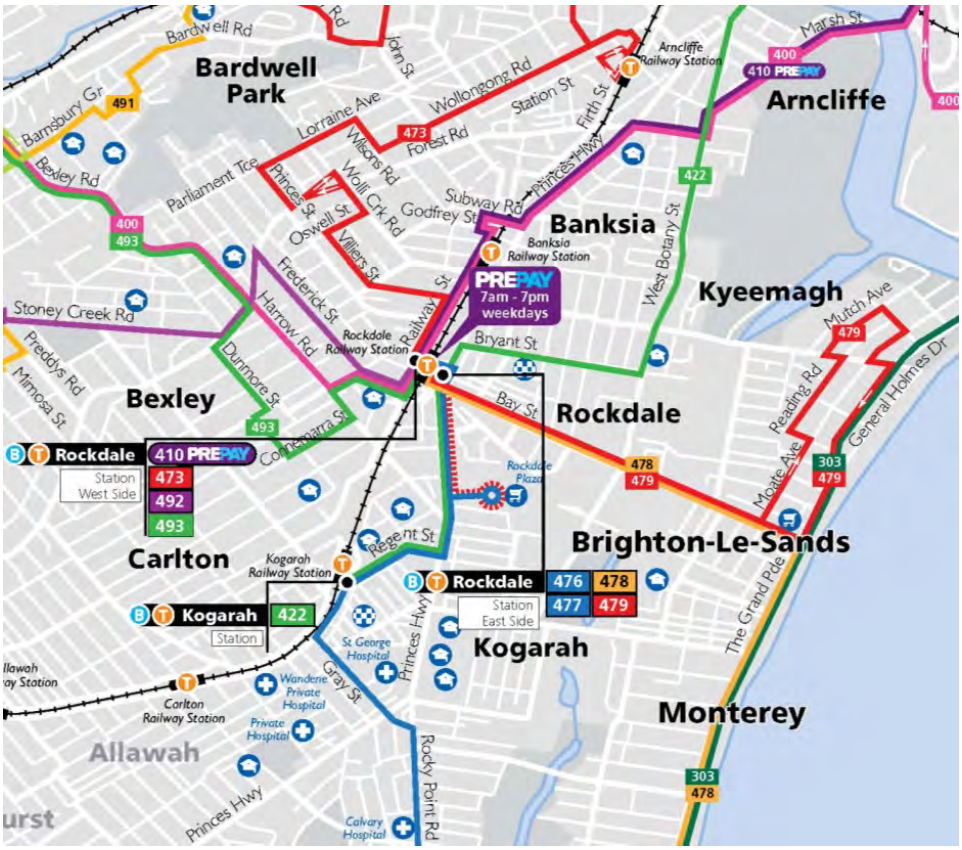


Figure 8-5 Bus routes around the President Avenue intersection site operated by State Transit

Source: State Transit, November 2017

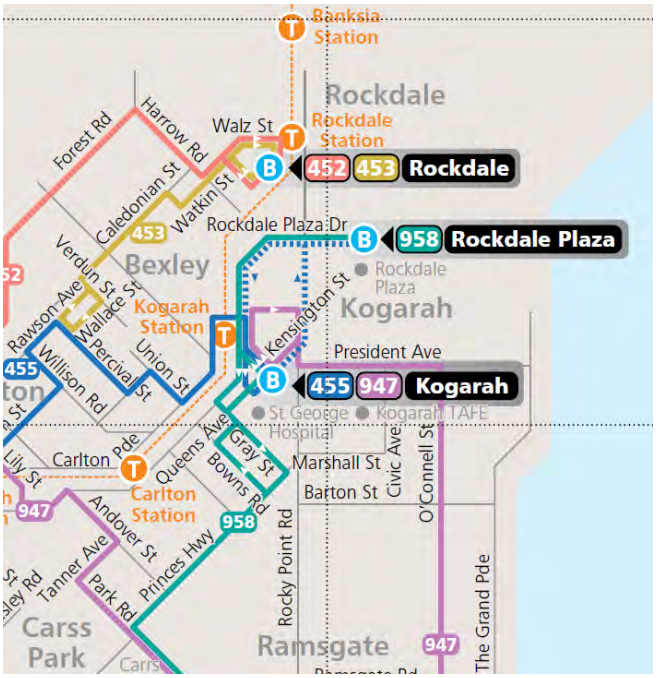


Figure 8-6 Bus routes around the President Avenue intersection site operated by Transdev

Source: Transdev, November 2016

Walking and cycling facilities

Land uses around the President Avenue intersection area include recreational, commercial, and residential uses. The walking and cycling facilities within the study area vary with each of the different land use types and trip generators. Missing active transport links constrain access by walking and cycling between southern Sydney and areas north and west. This limits the ability to achieve a higher active transport mode share, which is a priority for the NSW Government. The project area around the President Avenue intersection has gaps in the shared cycle and pedestrian pathways where there is no continuous off-road path or dedicated lanes for cyclists. This means that for sections of their journey, cyclists must share busy roads with cars, trucks and buses.

Pedestrian connectivity

A number of walking trails are located close to the President Avenue intersection area, including the Cook Park Trail, Scarborough Ponds Trail and Rockdale Wetland Trail. The key roads in the vicinity of the President Avenue intersection include multi-lane roads that carry high volumes of vehicles daily. These road corridors provide an environment that discourages pedestrian activity and also creates a barrier for pedestrian movement, with pedestrians needing to cross at either overhead pedestrian bridges, or at formal pedestrian crossings. In addition, the presence of commercial and recreational areas also creates barriers to pedestrian access between rail transit and trip attractors.

Cyclist connectivity

The President Avenue intersection area is located close to Botany Bay and close to the Cook Park cycleway, a north-south cycle route, which runs from San Souci to Wolli Creek along the Botany Bay foreshore. This cycleway connects in the north to the Cooks River Cycleway and the Bourke Street cycleway off-road cycle routes, which provide connections to the west and north. It also joins south to the Captain Cook Bridge providing cycle links south towards Kurnell. The majority of the cycleway is a shared pedestrian and cycle path.

The proposed President Avenue intersection falls within a five kilometre cycle radius of train stations on the Illawarra Line and the Airport and East Hills Line. Not all of these stations have recognised cycle links accessing stations, and several stations that have cycle links require cyclists to travel along routes that are of moderate or high difficulty.

The cycle network, within a five kilometre radius of the President Avenue intersection area is shown in **Figure 8-7**. Aside from the Cook Park Trail and trails through Bicentennial Park or Memorial Fields, the cycle links parallel to the project are listed as medium to high difficulty on-road cycle routes.

Figure 8-7 Excerpt from RMS Active Transport Catchment and Cycling Map – 5km radius of President Avenue intersection area

Existing traffic volumes and patterns

Table 8-7 provides the existing AM peak hour, PM peak hour and AWT flows for the key road corridors in the vicinity of the President Avenue intersection. At some locations, only peak hour volumes were available.

Roads running north–south experience higher traffic flows in the northbound direction during the AM peak hour and in the southbound direction during the PM peak hour. A number of locations have a high proportion of heavy vehicles during peak hours, and AWT volumes on President Avenue, Princes Highway, The Grand Parade and West Botany Street indicate that on a typical weekday, five per cent or more of traffic using these roads is composed of heavy vehicles (HCV).

Table 8-7 Average peak mid-block traffic volumes at key locations around President Avenue intersection and surrounds (2015-2017 count data)

Location	Direction	AM peak hour		PM peak hour		AWT flow[2]	
		veh/hr[1]	HCV[3] %	veh/hr[1]	HCV%	veh/day	HCV%
President Avenue, west of Oakdale Avenue	Eastbound	1,530	9%	940	7%	17,580	8%
	Westbound	970	8%	1,390	6%	18,670	8%
President Avenue, east of Civic Avenue	Eastbound	1,010	10%	1,090	6%	16,500	7%
	Westbound	1,050	7%	1,090	7%	16,380	7%
Princes Highway, north of President Avenue	Northbound	2,530	3%	1,410	2%	-	-
	Southbound	620	9%	1,940	1%	-	-
Princes Highway, north of Rocky Point Road	Northbound	3,780	3%	1,760	2%	35,660	5%
	Southbound	1,180	6%	3,230	2%	32,920	5%
The Grand Parade, north of President Avenue	Northbound	2,710	6%	1,660	2%	-	-
	Southbound	1,060	7%	3,600	1%	-	-
The Grand Parade, south of Bath Street	Northbound	1,820	20%	950	8%	17,990	12%
	Southbound	570	15%	2,330	13%	22,380	13%
O'Connell Street, north of Banks Street	Northbound	1,330	2%	380	1%	-	-
	Southbound	220	3%	790	1%	-	-
West Botany Street, north of Green Street	Northbound	1,060	8%	530	4%	10,300	7%
	Southbound	530	8%	950	6%	10,610	7%

Source: Traffic surveys (2015-2017)

Table notes:

[1] Vehicles per hour (veh/hr) and vehicles per day (veh/day) rounded to the nearest 10

[2]AWT count data not available at all locations

[3] HCV % refers to the percentage of heavy vehicles that make up the total number of vehicles in the peak hour

8.2.4 St Peters interchange to President Avenue intersection corridor

The President Avenue intersection to St Peters interchange corridor accommodates high volumes of daily traffic, including freight, commuter and leisure trips. Limited waterway crossings create natural 'pinch points' in this corridor, given the constrained number and capacity of roads traversing these waterways, namely at the Princes Highway, Marsh Street and General Holmes Drive crossings of the Cooks River. These constraints cause through traffic to compete with local traffic for limited driving space on those roads, causing longer journey times and weakened network resilience.

This lack of separation of competing traffic movements results in displacement of traffic onto sub-arterial and other lower-order roads, with those roads subsequently performing the role of the arterial road network, a task for which they were not designed. There are also limited existing secondary and tertiary freight links in this corridor. The road freight hierarchy in the vicinity of the study area is shown in **Figure 8-8**.

Figure 8-8 Metropolitan (Sydney) Road Freight Hierarchy

Source: Excerpt from Metropolitan Road Freight Hierarchy on the State Road Network Practice Note, June 2011

Existing traffic volumes and patterns

Table 8-8 provides the existing AM peak hour, PM peak hour and AWT flows on key roads within the St Peters interchange to President Avenue intersection corridor. The table indicates roads running north–south experience higher traffic flows in the northbound direction during the AM peak hour and in the southbound direction during the PM peak hour.

Table 8-8 Average peak mid-block traffic volumes at key locations within the St Peters interchange to President Avenue intersection corridor (2015-2016 count data)

Location	Direction	AM peak hour		PM peak hour		AWT flow	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%[2]
Princes Highway, north of Banksia Avenue	Northbound	2,550	3%	1,220	2%	15,700	-
	Southbound	570	10%	1,870	2%	19,300	-
General Holmes Drive, south of Bestic Street	Northbound	3,900	3%	1,630	1%	32,600	-
	Southbound	1,530	6%	2,470	4%	34,800	-
West Botany Street, south of Spring Street	Northbound	970	7%	550	5%	12,000	7%
	Southbound	370	10%	1,240	6%	12,800	8%

Source: Traffic surveys (2015-2016), and data from Roads and Maritime online Traffic Volume Viewer

[2]HCV% not available at all locations

8.2.5 St Peters interchange and surrounds

The northern connection of the project is to the New M5 Motorway, where tunnel stubs are provided at Arncliffe as part of the New M5 Motorway project. This would provide an onward connection to both Sydney's strategic motorway network and to the surface road network via the St Peters interchange. Although no works are proposed at the St Peters interchange or on the surrounding surface roads as part of the project, the St Peters interchange would act as the nearest northern surface road connection for motorists using the project, and the interchange and surrounding roads have therefore been included in this assessment.

The St Peters interchange and associated local road upgrades are under construction as part of the New M5 Motorway project and were designed to facilitate the connection to the project, as well as a future link to the Sydney Airport and Port Botany. The interchange and associated local road upgrades are planned to be completed and open to traffic in 2020. The key roads in the vicinity of the project are shown on **Figure 8-9** and include the Princes Highway, King Street, Canal Road/Ricketty Street/Kent Road, Gardeners Road, Burrows Road, Campbell Road/Campbell Street, Euston Road and Bourke Road/Bourke Street. A description of each of these key roads is provided in section 5.5 of **Appendix D** (Traffic and transport technical report).

A summary of existing traffic volumes and patterns around the St Peters interchange and surrounds is provided in the following section. A detailed overview of the existing traffic and transport environment is provided in Chapter 5 of **Appendix D** (Traffic and transport technical report).

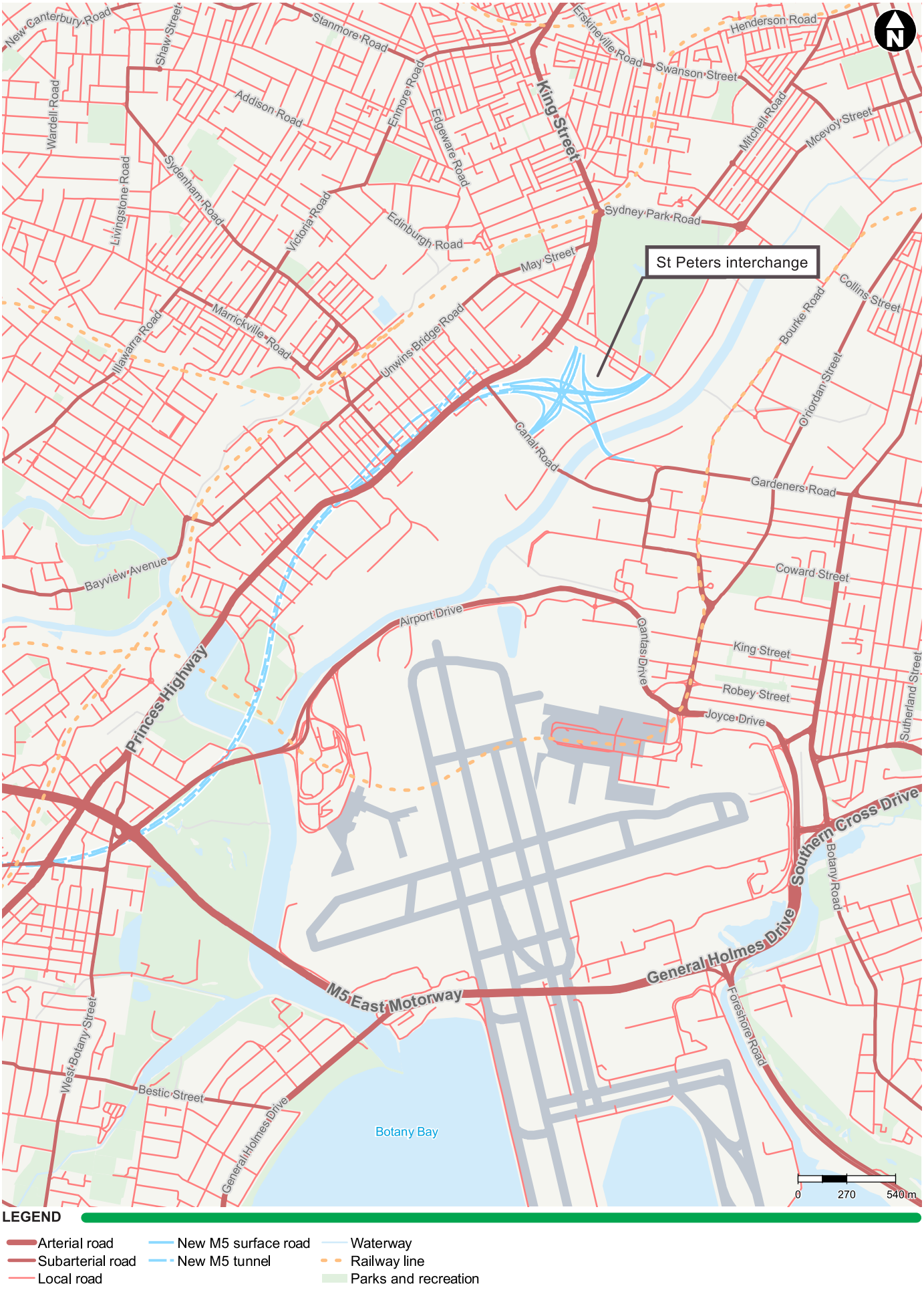


Figure 8-9 Road network around the St Peters interchange

Existing traffic volumes and patterns

Table 8-9 provides the 2014 AM peak hour, PM peak hour and AWT flows for the key road corridors in the vicinity of the St Peters interchange. Only peak hour volumes were available at some locations.

Roads running east-west experience higher traffic flows in the eastbound direction during the AM peak and in the westbound direction during the PM peak. The Princes Highway experiences higher traffic flows in the northbound direction during the AM peak and southbound direction during the PM peak. A number of locations indicate a high proportion of heavy vehicles (i.e. more than 10 per cent).

Table 8-9 Average mid-block traffic volumes at key locations around St Peters and surrounds (2014 count data)

Location	Direction	AM Peak		PM Peak		AWT Flow[1]	
		veh/hr	% HCV	veh/hr	% HCV	veh/day	% HCV
King Street, south of Alice Street	Northbound	1,020	5%	950	2%	-	-
	Southbound	780	7%	940	3%	-	-
Princes Highway, north of Campbell Street	Northbound	1,660	5%	980	3%	18,820	6%
	Southbound	560	9%	1,600	4%	17,370	7%
Princes Highway, south of Campbell Street	Northbound	1,720	11%	1,040	6%	19,680	9%
	Southbound	610	10%	1,550	9%	17,800	10%
Railway Road, west of Princes Highway	Eastbound	630	12%	640	4%	-	-
	Westbound	390	17%	550	5%	-	-
Princes Highway, south of Railway Road	Northbound	3,370	5%	1,600	5%	26,900	15%
	Southbound	780	10%	2,610	2%	25,440	17%
Euston Road, north of Campbell Road	Northbound	410	13%	190	7%	3,120	13%
	Southbound	200	23%	190	7%	2,560	16%
Euston Road, north of Sydney Park Road	Northbound	1,220	7%	600	5%	-	-
	Southbound	500	15%	1,330	5%	-	-
Campbell Road, west of Euston Road	Eastbound	860	9%	410	12%	7,530	11%
	Westbound	160	21%	320	13%	3,560	14%
Campbell Street, east of May Street	Eastbound	360	8%	320	8%	4,990	8%
	Westbound	140	16%	280	11%	2,990	12%
Edgeware Road, west of Edinburgh Road	Northbound	670	8%	800	3%	-	-
	Southbound	730	7%	780	1%	-	-
Ricketty Street	Eastbound	2,290	7%	1,160	9%	22,160	11%
	Westbound	960	17%	1,830	7%	20,610	12%
Gardeners Road, west of O'Riordan Street	Eastbound	1,090	13%	920	15%	14,240	14%
	Westbound	1,000	11%	1,120	12%	15,240	11%

Source: Traffic surveys (2014)

Table notes:

[1]AWT count data not available at all locations

[2] Vehicles per hour (veh/hr) and vehicles per day (veh/day) have been rounded to the nearest 10

8.3 Existing road network performance

This section outlines the existing road network performance within the President Avenue intersection corridor, St Peters interchange to President Avenue intersection corridor, and the St Peters interchange and surrounds study areas. The assessment of the existing operational performance of the surface road network around the President Avenue intersection and the St Peters interchange considered the following aspects of traffic performance:

- Network performance
- Intersection performance
- Travel times
- Traffic crashes.

The assessment of existing operational performance of the St Peters interchange to President Avenue intersection corridor looked at the existing speed and travel time performance along this corridor.

8.3.1 President Avenue intersection

Network performance

Table 8-10 presents the 2014/15 base scenario performance of the VISUM modelled road network for the President Avenue intersection and surrounds for the AM and PM peak hours. The low average speed (around 25 kilometres per hour in the AM and PM peak hours) experienced by vehicles traveling through the modelled network indicates the congested conditions on the road network.

Table 8-10 President Avenue intersection and surrounds modelled network performance – 2014/15 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (veh)	28,070	28,990
Total vehicle kilometres travelled in network (km)	81,220	86,010
Total time travelled approaching and in network (hr)	3,470	3,090
Total vehicles arrived	27,130	28,700
Average per vehicle in network		
Average vehicle kilometres travelled in network (km)	2.9	3.0
Average time travelled in network (mins)	7.4	6.4
Average speed (km/h)	23.4	27.9
Unreleased vehicles		
Unreleased demand (veh)[1]	0	0
% of total traffic demand	0%	0%

Source: AECOM (2018)

Intersection performance

Table 8-11 presents Vissim modelled intersection performance in the AM and PM peak hour for key intersections in the President Avenue corridor study area. **Table 8-12** presents VISUM modelled intersection performance in the AM and PM peak hour for key intersections in the wider modelled road network.

The intersection performance results indicate that:

- Modelled intersections within the Vissim modelled area operate at an acceptable level of service in the AM and PM peak hours
- Modelled intersection within the VISUM modelled area operate at an acceptable LoS except:
  - The General Holmes Drive / Bestic Street intersection, which experienced poor levels of service during the AM peak hour
  - The intersection of Princes Highway and Forest Road – key north-south and east-west roads – which performed poorly in the PM peak hour
  - The West Botany Street / Bay Street intersection, which experienced poor levels of service during the PM peak hour.

Table 8-11 President Avenue corridor: Vissim modelled key intersection performance – 2014/15 AM and PM peak hour

Key intersections	Average delay (sec)	LoS
AM peak hour		
The Grand Parade / President Avenue	25	B
President Avenue / Crawford Road	10	A
President Avenue / O'Connell Street	32	C
President Avenue / West Botany Street	16	B
Princes Highway / President Avenue	20	B
PM peak hour		
The Grand Parade / President Avenue	22	B
President Avenue / Crawford Road	14	A
President Avenue / O'Connell Street	14	B
President Avenue / West Botany Street	26	B
Princes Highway / President Avenue	27	C

Source: AECOM (2018)

Table 8-12 President Avenue intersection and surrounds: VISUM modelled key intersection performance – 2014/15 AM and PM peak hour

Key intersections	Average delay (sec)	LoS
AM peak hour		
Princes Highway / West Botany Street	15	B
Wickham Street / West Botany Street	46	D
Princes Highway / Wickham Street/ Forest Road	48	D
General Holmes Drive / Bestic Street	58	E
Princes Highway / Bay Street	33	C
Princes Highway / Rocky Point Road	32	C
West Botany Street / Bay Street	47	D
West Botany Street / Bestic Street	40	C

Key intersections	Average delay (sec)	LoS
PM peak hour		
Princes Highway / West Botany Street	11	A
Wickham Street / West Botany Street	27	B
Princes Highway / Wickham Street/ Forest Road	68	E
General Holmes Drive / Bestic Street	28	B
Princes Highway / Bay Street	44	D
Princes Highway / Rocky Point Road	18	B
West Botany Street / Bay Street	61	E
West Botany Street / Bestic Street	37	C

Source: AECOM (2018)

Traffic crashes

Table 8-13 summarises the crash history for five years (1 January 2012 – 31 December 2016) on the key roads around the President Avenue intersection.

Rear-end collisions were found to be the most common crash type across the roads assessed. Just over 50 per cent of collisions over the past five years on The Grand Parade / General Holmes Drive have been rear-end collisions. A high proportion of rear-end crashes is typical with queuing, which occurs as roadways reach capacity and suggests that traffic congestion is a contributing factor.

Table 8-13 President Avenue intersection and surrounds: crash statistics (Jan 2012 to Dec 2016)

Road section	Crashes			
	Total	Fatal	Injury	Tow-away
Princes Hwy (Gannon St to Jubilee Ave)	580	1	308	271
Rocky Point Rd (Princes Hwy to Jubilee Ave)	54	1	30	23
West Botany St (Princes Hwy to President Ave)	246	0	119	127
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	398	1	218	179
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	144	0	74	70
President Ave (Princes Hwy to The Grand Pde)	94	2	57	35
O'Connell St / Chuter Ave (President Ave to Barton St)	17	0	8	9
Bay St (Princes Hwy to The Grand Pde)	122	1	73	48
Sydney Metropolitan average / NSW average – all roads				
Sydney Metropolitan Area	99,500	400	55,300	43,800
NSW	173,000	1,600	96,000	75,300

Source: Summarised from crash reports, 2018

Further analysis of traffic crashes within the President Avenue intersection study area under existing traffic conditions, including crash severity indices, crash rates per 100 million vehicle kilometres travelled (100MVKT) and crash costs for the key roads surrounding the President Avenue intersection show a similar pattern. Details are provided in Chapter 6 of **Appendix D** (Traffic and transport technical report)

8.3.2 President Avenue intersection to St Peters interchange corridor

The key north–south links in the St Peters interchange and the President Avenue intersection corridor are the Princes Highway, General Holmes Drive and West Botany Street.

Average AM and PM peak period speeds, compared to sign posted speeds on the Princes Highway and General Holmes Drive within the St Peters interchange to President Avenue intersection corridor are shown in **Table 8-14**. The average speeds experienced by motorists during the peak periods are significantly less than the sign posted speed limits indicating congested conditions on these roads.

Table 8-14 Average AM and PM peak period speeds along key roads within the St Peters interchange and President Avenue intersection corridor (2016 survey data)

Location	Direction	AM peak period		PM peak period	
		Average speed (km/h)	Signed speed (km/h)	Average speed (km/h)	Signed speed (km/h)
Princes Highway	Northbound	24	60	25	60
	Southbound	26	60	23	60
	Northbound	36	70	34	70
	Southbound	36	70	34	70
General Holmes Drive	Northbound	38	60	33	60
	Southbound	32	60	37	60
	Northbound	53	70	40	70
	Southbound	34	70	50	70

8.3.3 St Peters interchange and surrounds

This section presents existing network performance and intersection performance analysis around the St Peters interchange. Currently, traffic conditions around the St Peters interchange are temporarily altered due to the construction of the New M5 project, with road network layouts and traffic conditions changing frequently during this construction period. To allow an assessment that reflects the unaltered road network performance, the network performance reported in this section is for the situation prior to construction of the New M5 project commencing.

Network performance

Table 8-15 presents the 2014/15 base case performance of the modelled road network for the St Peters interchange and surrounds for the AM and PM peak hours. The results indicate a similar level of demand in each peak period. However, the AM peak hour results show longer average travel time (around 18 per cent higher in the AM peak) and lower average speed per vehicle (about 14 per cent lower in the AM peak) through the modelled network compared to the PM peak. This indicates that the modelled network is slightly more congested in the AM peak hour compared to the PM peak hour.

Table 8-15 St Peters interchange and surrounds modelled network performance – 2014/15 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (veh)	25,420	24,580
Total vehicle kilometres travelled in network (km)	75,770	71,710
Total time travelled approaching and in network (hr)	3,090	2,530
Total vehicles arrived	24,920	24,590
Average per vehicle in network		
Average vehicle kilometres travelled in network (km)	2.7	2.7
Average time travelled in network (mins)	6.7	5.7
Average speed (km/h)	24.6	28.4
Unreleased vehicles		
Unreleased demand (veh)	230	0
% of total traffic demand	1%	0%

Source: AECOM 2018

Intersection performance

Table 8-16 presents the modelled AM and PM peak hour LoS for key intersections at the St Peters interchange and surrounds in the 2014/15 'base case' scenario. The intersection performance results demonstrate that these intersections generally perform at acceptable levels of service during the peak hours, except for the Princes Highway / May Street intersection in the AM peak hour and the Gardeners Road / Bourke Road intersection in the PM peak hour. The levels of service indicate these intersections are close to capacity and small increases in demand would result in large additional delays and queuing.

Table 8-16 St Peters interchange and surrounds: modelled key intersection performance (LoS) – 2014/15 AM and PM peak hour

Key intersections	Average delay (sec)	LoS
AM peak hour		
O'Riordan Street / Bourke Road	16	B
Gardeners Road / O'Riordan Street	43	D
Gardeners Road / Bourke Road	51	D
Ricketty Street / Kent Road	24	B
Campbell Road / Euston Road	1	A
Princes Highway / Campbell Street	44	D
Princes Highway / May Street	89	F
Princes Highway / Sydney Park Road	23	B
Sydney Park Road / Mitchell Road	24	B
Euston Road / Sydney Park Road	8	A
PM peak hour		
O'Riordan Street / Bourke Road	19	B
Gardeners Road / O'Riordan Street	39	C
Gardeners Road / Bourke Road	67	E
Ricketty Street / Kent Road	22	B

Key intersections	Average delay (sec)	LoS
Campbell Road / Euston Road	1	A
Princes Highway / Campbell Street	25	B
Princes Highway / May Street	45	D
Princes Highway / Sydney Park Road	26	B
Sydney Park Road / Mitchell Road	2	A
Euston Road / Sydney Park Road	8	A

Source: AECOM

Traffic crashes

Crash density mapping was used to identify key roads around the St Peters interchange that warranted additional attention. These roads included the Princes Highway, Gardeners Road, Euston Road and Bourke Road. The crash history for five years (1 January 2012 – 31 December 2016) for these roads is summarised in **Table 8-17**.

Table 8-17 St Peters interchange and surrounds: crash statistics (Jan 2012 to Dec 2016)

Road section	Crashes			
	Total	Fatal	Injury	Tow-away
Princes Highway (Enmore Road to Gannon Street)	379	2	214	163
Canal Road / Ricketty Street / Gardeners Road (Princes Highway to Botany Road)	168	0	94	74
Euston Road (Sydney Park Road to Campbell Road)	44	0	23	21
Bourke Road (Wyndham Street to Gardeners Road)	57	0	37	20
Sydney Metropolitan average / NSW average - all roads				
Sydney Metropolitan Area	99,500	400	55,300	43,800
NSW	173,000	1,600	96,000	75,300

Further analysis of traffic crashes within the St Peters interchange and surrounds study area under existing traffic conditions, including crash severity indices, crash rates per 100 million vehicle kilometres travelled (100MVKT) and crash costs for the key roads surrounding the St Peters interchange are provided in Chapter 6 of **Appendix D** (Traffic and transport technical report)

8.4 Potential impacts – construction

8.4.1 Introduction

This section outlines the potential impacts on the surrounding road network during construction of the project and summarises the key aspects of the construction impact assessment presented in Chapter 7 of **Appendix D** (Traffic and transport technical report). A detailed description of the indicative construction approach is provided in **Chapter 7** (Construction).

8.4.2 Overview of potential traffic and transport impacts during construction

Construction of the project is expected to take around four years, which includes commissioning that would occur concurrently with the final stages of construction. During construction, the project may affect the surrounding road network as a result of:

- Construction vehicles using the surface road network, especially heavy vehicles transporting spoil
- Surface road works, requiring temporary traffic, cyclist and/or pedestrian diversions, road occupation and temporary road closures
- Temporary changes to speed limits.

Surface areas would be required to support tunnelling activities, construct the tunnel portals, the President Avenue intersection, surface roadworks to the local network, ventilation facilities, tunnel support facilities and other ancillary operations buildings and facilities.

Civil works would be required including earthworks in Bicentennial Park, the President Avenue surface works and other network integration work. Associated surface road works may require temporary traffic and/or cyclist and pedestrian detours, road occupation, temporary changes to road markings or temporary road closures. The work on President Avenue would need to be carried out in stages to maintain existing through lanes and turning movements.

Heavy vehicles would deliver and remove construction plant, equipment and materials as well as remove waste and spoil from the project sites. In addition, delivery and removal of large plant and equipment would require the use of oversized / over-dimension vehicles. These types of deliveries would occur infrequently and would generally be scheduled to occur during the night time period to minimise impacts on the surface road network. Any road closures or diversions associated with oversize/over-dimension vehicles would be managed to ensure access to properties would be maintained, however delays may be experienced. The routes for oversize / over-dimension vehicles would be documented in the CTAMP and would use the arterial road network as far as practicable.

Surface construction works (such as for ancillary infrastructure, portal works, and integrations to the New M5 Motorway and surface roads) and the establishment of construction ancillary facilities and their associated entry and exit driveways may result in traffic related impacts including temporary alterations to:

- Existing property access
- Existing pedestrian and cyclist access and movements
- Bus stops
- Local traffic environment.

A permanent power supply connection would be constructed within and outside the project footprint to service the construction and operation of the project.

8.4.3 Construction ancillary facilities

Construction ancillary facilities would be used for a combination of civil surface works, tunnelling and tunnelling support, construction workforce parking and administrative purposes. The construction boundaries and construction ancillary facilities are shown in overview in **Figure 7-1** in **Chapter 7** (Construction). A summary of these facilities is provided in the following sections, with detailed descriptions including an overview of the construction activities that would occur at each of the construction ancillary facilities outlined in **Chapter 7** (Construction).

Arncliffe construction ancillary facility (C1)

Location and construction activities

The Arncliffe construction ancillary facility (C1) would be located at Kogarah Golf Course at Marsh Street. This facility would use the land currently used as a construction ancillary facility for the New M5 Motorway project. The construction site for the New M5 Motorway would be demobilised prior to being made available for construction of this project. This site would be used to support tunnelling; including loading of spoil, spoil removal and haulage off-site, as well as to construct a substation and water treatment plant for operation of the project.

Tunnelling and spoil management within C1 would occur 24 hours a day, up to seven days a week. Spoil removal and haulage would occur between 7am – 6pm on weekdays and between 8am – 1pm on Saturday. Where practical, spoil would be removed outside of peak periods. Feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements outside of standard construction hours.

Entry and exit

As part of the New M5 project, modifications to the layout and traffic signals at the Marsh Street / Flora Street intersection have been completed to accommodate access to the Arncliffe construction ancillary facility (C1). This arrangement would be maintained and provide for right and left turn movements into the site and left turn movements out for both light and heavy vehicles.

Local road impacts

No vehicle impacts are expected on local roads with heavy and light vehicle access and egress taken directly to and from Marsh Street.

Rockdale construction ancillary facility (C2)

Location and construction activities

The Rockdale construction ancillary facility (C2) would be located at Rockdale, east of West Botany Street and south of Bay Street, on land currently occupied by a Roads and Maritime depot. Existing activities at the Roads and Maritime maintenance depot would continue during construction. C2 would be used to support tunnelling, including loading of spoil and spoil removal.

Spoil handling at C2 would occur 24 hours a day, up to seven days a week. Spoil removal and haulage would occur between 7am – 6pm on weekdays and between 8am – 1pm on Saturday. Where practical, spoil would be removed outside of peak periods. Feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements at night.

Entry and exit

Heavy and light vehicles would access and egress the site through traffic signals on West Botany Street that would be removed at the end of the construction period.

Local road impacts

No vehicle impacts are expected on local roads with heavy and light vehicle access and egress taken directly to and from West Botany Street.

President Avenue construction ancillary facility (C3)

Location and construction activities

The President Avenue construction ancillary facility (C3) would be located above ground at Rockdale Bicentennial Park and on the western side of West Botany Street. It would be around 151,000 square metres. The site would be used to support the construction of the cut-and-cover structures for the President Avenue interchange, the construction of the Rockdale Motorway Operations Complex (south) (MOC3), including the Rockdale ventilation facility, and surface works.

During construction, West Botany Street would require temporary diversion to maintain traffic flow. Night works would be required for the upgrade works along President Avenue. Some night works may be required during construction of the cut-and-cover structures, such as utility relocation and protection works or if construction of the diaphragm wall extends beyond normal construction hours.

Spoil would be removed during the day and outside of peak periods where possible. Feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements at night.

Entry and exit

The following entry and exit points are anticipated for use at the C3 site:

- Left-in left-out on President Avenue, which would primarily be used by light vehicles to access the site office and carpark.
- All movements on the eastern and western sides of West Botany Street via traffic signals that would be removed at the end of the construction period. This would operate as a single four way intersection.

Heavy vehicles would be able to enter on President Avenue and exit on West Botany Street via an internal haulage road within the C3 site.

Local road impacts

No vehicle impacts are expected on local roads with heavy and light vehicle access and egress taken directly to and from West Botany Street and President Avenue.

Shared cycle and pedestrian pathways construction ancillary facilities (C4/C5)

The construction of the shared cycle and pedestrian pathways between Bestic Street and Bruce Street would be supported by C4 and C5.

Entry and exit

Access and egress to C4 would be provided by a left-in, left-out arrangement from West Botany Street. Temporary traffic controls would be provided on Bruce Street to accommodate right-in, left-out access arrangements to C5.

Local road impacts

A small volume of heavy and light vehicles would use Bruce Street, a local road, to access C5. The daily and peak hour traffic forecasts are provided in **section 7.3.1**.

Princes Highway construction ancillary facility (C6)

The Princes Highway construction ancillary facility (C6) would be located at Kogarah, on the north-east corner of Princes Highway and President Avenue. This land is currently occupied by 7-Eleven Kogarah, including a petrol station and an auto service centre.

This construction ancillary facility would be around 1,500 square metres and would support the construction of the Princes Highway and President Avenue intersection upgrade. The site would include some offices, amenities and workshops. Key construction activities to occur at this site would include:

- Property adjustment and demolition (e.g. of the 7 Eleven service station)
- Relocation of utilities, stormwater infrastructure and substation
- Laydown and parking of construction vehicles and equipment
- Pavement works along Princes Highway and President Avenue
- Rehabilitation and landscaping.

Entry and exit

Access and egress to the construction ancillary facility would be provided by a left-in, left-out arrangement from the existing eastern access / egress point currently provided for the 7-Eleven petrol station and the auto service centre along President Avenue.

Local road impacts

No vehicle impacts are expected on local roads with heavy and light vehicle access and egress taken directly to and from President Avenue. The traffic expected to be generated by the construction ancillary facility would be offset by the removal of traffic generated by the current operation of the 7-Eleven petrol station and the auto service centre.

Other construction sites

Additional construction sites would be required to construct components of the project that lie outside the boundaries of the construction ancillary facilities. These would be supported by C2 and C3 and be located at the following locations:

- Between Bruce Street and the President Avenue construction ancillary facility for the construction of the shared cycle and pedestrian pathways and on-road cycleway. Access from Bestic Street would be required for construction workers, delivery of materials and removal of spoil.
- South of President Avenue, east of Civic Avenue for the construction of the shared cycle and pedestrian pathways and bridge over President Avenue
- President Avenue / Princes Highway intersection (within the construction boundary), to facilitate upgrade works.
- Along the route of the permanent power supply connection. The power line would be constructed underground either by trenching or, where required, under-boring. The power line would be located within the existing road reserve, with the exception of where it would cross Bardwell Valley Golf Club and Silver Jubilee Park.

8.4.4 Construction traffic management and access

This section identifies the route and scheduling of construction movements, and the number, frequency and size of construction-related vehicles, including for spoil removal.

Traffic generation and distribution

Construction vehicles expected to access the works include:

- Light vehicles (e.g. workforce vehicles)
- Light trucks and commercial vehicles (e.g. delivery vans)
- Heavy vehicles (e.g. semi-trailers, spoil trucks, concrete trucks and cranes)
- Oversize and over mass vehicles and special purpose vehicles (e.g. precast concrete beam delivery, plant on low loaders or large mobile cranes).

Table 8-19 provides details of light and heavy vehicle volumes predicted to arrive and depart from construction ancillary facilities during the AM peak hour, PM peak hour and daily period. The peak hours for construction-related traffic volumes are typically between 7am and 8am and between 5pm and 6pm. The existing intersection peak hours vary throughout the network so for consistency the construction volume peak period has been modelled at each location. Much lower light vehicle volumes would be generated outside of these peak arrival and departure hours, so this approach provides a robust assessment of construction impact.

The haulage routes from the main construction ancillary facilities to the arterial road network are shown in **Figure 8-10** to **Figure 8-12**. Depending on final spoil management sites, spoil haulage routes may be subject to change. Delivery of concrete to support tunnel construction would originate from batching plants close to the project region. Other materials required for construction would, where available, originate from within the Sydney region and surrounds and would use the arterial road network to access the various construction sites.

The construction ancillary facilities are located to allow vehicles (heavy vehicles in particular) to access and egress via the arterial road network to avoid or minimise impacts on the local road network. Light vehicles (predominantly workers accessing car parking areas on site) would distribute across the road network at their discretion.

Indicative access routes to and from construction ancillary facilities would be confirmed in the Construction Traffic and Access Management Plan (CTAMP). The CTAMP would also confirm the use of a marshalling area(s) for spoil trucks to further assist in scheduling of transport movements by staggering the arrival of vehicles to site. This would also minimise queuing and parking of heavy vehicles on local roads in the vicinity of the project. A marshalling area would be provided at the Arncliffe construction ancillary facility within C1. Additional marshalling areas (if required) may be located in non-residential areas and close to the arterial road network and construction ancillary facilities. Marshalling areas will be prohibited on local roads.

Construction site access

The proposed access to the construction sites is summarised in **Table 8-18**. Access is proposed to be gained directly from arterial roads, with the exception of Bruce Street, which would be used to access the C5 construction ancillary facility.

Access points and routes to and from construction ancillary facilities would be confirmed during detailed design and documented in the CTAMP.

Table 8-18 Indicative access routes to and from construction ancillary facilities

Location	Access and egress routes (heavy and light vehicles)
Arncliffe construction ancillary facility (C1)	The existing arrangement, for construction of the New M5 would be maintained: the signalised intersection on Marsh Street is left and right-in, left-out
Rockdale construction ancillary facility (C2)	West Botany Street: all movements facilitated by traffic signals that would be removed at the end of the construction period
President Avenue construction ancillary facility (C3)	President Avenue: left-in, left-out West Botany Street: all movements facilitated by traffic signals that would be removed at the end of the construction period. Access would be required on both sides of West Botany Street. Accesses would be opposing and would use the same traffic signals.
CCP construction ancillary facilities (C4 and C5)	West Botany Street: left-in, left-out Bruce Street: right-in, left-out
Princes Highway construction ancillary facility (C6)	President Avenue: left-in, left-out

Table 8-19 Indicative daily and peak period construction traffic volumes

Location		Daily vehicles[1] (two-way)		AM peak hour (7.00–8.00 am)				PM peak hour (5.00–6.00 pm)			
		Heavy vehicles	Light vehicles	Heavy vehicles		Light vehicles		Heavy vehicles		Light vehicles	
				Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart
C1	Arncliffe construction ancillary facility	276	336	13	13	65	0	13	13	0	76
C2	Rockdale construction ancillary facility	274	352	12	12	47	0	11	11	0	52
C3	President Avenue construction ancillary facility[2]	178	642	6	6	53	0	15	15	0	114
C4	Shared cycle and pedestrian pathways construction ancillary facility	16	64	1	1	5	0	1	1	0	8
C5	Shared cycle and pedestrian pathways construction ancillary facility	26	88	1	1	7	0	2	2	0	10
-	Bestic Street	16	22	1	1	2	0	1	1	0	2
C6	Princes Highway construction ancillary facility	20	176	0	0	7	0	0	0	0	25

Table notes:
1. The number of vehicles that would arrive at each site in a 24 hour period
2. PM volumes from 4-5pm have been used for this site to provide a more conservative assessment as volumes drop substantially after 5pm

LEGEND

- Construction boundary
- Construction ancillary facility
- Indicative inbound spoil haulage
- Indicative outbound spoil haulage

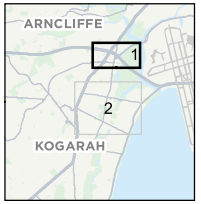


Figure 8-10 Indicative spoil haulage routes - Arncliffe construction ancillary facility (C1)

LEGEND

- Construction boundary
- Construction ancillary facility
- Indicative inbound spoil haulage
- Indicative outbound spoil haulage
- Permanent power supply line
- Permanent power supply construction boundary

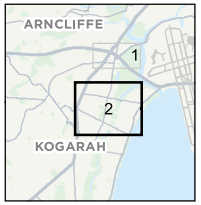
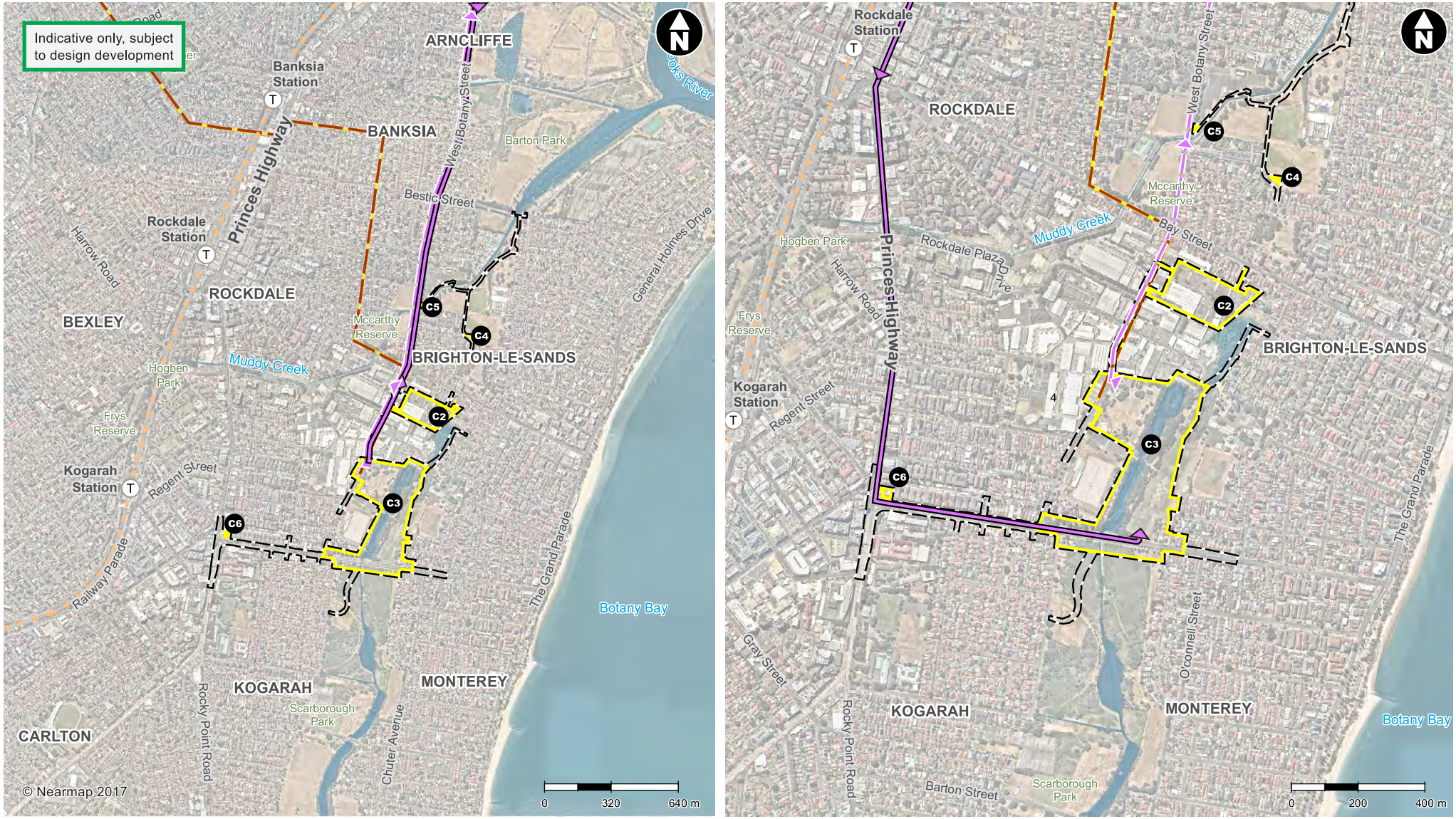


Figure 8-11 Indicative spoil haulage routes - Rockdale construction ancillary facility (C2)



LEGEND

- Construction boundary
- Construction ancillary facility
- Indicative inbound spoil haulage
- Indicative outbound spoil haulage
- Permanent power supply line
- Permanent power supply construction boundary

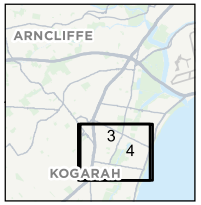


Figure 8-12 Indicative spoil haulage routes - President Avenue construction ancillary facility (C3)

Construction workforce parking

A number of the project's workforce would drive to construction sites and require car parking. The number of construction personnel requiring parking would vary over the duration of the construction program.

A preliminary assessment of parking provision, based on approximate peak workforce estimates anticipate that the total parking provision within the construction sites would be able to meet forecast parking demand, as shown in **Table 8-20**. While Rockdale construction ancillary facility (C2) has a forecast deficit, the forecast surplus at the other construction ancillary facilities in the vicinity could be used to mitigate associated impacts.

To assist in minimising impacts from the construction workforce using on-street parking, the use of public transport would be encouraged (where feasible). All construction ancillary facilities are located about a 15 minute walk from a train station. C2 and C3 are also serviced by one or more bus routes. However, workers starting or ending shifts very early or very late would be more likely to use private vehicles.

Table 8-20 Parking demand and provision at construction ancillary facilities

Location	Approximate day shift peak construction workforce	Estimate of parking demand (0.7 spaces/staff)	Approximate proposed parking numbers	Surplus or Deficit
Arncliffe construction ancillary facility (C1)	65	46	140	+94
Rockdale construction ancillary facility (C2)	94	66	50	-16[1]
President Avenue construction ancillary facility (C3)	114	80	150	+70
Shared cycle and pedestrian pathways construction ancillary facility (C4)	10	7	10	+3
Shared cycle and pedestrian pathways construction ancillary facility (C5)	12	8	10	+2
Princes Highway construction ancillary facility (C6)	30	21	25	+4
Total	325	228	385	+157

Table notes:

1. Opportunities to provide additional car parking within the Rockdale construction ancillary facility are being investigated and would be confirmed in the CTAMP

A car parking strategy would be developed as part of the CTAMP to identify actions that would be implemented by the contractor to avoid or minimise the use of on-street parking in the vicinity of construction sites by the construction workforce. The car parking strategy would consider forecast parking demand, review of existing parking supply, alternative parking arrangements and communication and engagement. Processes for monitoring, reporting and corrective actions would also be part of the strategy.

8.4.5 Construction impact assessment

This section presents an assessment of the potential impacts from construction activities on:

- Proposed access routes to and from construction ancillary facilities and construction sites
- Car parking
- Public transport
- Pedestrians and cyclists.

Road closures and diversions, and reconfiguration of the road, cycle and pedestrian network are also assessed.

Background traffic volumes and patterns

The year 2021 has been used as the assessment year for construction impacts, as this is when peak construction traffic volumes are forecast. As shown in **Table 8-21**, between the 2015 base case and 2021 peak construction year used in the assessment, substantial increases in background traffic volumes are forecast at most road locations. This growth in background traffic can be attributed mainly to the forecast increase in population and changes to employment distribution across Sydney (refer to **section 8.5.2**.

Table 8-21 Construction year background traffic growth^

Road location	Direction	AM peak hour (veh/hr)			PM peak hour (veh/hr)		
		2015 Base	**2021**	**% Change**	**2015 Base**	**2021**	**% Change**
Princes Highway south of Wickham Street	NB	2,510	2,640	+5	930	1,190	+28
	SB	590	750	+27	2,070	2,080	+<1
Marsh Street, north of M5 ramps	NB	3,010	3,050	+1	1,000	910	-9
	SB	940	1,270	+35	2,220	2,320	+5
West Botany Street, south of Bay Street	NB	1,520	1,540	+1	770	790	+3
	SB	550	610	+11	1,320	1,310	-1
President Avenue west of West Botany Street	EB	1,580	1,670	+6	1,060	1,240	+17
	WB	1,100	1,270	+15	1,610	1,680	+4
Bay Street, west of West Botany Street	EB	510	630	+24	540	660	+22
	WB	390	560	+44	470	600	+28
Bestic Street, east of West Botany Street[3]	EB	1,030	1,260	+22	650	820	+26
	WB	390	670	+72	690	770	+12

^Traffic volume rounded to nearest 10

[3] Bestic Street volumes are to a 2018 base

Intersection performance

The intersection performance analysis presented in **Table 8-22** forecasts that all intersections are forecast to operate at an acceptable LoS D or better except the Princes Highway intersection with Wickham Street and Forest Road, and the intersection of West Botany Street and Bay Street, both of which would operate at LoS F during both peak hours in the 'without construction' scenario.

In the 'with construction' scenario, up to 230 passenger car units (PCU) are added to the modelled road network in the AM peak hour and up to 260 PCU in the PM peak hour. The forecast additional traffic is most heavily concentrated on West Botany Street and the M5 East ramps intersection with Marsh Street.

The forecast increase in traffic volumes in the 'with construction' scenario would result in minor impacts in the AM peak hour with a forecast worsening in level of service at:

- The intersection of Marsh Street and M5 East ramps (from LoS C to LoS D)
- The Marsh Street / Flora Street / C1 access (from LoS A to LoS B).

An improvement from LoS D to LoS C is forecast at the intersection of Wickham Street and West Botany Street. This results from increased volumes forecast on the northern approach to this intersection, with this approach experiencing the best levels of service at this intersection (reducing the overall average delay). The most significant increase in average delay is seen at the already very congested intersection of West Botany Street and Bay Street.

The level of service is forecast to change at only one intersection in the PM peak hour; from LoS C to LoS D at the intersection of Marsh Street and M5 East ramps. As with the AM peak hour, the only intersection to experience a large increase in delay is West Botany Street and Bay Street, which reflects the already very congested conditions at the intersection.

Traffic volumes associated with the shared cycle and pedestrian pathways sites (C4 and C5) are not considered in the intersection analysis as they are forecast to operate for about nine months and generate less construction traffic (forecast volumes are shown in **Table 8-19**). Bruce Street would be used to access C5 and is a local road, but minimal impact is expected due to maximum forecast hourly volumes of four heavy vehicles (two arriving, and two leaving) and 10 light vehicles.

Access and egress to the Princes Highway construction ancillary facility (C6) would be provided by a left-in, left-out arrangement from the existing eastern access / egress point currently provided for the petrol station and the auto service centre along President Avenue. The traffic expected to be generated by the construction ancillary facility would be offset by the removal of traffic generated by these current uses. Based on the maximum forecast hourly volumes of seven light vehicles in the AM peak hour and 25 light vehicles in the PM peak hour, the impact is forecast to be negligible or reduced from current operations.

The construction works would also require the establishment of two new signalised intersections on West Botany Street for the duration of the construction program to facilitate construction vehicle access:

- At the Rockdale construction ancillary facility (C2) about 100 metres south of Bay Street
- At the President Avenue construction ancillary facility (C3), between the existing off street car parks at Bicentennial Park.

These intersections would operate on demand and the impact on traffic movements is therefore expected to be minor.

Table 8-22 Intersection operational performance summary in 2021 for the AM and PM peak hours^

Intersection	Without construction			With construction		
	Volume (PCU)	Ave Delay (sec)	LoS	Volume (PCU)	Ave Delay (sec)	LoS
AM peak hour						
Princes Highway / Wickham Street/ Forest Road	4,370	>100	F	4,410	>100	F
Wickham Street / West Botany Street	4,060	43	D	4,180	40	C
West Botany Street / Marsh Street	4,190	22	B	4,330	27	B
Marsh Street / M5 Ramps	5,540	33	C	5,770	45	D
Marsh Street / Flora Street / C1 Access	4,560	13	A	4,680	15	B
West Botany Street / Bestic Street	3,000	44	D	3,130	47	D
West Botany Street / Bay Street	3,270	78	F	3,400	>100	F
West Botany Street / President Avenue	3,480	31	C	3,530	31	C
PM peak hour						
Princes Highway / Wickham Street/ Forest Road	5,270	>100	F	5,320	>100	F
Wickham Street / West Botany Street	4,060	33	C	4,230	38	C
West Botany Street / Marsh Street	3,890	11	A	4,070	12	A
Marsh Street / M5 Ramps	4,400	38	C	4,660	43	D
Marsh Street / Flora Street / C1 Access	3,300	11	A	3,420	14	A
West Botany Street / Bestic Street	2,880	42	C	3,000	41	C
West Botany Street / Bay Street	3,140	75	F	3,310	100	F
West Botany Street / President Avenue	3,620	37	C	3,650	39	C

^Traffic volume rounded to nearest 10

Temporary closures and diversions

Construction of the project would be subject to careful traffic management to maintain the functionality of surrounding roads as well as the safety of members of the public, motorists and construction personnel. Generally, temporary road pavements would be constructed as early as possible within the program to separate motorists from work zones. However, phases of traffic management and traffic switches may be required at some locations during construction.

Detailed traffic staging and the use of temporary retaining walls would allow the maintenance of existing through lanes (at least two eastbound and two westbound) and turn movements along President Avenue during construction. President Avenue would have to be closed to traffic during the lifting of the shared pedestrian and cyclist bridge structure – this would likely occur over one to two nights and would therefore result in limited disruption. Alternative routes and local traffic access would be provided during this period. In addition, the outer lanes of West Botany Street will need to be closed outside of peak hours during site establishment at C3.

Other changes to the road network around President Avenue are shown in **Figure 8-13.**

The detailed design process would include determining temporary closures and diversions to be implemented during construction. These will be documented in a CTAMP as part of the Construction Environmental Management Plan. All temporary traffic and transport arrangements are subject to further detailed assessment through the CTAMP approval process.

Parking along President Avenue would be progressively unavailable during construction. The posted speed along West Botany Street and President Avenue may be reduced for safety reasons and to facilitate traffic management during construction. In addition, parking along West Botany Street adjacent to construction works would be unavailable during construction of the cut-and-cover structures.

Impact on sports field parking

Rockdale Bicentennial Park and the Ilinden Sports Centre comprise a number of sporting fields and recreational facilities, as well as open grassed areas. Car parking for these areas is provided by existing off-street parking facilities in the north western corner of Bicentennial Park (consisting of around 60 spaces), parking areas to the north and west of Ilinden Sports Centre (consisting of around 200 spaces and 22 spaces respectively) and sections of on-street parking along President Avenue and West Botany Street.

The President Avenue construction ancillary facility would be located on land currently used for two sports pitches in Bicentennial Park East and would require the removal of the existing car park in the north western corner of Bicentennial Park (accessed from West Botany Street), which provides around 60 car parking spaces. On-street parking along sections of President Avenue would also be removed during construction. The car park and on-street parking would be reinstated following completion of construction. Aforementioned parking areas located to the north and west of the Ilinden Sports Centre would not be impacted by the project.

The car parking to be retained at the Ilinden Sports Centre appears to provide sufficient parking for activities that would occur during construction, as the parking demand would be expected to decrease with the temporary relocation of some sporting fields, the skate park and children's playground. The removal of off-street and on-street parking during construction is therefore expected to have a minor impact on sports field parking.

The development of the CTAMP would include consultation with Bayside Council and local stakeholders, including Ilinden Sports Centre, regarding parking requirements during construction and replacement car parking would be provided if there are significant impacts on parking for the unaffected sports fields and recreational facilities at this location. In particular, Ilinden Sports Centre would be consulted with regards to the frequency and size of events held at the centre, to inform the management of parking requirements during construction.

Impacts on on-street parking

During construction there would be a temporary loss in on-street parking. This loss of parking would occur in stages and the spaces lost listed below would not occur at the same time. The on-street parking areas that would be impacted are:

- O'Neill Street, next to Rockdale Bicentennial Park (about 16 spaces)
- Civic Avenue (northbound), near President Avenue (about 10 spaces)
- West Botany Street (northbound and southbound), between French Street and northern boundary of C3 (about 16 spaces and 19 spaces).

The above on-street parking areas would be reinstated following completion of construction. The following on-street parking areas would be removed during construction and reinstated during non-peak periods following construction:

- President Avenue (eastbound), between Princes Highway and Traynor Avenue (about 53 spaces)
- President Avenue (westbound), between Traynor Avenue and Princes Highway (about 46 spaces).

Temporary parking loss would be managed in accordance with the CTAMP. Permanent parking loss is discussed in **section 8.7**.

Property access

Access to properties not acquired, leased or otherwise occupied for project purposes would generally be maintained at all times during construction. Where temporary impacts on existing property access are unavoidable as a result of construction activities (e.g. footpath and pavement works), consultation would be carried out with the landowner and/or tenant to provide equivalent standards of access.

The President Avenue interchange works would require the closure of the O'Neill Street and Moorefield Avenue intersections with President Avenue and the re-development of these streets as culs-de-sac. These changes would slightly increase travel times for motorists. However, the creation of culs-de-sac would also provide opportunities for amenity improvements along these streets, as through traffic would be reduced. Pedestrian connections between President Avenue and O'Neill Street and Moorefield Avenue would be retained.

Traffic crashes

Construction traffic volumes are expected to be low when compared to existing traffic volumes on key arterial roads connecting to the construction ancillary facility locations. The greatest increases are forecast to occur on the M5 East Motorway, west of Princes Highway, and on West Botany Street, south of Bay Street. When compared to forecast 2021 traffic volumes, total construction traffic would be the equivalent of around five per cent of peak hour traffic on the M5 East, and between 10-15 per cent in the AM peak hour and PM peak hour on West Botany Street.

As the volume of traffic generated by construction is expected to be low compared to existing traffic, the effects of this short-term increase on the existing road network is not expected to substantially impact road safety in the study area. There is still a risk with construction traffic interacting with general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites. Any foreseen impacts on road safety for all users during construction would be mitigated as much as possible through the provision of tailored traffic management plans and other measures.

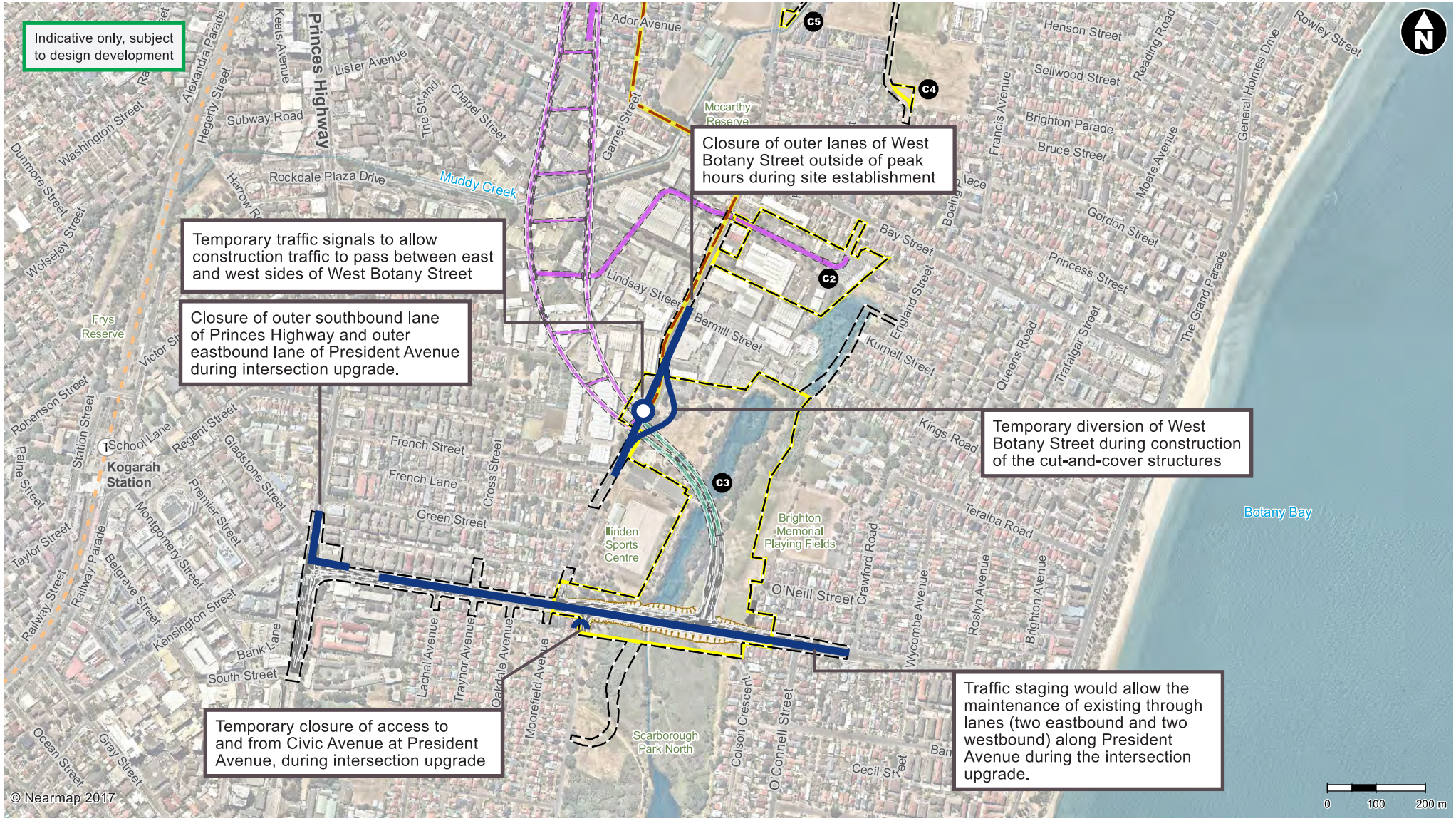


Figure 8-13 Temporary changes to the road network during construction

Public transport services

Bus services

President Avenue, West Botany Street and Princes Highway lanes and movements would be kept open during peak hours allowing bus services to continue. The project may require the temporary relocation of some bus stops along President Avenue during construction, which may result in some passengers having to walk a short distance further to access a temporary bus stop. Temporary changes to bus stops would be undertaken in consultation with Transport for NSW, the bus operators and Bayside Council and would seek to minimise the distance from existing bus stops.

Bus passengers and commuters travelling to train stations may also experience temporary traffic disruptions or delays during construction.

Rail services

Bus service connections to railway stations may be affected due to a reduction in the reliability of bus services during the construction period, but there would be no impacts on rail services.

Active transport (walking and cycling)

The potential impacts on pedestrians and cyclists during construction of the project were assessed based on broad criteria outlined in **Table 8-23**. An increase in the number of heavy vehicles during the construction period would potentially impact walking and cycling amenity and safety. This would be most prevalent around the access points to construction ancillary facilities and other construction sites. Pedestrian footways and cycling paths would need to be closed or diverted during construction.

Construction would be carried out in stages resulting in changing impacts over the course of the construction program. A key objective of the construction program would be to minimise disruption to pedestrians and cyclists and enable the use of the active transport links to be provided by the project as soon as possible.

Table 8-23 Active transport – impact severity

Severity	Impact
Negligible	• The impacts result in a negligible change (minor increase in traffic volumes) and do not require any mitigation.
Minor	• Diversion of less than 200 metres on key routes • Negligible safety impact.
Moderate	• Diversion of more than 200 metres but less than 500 metres on key routes • Negligible safety impact.
High	• Diversion of more than 500 metres on key routes • Potential safety impact.

Construction of the President Avenue intersection and upgrade works would result in changes to the pedestrian and cyclist facilities in the vicinity. These changes are described and assessed in **Table 8-24**. A strategy for ensuring pedestrian and cyclist access is maintained throughout construction would be included in the CTAMP. The CTAMP would also include details of construction safety elements such as hoardings and secure access points in the vicinity of public parks, playing fields and footpaths.

Table 8-24 Impacts on pedestrian and/or cyclist facilities

Changes to pedestrian and/or cyclist facilities	Impact
Closing or detouring the pedestrian pathways along either side of President Avenue during works along President Avenue. This would occur one side at a time and diversions would be put in place so that a pedestrian pathway on one side of President Avenue would always be available.	This would have a minor impact as there are only small number of land uses in the section between the pedestrian crossings at the West Botany Street and O'Connell Street intersections that would generate pedestrians. This temporary change would not be expected to increase the risk to public safety as pedestrians would continue to use pedestrian pathways and pedestrian crossings would be used to ensure safe crossing of President Avenue.
Temporary blocking of the walking path that circumnavigates Rockdale Bicentennial Park during construction of the cut-and-cover structure. A temporary diversion would be put in place during construction following consultation with Bayside Council.	This diversion would have a minor impact given the presence of footpaths on the adjoining streets, which would be used to minimise the length of the diversion compared to the existing route (to less than 200 metres). Negligible change in the risk to pedestrian and cyclist safety is anticipated as users of this path would be diverted away from construction activities.
Retention of the pedestrian access between West Botany Street and Kings Road with potential relocation to the northern extent of the park area.	This would be expected to have a minor impact as the diversion would add less than 200 metres to the route and would not result in an increase in potential safety risks, as users of this path would be diverted away from construction activities.
Closure of the pedestrian bridge over Rockdale Wetlands for the duration of the construction works in the area. Pedestrians would be diverted along President Avenue or the pedestrian access between West Botany Street and King Street.	This would have a moderate impact in the worst case for pedestrians travelling between Ilinden Sports Centre and the residential streets around O'Neill Street and Sybil Lane as the diversion would increase the distance pedestrians and cyclists would need to travel by more than 200 metres but less than 500 metres. However, this diversion is required to enable construction of the cut-and-cover structures and to minimise interactions between pedestrians, cyclists and construction activities.
Temporary closure (one side at a time) of pedestrian pathways along either side of Princes Highway during the intersection upgrade works. Pedestrians would be diverted to the opposite side during closure of one side.	This would result in a minor impact as the diversion would be less than 200 metres. There would be a negligible change in potential safety risks to pedestrians and cyclists as these users would be diverted away from construction activities and would continue to use the pedestrian path network.
Removal of on-street parking lane west of the President Avenue intersection and creation of three traffic lanes in each direction.	Although President Avenue does not currently form part of the mapped cycle network, cyclists may currently use President Avenue to connect to the existing cycle network. While increased traffic along President Avenue could increase the safety hazard for cyclists, removal of the on-street parking as part of the project the project would have the following benefits for cyclists: – Removal of the potential hazard for cyclists of car doors opening in front of them – Removal of the safety hazards associated with cyclists moving into and out of the parking lane. With three lanes of traffic proposed along President Avenue, the cyclists could ride in the middle of the left lane (as allowed by the road rules, and recommended by cycle bodies).

Permanent power supply connection

The power line would be constructed underground either by trenching or, where required, under-boring. The power line would be located within the existing road reserve, with the exception of where it would cross Bardwell Valley Golf Club.

The works have the potential to result in short term, localised changes and disruptions to the existing road and transport network as a result of:

- The trenching and opening of the roadway and footpaths for service installation
- The movement of construction vehicles, particularly plant and equipment transporting materials, equipment, spoil and waste materials, to and from the work areas
- Temporary traffic diversions, road occupation, temporary alterations to access, temporary lane closures, and alterations to speed limits.

Impacts on parking and residential/commercial access

The works would require excavation of footpaths and roads. In some locations, works would temporarily affect access to residential properties / businesses. These impacts would be short term as all areas would be reinstated as works progresses along the alignment. Access to properties would be maintained during construction, and contractors would have steel plates on site should cars need to be provided with access to or from driveways.

Impacts on public transport network

Where bus routes may be impacted, they are likely to be able to continue uninterrupted with minor amendments to bus stop locations. However, bus routes may need to be diverted for a short time depending on the location. Consultation with TfNSW and State Transit Authority (STA) would be required in advance to ensure the successful diversion of bus routes and relocation of bus stops as and when required by the power line construction program.

Impacts to rail services would be minimised through consultation with rail authorities to ensure works are planned to align with scheduled rail maintenance. All bridge works for rail crossings would be planned and undertaken in consultation with the relevant rail authorities.

Impacts on active transport network

Where works are required within the footpath, a diversion for pedestrians around the work site would be required. Generally, the impacts to pedestrians would be minimal as pedestrian routes would be maintained at all times. Appropriate traffic control and pedestrian movement plans will be developed in accordance with the Roads and Maritime guidelines.

The assessment of the cycle network found that there would generally be minimal impacts to the cycle network. Works are not anticipated to impact on any shared pathways or dedicated cycle lanes, except for one block on Bardwell Road, and works would typically not involve any full road closures. As such, active transport networks are unlikely to be affected by the proposed works.

Impacts on safety

There would be an increase in the number of construction vehicles and work sites along the power line route. All traffic management devices implemented along the route would be designed and implemented by suitably qualified technicians in accordance with the Roads and Maritime Services – *Traffic control at work sites manual.* It is not anticipated that the increase in construction vehicle volumes and work sites would have detrimental impacts on road safety.

Consultation with emergency services would be undertaken and notified of the proposed works and affected road network. Access for emergency vehicles would be maintained at all times during construction

To ensure disruption to the road, public transport, cycle and pedestrian network is minimised as much as possible, a series of management measures would be implemented as part of construction planning, based on the type of roads impacted and the users that would be affected, and these would be documented in the CTAMP. This would cover stakeholder engagement, approvals and permits, such as applications for a Road Occupancy Licence for any activity on classified roads or crown roads, the design and implementation of Traffic Control Plans (TCPs) to cover works at intersections, mid-blocks and laydown areas.

8.4.6 Cumulative construction traffic impacts

8.4.6.1 M4-M5 Link

The construction of the proposed future M4-M5 Link may overlap with this project (subject to approval). The proposed M4-M5 Link Campbell Road civil and tunnel site would add 15-25 PCU to the road network in the AM and PM peak hours, with construction vehicles proposed to travel along Princes Highway through the intersection with Wickham Street and Forest Road and from West Botany Street to the M5 East on-ramp (westbound vehicles would access the M5 East from West Botany Street).

Intersection analysis indicates that the impact from this additional M4-M5 Link construction traffic on the intersections would be minimal, with all intersections operating at the same level of service as without M4-M5 Link construction traffic.

8.4.6.2 New M5 Motorway

The New M5 Motorway is expected to be operational in 2020. The Arncliffe construction ancillary facility, currently being used for the New M5 Motorway project, would be used by this project. There would be no overlap in construction traffic and transport impacts associated with the consecutive use of the Arncliffe construction ancillary facility.

8.4.6.3 Sydney Gateway

Elements of the construction program for the project may occur simultaneously with the construction of Sydney Gateway (subject to approval). However, no details of the construction of the Sydney Gateway project are yet available. The CTAMP for the Sydney Gateway project would need to consider any overlap in heavy vehicle and other access routes, once this information becomes available.

8.4.6.4 Sydney Metro City & Southwest

Elements of the construction program may occur simultaneously with the construction of Stage 2 of the Sydney Metro – Sydney Metro City & Southwest (Chatswood to Sydenham). The indicative construction program for Sydney Metro City & Southwest indicates that tunnel construction and station excavation and structural works would generally be complete by 2021[4].

The two construction sites closest to the project are Waterloo Station and the Marrickville dive site:

- At the Waterloo Station construction site, station excavation and structural works are planned to be completed by 2020, with station fitout in 2021. The anticipated peak hour vehicle numbers at the Waterloo Station construction site during the fitout phase is two heavy vehicles and 10 light vehicles in the AM peak hour and six heavy vehicles and two light vehicles in the PM peak hour. These volumes are reported as having minimal impact on traffic operations[5]
- At the Marrickville dive site, tunnelling is planned to be completed by 2020, with only tunnel fitout underway in 2021. The anticipated peak hour vehicle numbers at the Marrickville dive site during the fitout phase is two heavy vehicles and 60 light vehicles in the AM peak hour and two heavy vehicles and no light vehicles in the PM peak hour. These volumes are not considered to have a material impact on the overall operation of the road network[6].

The main construction route to the above construction sites would likely be from the St Peters interchange and therefore would not interact with construction traffic for this project.

The construction of the Waterloo Metro Quarter development planned at the new Waterloo Station may also overlap. While there is no detail available at this stage, the main construction route for this would also likely be from the St Peters interchange and therefore would not interact with construction traffic for this project.

At present, there are no other major projects whose construction would significantly increase traffic volumes and patterns along the key arterial roads within the project area during the construction period. Construction volumes associated with minor works are anticipated to have a minimal impact similar to that of daily or seasonal variations in traffic volumes and patterns. Notwithstanding, any scheduled construction activities would be taken into account during construction of the project

[4] Sydney Metro Chatswood to Sydenham EIS, May 2016
[5] Ibid
[6] Ibid

8.5 Assessment of operational impacts without the project

8.5.1 Introduction

The sections below provide an overview of key findings for forecast conditions on the future road network without the project. Chapter 8 of **Appendix D** (Traffic and transport technical report) provides a detailed analysis of forecast future conditions without the project.

In the future, without the project, a forecast increase in population and employment in the Sydney Metropolitan Area is forecast to result in growth in travel demand for traffic and public transport, resulting in increased congestion levels on the road network. Importantly, this growth in traffic is not confined to major routes – increased traffic on many roads in Sydney is forecast without the project in 2026 and 2036 peak periods, as vehicles seek to avoid the congested arterial road networks by travelling along lower order roads.

8.5.2 Sydney metropolitan road network

Impacts from traffic demand changes forecast by the SMPM in a 'Do minimum' scenario using forecast AM and PM peak hour traffic volumes for 2026 and 2036 are summarised in **Table 8-25** for general traffic, on-road freight and on-road public transport. **Table 8-26** compares the vehicle kilometres travelled (VKT) and the vehicle hours travelled (VHT) in the 2026 'Do minimum' and 2036 'Do minimum' scenarios with the 'base case' scenario. The forecast change in daily traffic volumes is also shown on bandwidth plots for 2026 and 2036 in Chapter 8 of **Appendix D** (Traffic and transport technical report).

Table 8-25 Impacts from traffic demand changes forecast by the SMPM in a 'Do minimum' scenario on general traffic, on-road freight and on-road public transport

	Scenario	
	'Do minimum' 2026	**'Do minimum' 2036**
General traffic	Based on SMPM outputs, a reduction in daily traffic is forecast along the M5 East Motorway (east of King Georges Road) as a result of traffic switching to use the New M5 compared to the 'base case' scenario. Increased daily traffic is forecast along the surface roads south of the M5 East Motorway, such as the Princes Highway, General Holmes Drive / The Grand Parade, Bestic Street, Bays Street and President Avenue. The increase in daily traffic is mainly due to the forecast increase in population and changes to employment distribution across Sydney. Table 8-26 compares the VKT and the VHT in the 2026 'Do minimum' scenario with the 'base case' scenario. An increase in VKT and VHT is forecast on an average weekday on the Sydney metropolitan road network compared to the 2014/15 base case scenario.	Based on SMPM outputs, reductions in daily traffic are still forecast along the M5 Motorway (east of King Georges Road) as a result of the New M5. Increases in daily traffic movements in 2036 follow a similar pattern forecast for 2026 but with larger volumes. As in 2026, changes in population and employment distribution are the main cause of the forecast traffic increases along the surface roads south of the M5 East Motorway, such as the Princes Highway, General Holmes Drive / The Grand Parade, Bestic Street, Bays Street and President Avenue. As shown in Table 8-26, an increase in VKT and VHT is forecast on an average weekday on the Sydney road network in 2036 compared to the 2014/15 base case scenario. The increase in VHT is more than VKT indicating that the forecast increase in traffic demand on the network is causing congestion, with travel times forecast to increase.

	Scenario	
	'Do minimum' 2026	**'Do minimum' 2036**
On-road freight	Forecast changes in daily road-based freight or heavy vehicle movements largely follow the same pattern as the general traffic movements, with decreases in heavy vehicle traffic on the M5 Motorway east of King Georges Road as vehicles take up use of the WestConnex Motorway. A key difference is on Foreshore Road which provides access to Port Botany, and on which there is a proportionally much greater increase in heavy vehicle traffic, compared to the increase in general traffic. This is to be expected given the working port function of Port Botany. Table 8-27 compares the VKT and the VHT in the 2026 'Do minimum' scenario with the 'base case' scenario for heavy vehicles.	The key changes in heavy vehicle traffic between the 2014/15 'base case' scenario and the 2036 'Do minimum' scenario are slightly different compared to the changes forecast from the 2014 'base case' scenario to the 2026 'Do minimum' scenario. As was observed in the 2026 'Do minimum' scenario, heavy vehicles shift from the M5 Motorway east of King Georges Road, to take up use of the WestConnex motorway, however a background increase in heavy vehicles in the ten years between 2026 and 2036 is forecast to result in a net increase in heavy vehicles on the M5 Motorway, despite the shift in a significant proportion of these vehicles to the WestConnex motorway. Table 8-27 compares the VKT and the VHT in the 2036 'Do minimum' scenario with the 'base case' scenario for heavy vehicles.
On-road public transport	The increase in traffic forecast on roads would be expected to negatively impact the travel time and reliability of bus services. In particular, several bus routes operate on the Princes Highway, Marsh Street / Airport Drive, and the Grand Parade / General Holmes Drive, all of which are indicated to experience an increase in traffic volumes, in one or both directions.	Similar to the 2026 'Do minimum' scenario, a forecast increase in traffic on roads would be expected to increase bus travel times and decrease travel time reliability.

Table 8-26 Comparison of daily million vehicle kilometres travelled (MVKT) and million vehicle hours travelled (MVHT) for metropolitan Sydney in 2026 'Do minimum' and 2014/15 'base case' scenarios for general traffic

Scenario	Year	Daily MVKT			Daily MVHT		
		Motorway	Other	Total	Motorway	Other	Total
Base case	2014/15	21.960	66.470	88.430	370	2.140	2.510
Do minimum	2026	28.290	84.720	113.000	520	3.100	3.620
Percentage change		+29%	+27%	+28%	+41%	+45%	+44%
Do minimum	2036	32.800	100.940	133.740	760	4.880	5.630
Percentage change (2014/15 to 2036)		+49%	+52%	+51%	+105%	+128%	+124%

Source: SMPM February 2018

Table 8-27 Comparison of daily million vehicle kilometres travelled (MVKT) and million vehicle hours travelled (MVHT) for metropolitan Sydney in 2026 'Do minimum' and 2014/15 'base case' scenarios for heavy vehicles

Scenario	Year	Daily MVKT			Daily MVHT		
		Motorway	Other	Total	Motorway	Other	Total
Base case	2014/15	2.350	3.880	6.230	0.040	0.110	0.150
Do minimum	2026	3.450	5.110	8.560	0.060	0.180	0.240
Percentage change		+47%	+32%	+37%	+50%	+64%	+60%
Do minimum	2036	4.370	6.250	10.620	0.090	0.280	0.370
Percentage change (2014/15 to 2036)		86%	61%	70%	125%	155%	147%

Source: SMPM February 2018

8.5.3 Operational performance without the project

8.5.3.1 President Avenue intersection and surrounds

Changes to the road network in the 'Do minimum' scenario

Projects within other Roads and Maritime programs were included in the operational modelling for the 'Do minimum' scenarios. Projects within the President Avenue intersection VISUM model network included Pinch Point Program upgrades to the Princes Highway and Rockdale Plaza Drive intersection, the Princes Highway and Rocky Point Road intersection, the Kogarah Street / Gray Street intersection and The Grand Parade and President Avenue, Brighton-Le-Sands intersection.

Network performance

Do minimum' scenario (2026 and 2036)

Table 8-28 and **Table 8-29** present a comparison of the performance of the modelled road network between the 2014/15 'base case' scenario and 2026 'Do minimum' and 2036 'Do minimum' scenarios for the AM and PM peak hours.

With forecast traffic growth, the network performance of the surrounding road network without the project is forecast to deteriorate over time. This part of the road network is forecast to be unable to accommodate the future traffic demands, with slow average speeds (at or less than 20 kilometres per hour) and queuing forecast during the AM and PM peak periods by 2036. The forecast traffic demand results in increased congestion along Princes Highway, The Grand Parade and West Botany Street in the future.

Table 8-28 President Avenue intersection and surrounds: VISUM modelled network performance – AM peak hour (2014/15 'base case' vs 2026 'Do minimum' scenario and 2036 'Do minimum' scenario)

Network measure	2014/15 'base case'	2026 'Do minimum'	Percentage change (from 'base case')	2036 'Do minimum'	Percentage change (from 'base case')	Percentage change (from 2026 'Do minimum')
All vehicles						
Total traffic demand (veh)	28,070	32,100	+14%	35,010	+25%	+9%
Total vehicle kilometres travelled in network (km)	81,220	90,670	+12%	96,120	+18%	+6%
Total time travelled approaching and in network (hr)	3,470	4,630	+33%	5,480	+58%	+18%
Total vehicles arrived	27,130	29,580	+9%	31,180	+15%	+5%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	2.9	2.8	-3%	2.8	-3%	0%
Average time travelled in network (mins)	7.4	8.7	+18%	9.4	+27%	+8%
Average speed (km/h)	23.4	19.6	-16%	17.5	-25%	-11%
Unreleased vehicles						
Unreleased demand (veh)	0	200	-	510	-	-
Percentage of total traffic demand	0%	Less than 1%	-	1%	-	-

Table 8-29 President Avenue intersection and surrounds: VISUM modelled network performance – PM peak hour (2014/15 'base case' vs 2026 'Do minimum' scenario and 2036 'Do minimum' scenario)

Network measure	2014/15 'base case'	2026 'Do minimum'	Percentage change (from 'base case')	2036 'Do minimum'	Percentage change (from 'base case')	Percentage change (from 2026 'Do minimum')
All vehicles						
Total traffic demand (veh)	28,990	32,670	+13%	35,460	+22%	+9%
Total vehicle kilometres travelled in network (km)	86,010	93,110	+8%	98,530	+15%	+6%
Total time travelled approaching and in network (hr)	3,090	3,940	+28%	4,810	+56%	+22%
Total vehicles arrived	28,700	31,090	+8%	32,720	+14%	+5%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	3.0	2.9	-3%	2.8	-7%	-3%
Average time travelled in network (mins)	6.4	7.2	+13%	8.1	+27%	+13%
Average speed (km/h)	27.9	23.6	-15%	20.5	-27%	-13%
Unreleased vehicles						
Unreleased demand (veh)	0	220	-	370	-	-
% of total traffic demand	0%	<1%	-	1%	-	-

Intersection performance

Table 8-30 presents Vissim modelled intersection performance in the AM and PM peak hour for key intersections in the President Avenue corridor study area, while **Table 8-31** presents the VISUM modelled intersection performance in the AM and PM peak hour for key intersections in the wider modelled road network.

The intersection performance results demonstrate that background traffic growth is forecast to result in a number of intersections in the wider modelled road network experiencing significant congestion, particularly in the 2036 'Do minimum' scenario.

Table 8-30 President Avenue corridor: Vissim modelled key intersection performance – 2026 and 2036 'Do minimum' scenarios

Key intersections	2014/15 'base case'		2026 'Do minimum'		2036 'Do minimum'	
	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS
AM peak hour						
The Grand Parade / President Avenue	25	B	29	C	37	C
President Avenue / Crawford Road	10	A	11	A	19	B
President Avenue / O'Connell Street	32	C	23	B	44	D
President Avenue / West Botany Street	16	B	32	C	18	B
Princes Highway / President Avenue	20	B	25	B	45	D
PM peak hour						
The Grand Parade / President Avenue	22	B	24	B	37	C
President Avenue / Crawford Road	14	A	15	B	18	B
President Avenue / O'Connell Street	14	B	15	B	15	B
President Avenue / West Botany Street	26	B	28	B	24	B
Princes Highway / President Avenue	27	C	34	C	37	C

Table 8-31 President Avenue intersection and surrounds: VISUM modelled key intersection performance – 2026 and 2036 'Do minimum' scenarios

Key intersections	2014/15 'base case'		2026 'Do minimum'		2036 'Do minimum'	
	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS
AM peak hour						
Princes Highway / West Botany Street	15	B	17	B	18	B
Wickham Street / West Botany Street	46	D	52	D	54	D
Princes Highway / Wickham Street / Forest Road	48	D	67	E	68	E
General Holmes Drive / Bestic Street	58	E	66	E	65	E
Princes Highway / Bay Street	33	C	44	D	66	E
Princes Highway / Rocky Point Road	32	C	33	C	30	C
West Botany Street / Bay Street	47	D	70	E	73	F
West Botany Street / Bestic Street	40	C	48	D	61	E
PM peak hour						
Princes Highway / West Botany Street	11	A	11	A	11	A
Wickham Street / West Botany Street	27	B	33	C	40	C
Princes Highway / Wickham Street / Forest Road	68	E	78	F	85	F
General Holmes Drive / Bestic Street	28	B	39	C	42	C
Princes Highway / Bay Street	44	D	55	D	68	E
Princes Highway / Rocky Point Road	18	B	19	B	21	B
West Botany Street / Bay Street	61	E	64	E	67	E
West Botany Street / Bestic Street	37	C	55	D	69	E

Travel times

In addition to network performance statistics, travel times for selected routes within the modelled road network were extracted from the VISUM and Vissim models and compared for the 2026 and 2036 'Do minimum' scenarios. **Figure 8-14** indicates the routes on which forecast travel times were measured, comprising:

- Princes Highway, from Rocky Point Road intersection to West Botany Street intersection (and in the opposite direction) – green route
- West Botany Street, from President Avenue intersection to Princes Highway intersection (and in the opposite direction) – blue route
- President Avenue, from Princes Highway intersection to The Grand Parade intersection (and in the opposite direction) – red route
- The Grand Parade, from Barton Street intersection to Bestic Street intersection (and in the opposite direction) – cyan route.

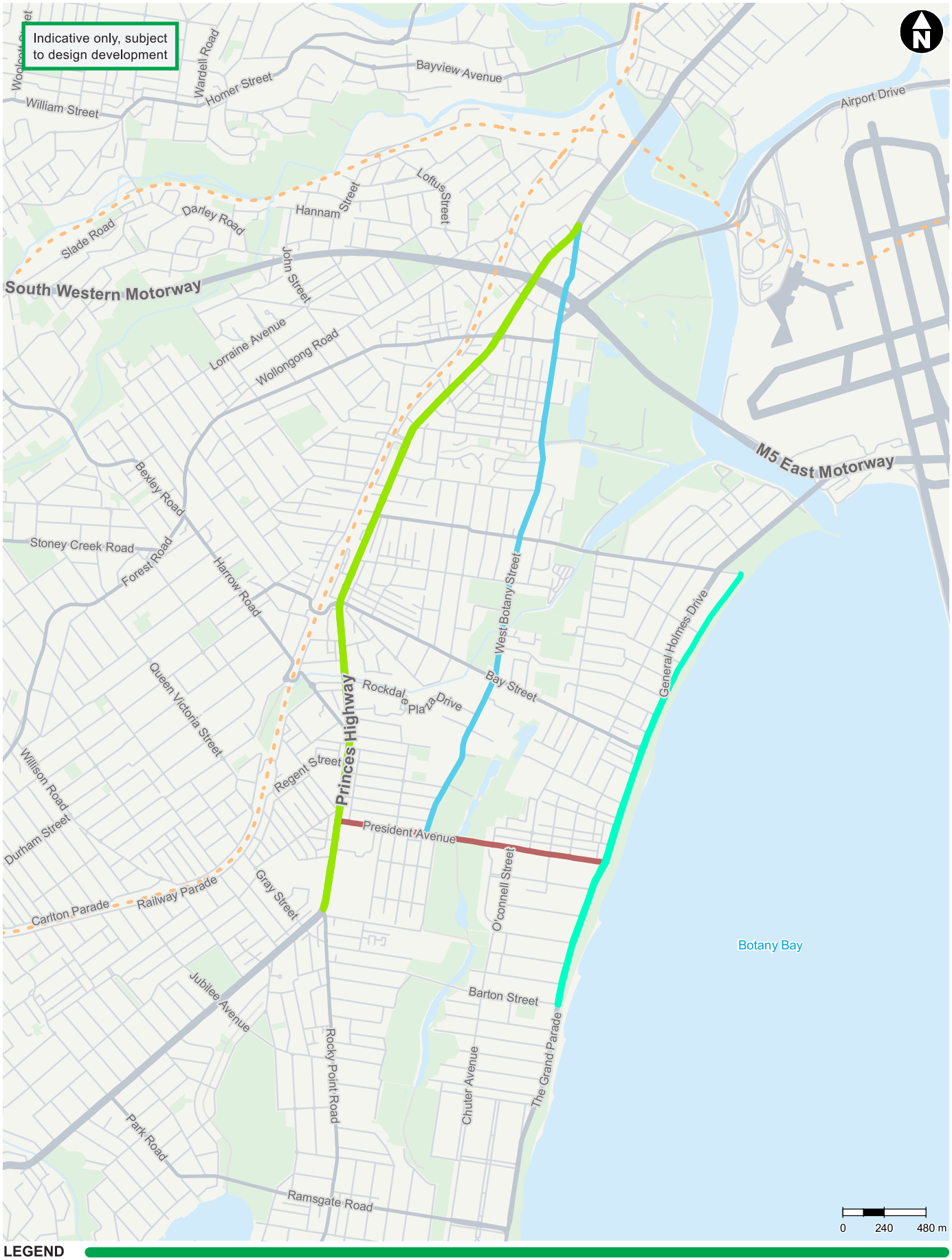


Figure 8-14 President Avenue intersection and surrounds: selected travel time routes

Figure 8-15 and **Figure 8-16** show a comparison of VISUM travel times recorded on the Princes Highway, West Botany Street and The Grand Parade routes in the 2014/15 'base case' and 2026 and 2036 'Do minimum' scenarios. Chapter 8 of **Appendix D** (Traffic and transport technical report) includes additional detail about travel times and speeds on the routes around President Avenue.

In the AM peak hour, increased travel times along these routes are forecast over time in the 'Do minimum' scenarios, especially in the peak directions. Similarly results are forecast in the PM peak hour, with increased travel times forecast along Princes Highway and West Botany Street in the 'Do minimum' scenarios, with a smaller increase forecast along The Grand Parade. These travel times reflect the deterioration in network performance in the 'Do minimum' scenarios associated with the forecast growth in traffic demand.

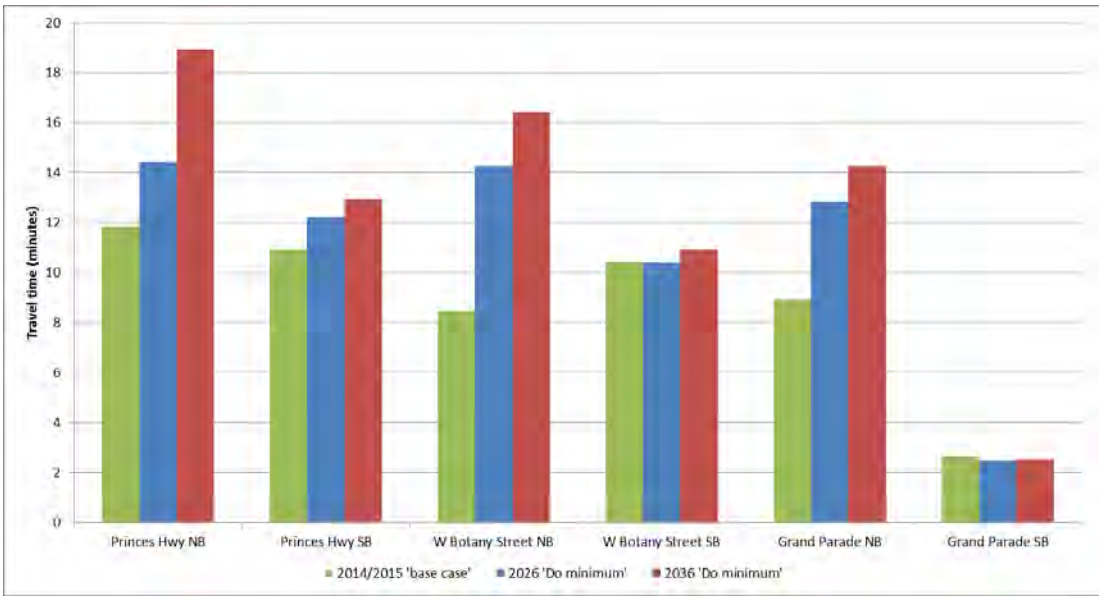


Figure 8-15 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – AM peak 'Do minimum' scenarios

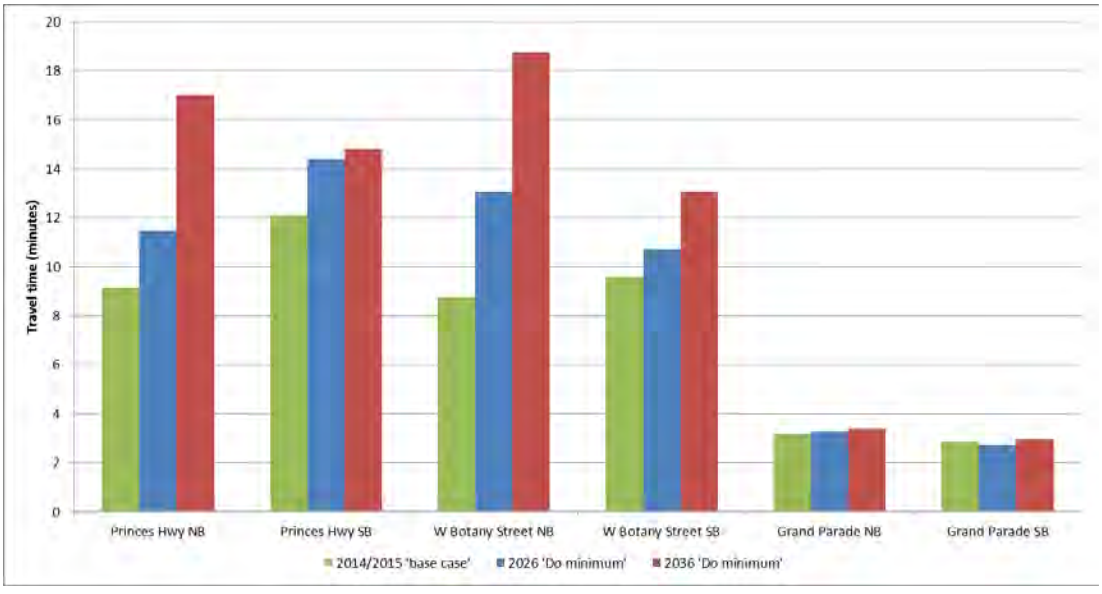


Figure 8-16 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – PM peak 'Do minimum' scenarios

Traffic crashes

The frequency of crashes on the roads in the vicinity of the President Avenue intersection would be expected to increase in proportion to forecast traffic volume growth. The potential for crashes – indicated by the crash rates per vehicle kilometres travelled on the existing road network as outlined in **section 8.3** – would remain.

By 2036, the growth in traffic volumes in the 'Do minimum' scenario is forecast to result in a proportional rise in crash frequencies and costs along the following road sections:

- Princes Highway (Gannon Street to Jubilee Avenue)
  - Crashes would be expected to increase from an average of 116 to 139 per annum
  - The corresponding annual cost of crashes would rise from $12.7 million to $15.1 million per annum
- Rocky Point Road (Princes Highway to Jubilee Avenue)
  - Crashes would be expected to increase from an average of 11 to 13 per annum
  - The corresponding annual cost of crashes would rise from $2.3 million to $2.8 million per annum
- West Botany Street (Princes Highway to President Avenue)
  - Crashes would be expected to increase from an average of 49 to 58 per annum
  - The corresponding annual cost of crashes would rise from $4.3 million to $5.1 million per annum
- The Grand Parade / General Holmes Drive (Southern Cross Drive to Barton Street)
  - Crashes would be expected to increase from an average of 80 to 100 per annum
  - The corresponding annual cost of crashes would rise from $8.4 million to $13.5 million per annum
- Marsh Street / Airport Drive (West Botany Street to North Precinct Road)
  - Crashes would be expected to increase from an average of 29 to 33 per annum
  - The corresponding annual cost of crashes would rise from $2.7 million to $3.1 million per annum
- President Avenue (Princes Highway to The Grand Parade)
  - Crashes would be expected to increase from an average of 19 to 23 per annum
  - The corresponding annual cost of crashes would rise from $4.9 million to $6.2 million per annum
- O'Connell Street / Chuter Avenue (President Avenue to Barton Street)
  - Crashes would be expected to increase from an average of 3 to 4 per annum
  - The corresponding annual cost of crashes would rise by less than $0.1 million per annum
- Bay Street (Princes Highway to The Grand Parade)
  - Crashes would be expected to increase from an average of 24 to 34 per annum
  - The corresponding annual cost of crashes would rise from $4.7 million to $6.5 million per annum.

The above analysis has been undertaken assuming the future frequency, type, and severity of crashes would be consistent with historic trends. On this basis the forecast growth in traffic would be expected to result in both the total number and cost of crashes increasing.

Public transport services

Bus services

Figure 8-17 shows the comparison of average bus travel time for five bus routes (303/X03, 478, 400/410, 422 and 947) across the President Avenue intersection and surrounds modelled road network extracted from the VISUM models for the 2026 and 2036 'Do minimum' scenario in the AM and PM peak hours. The routes were selected as those with the highest frequency and which travelled a significant part of the modelled road network.

These results indicate that the average bus travel times in the modelled road network are forecast to increase in the AM and PM peak hours as congestion worsens. An analysis of bus patronage changes forecast by the Sydney Strategic Travel Model (STM) for travel zones that fall within the traffic and transport assessment study is provided in Chapter 8 of **Appendix D** (Traffic and transport technical report). The analysis forecasts significant growth in both inbound and outbound trips in the peak and non-peak periods.

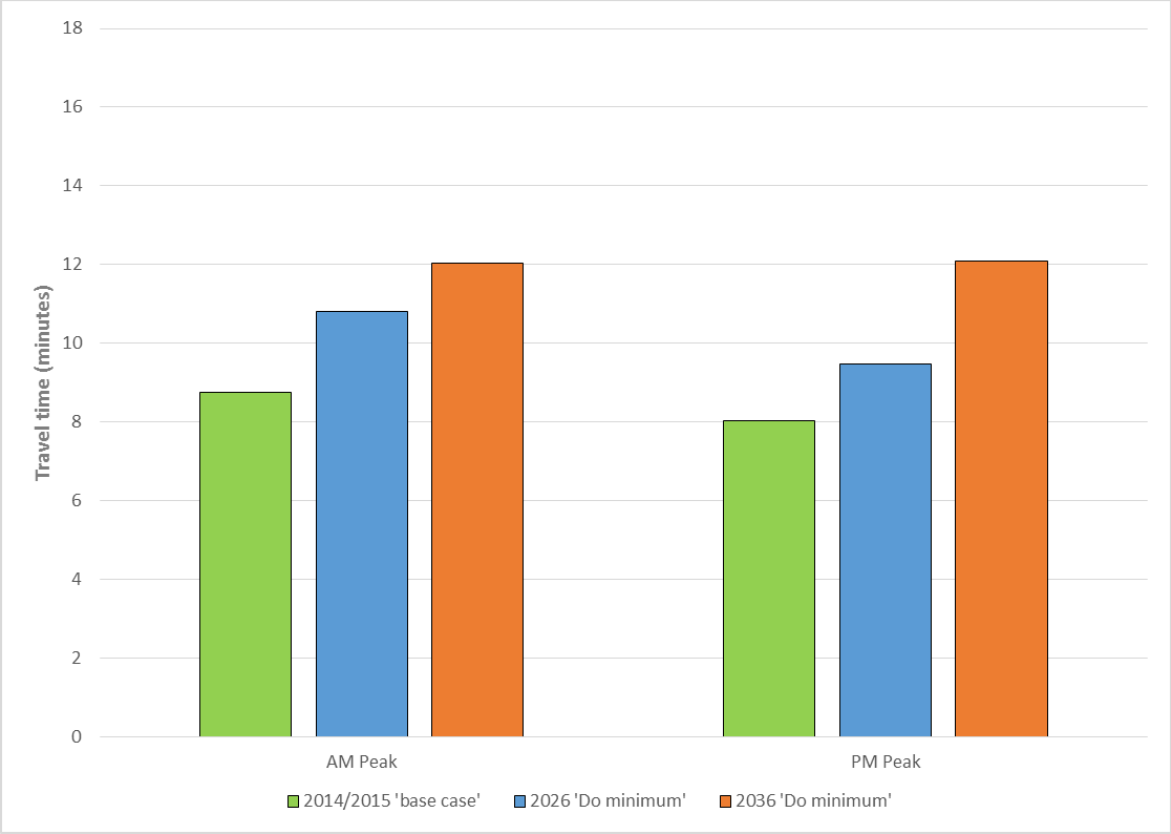


Figure 8-17 President Avenue intersection and surrounds: VISUM modelled average bus travel times – 'Do minimum' comparison

Active transport facilities

Existing and forecast traffic volumes on the Princes Highway are likely to increase the difficulty in achieving outcomes associated with activation of the Princes Highway through the Rockdale Town Centre, including improvements to streetscape amenity on the Princes Highway around Bestic Street and Rockdale Plaza Drive. Specifically, they will make it difficult to increase pedestrian amenity and permeability due to noise, pollution and safety impacts associated with high forecast traffic volumes, and also potentially create conflicts with vehicle movements required to service these activity uses including customer parking and loading requirements.

8.5.3.2 St Peters interchange and surrounds

Changes to road network in 'Do minimum' scenario

Changes to the road network around the St Peters interchange and surrounds are planned and have therefore been included in the 2026 and 2036 'Do minimum' scenarios. These changes include:

- Pinch point works by Roads and Maritime at the Princes Highway / Railway Road intersection
- The Airport North project, which includes improvements to the Domestic Triangle and O'Riordan Street corridor
- Network improvements in the Mascot Town Centre Precinct
- Network changes as part of the King Street Gateway project
- The Sydney Gateway project.

These changes are described in detail in section 8.3.1 of **Appendix D** (Traffic and transport technical report).

Network performance

Table 8-32 and **Table 8-33** present a comparison of the performance of the modelled road network between the 2014/15 'base case' scenario and 2026 'Do minimum' and 2036 'Do minimum' scenarios for the AM and PM peak hours.

A large amount of road infrastructure is planned for the area including the St Peters interchange, providing access to and from the New M5 and M4-M5 Link motorways, and the Sydney Gateway, providing a high-capacity connection between the St Peters interchange and the Sydney Airport and Port Botany precinct. With this new infrastructure, forecast average travel speed through the road network is higher than the 2014/15 base case even with a forecast traffic growth of 20-30 per cent by 2026. However, by 2036, further growth is forecast to increase traffic demand in an already congested area, and cause a drop in average speeds in the network during peak hours.

Table 8-32 St Peters interchange network performance – AM peak hour (2014/15 'base case' vs 2026 'Do minimum' scenario and 2036 'Do minimum' scenario)

Network measure	2014/15 'base case'	2026 'Do minimum'	Percentage change (from 'base case')	2036 'Do minimum'	Percentage change (from 2026 'Do minimum')
All vehicles					
Total traffic demand (veh)	25,420	31,410	+24%	33,910	+8%
Total vehicle kilometres travelled in network (km)	75,770	120,120	+59%	131,580	+10%
Total time travelled approaching and in network (hr)	3,090	4,230	+37%	6,880	+56%
Total vehicles arrived	24,920	30,910	+24%	32,050	+4%
Average per vehicle in network					
Average vehicle kilometres travelled in network (km)	2.7	3.4	+26%	3.5	+3%
Average time travelled in network (mins)	6.7	7.3	+9%	10.2	+40%
Average speed (km/h)	24.6	28.4	+15%	20.4	-28%
Unreleased vehicles					
Unreleased demand (veh)	230	760	-	1,730	-
% of total traffic demand	1%	2%	-	5%	-

Table 8-33 St Peters interchange network performance – PM peak hour (2014/15 'base case' vs 2026 'Do minimum' scenario and 2036 'Do minimum' scenario)

Network measure	2014/15 'base case'	2026 'Do minimum'	Percentage change (from 'base case')	2036 'Do minimum'	Percentage change (from 2026 'Do minimum')
All vehicles					
Total traffic demand (veh)	24,580	31,620	+29%	34,420	+9%
Total vehicle kilometres travelled in network (km)	71,710	118,900	+66%	129,370	+9%
Total time travelled approaching and in network (hr)	2,530	4,120	+63%	4,930	+20%
Total vehicles arrived	24,590	31,130	+27%	33,150	+6%
Average per vehicle in network					
Average vehicle kilometres travelled in network (km)	2.7	3.4	+26%	3.4	0%
Average time travelled in network (mins)	5.7	6.9	+21%	7.3	+6%
Average speed (km/h)	28.4	29.7	+5%	27.9	-6%
Unreleased vehicles					
Unreleased demand (veh)	0	570	-	1,340	-
% of total traffic demand	0%	2%	-	4%	-

Intersection performance

Table 8-34 presents modelled intersection performance in the AM and PM peak hour for key intersections in the St Peters interchange study area in the 2026 and 2036 'Do minimum' scenarios.

The performance for a number of intersections in the St Peters interchange area is forecast to worsen when compared with the base case. The most affected are the Gardeners Road / O'Riordan Street intersection (AM and PM peaks), Gardeners Road / Kent Street intersection (AM peak), Campbell Road / Euston Road (AM peak), Euston Road / Sydney Park Road intersection (AM and PM peaks) and Princes Highway / Campbell Street intersection (AM peak). This is caused by the increase in general background traffic and the impact of the St Peters interchange on the local road network.

Table 8-34 St Peters interchange: key intersection performance – 2026 and 2036 'Do minimum' scenarios

Key intersections	2014/15 'base case'		2026 'do minimum'		2036 'do minimum'	
	Ave delay (sec)	LOS	Ave delay (sec)	LOS	Ave delay (sec)	LOS
AM peak hour						
O'Riordan Street / Bourke Road	16	B	23	B	38	C
Gardeners Road / O'Riordan Street	43	D	66	E	>100	F
Gardeners Road / Bourke Road	51	D	50	D	56	D
Gardeners Road / Kent Road			60	E	>100	F
Ricketty Street / Kent Road	24	B	55	D	55	D
Campbell Road / Euston Road	1	A	48	D	70	E
Princes Highway / Campbell Street	44	D	>100	F	>100	F
Princes Highway / May Street	89	F	61	E	76	F
Princes Highway / Sydney Park Road	23	B	28	B	41	C
Sydney Park Road / Mitchell Road	24	B	32	C	32	C
Euston Road / Sydney Park Road	8	A	50	D	58	E
PM peak hour						
O'Riordan Street / Bourke Road	19	B	13	A	14	A
Gardeners Road / O'Riordan Street	39	C	49	D	77	F
Gardeners Road / Bourke Road	67	E	37	C	37	C
Gardeners Road / Kent Road			34	C	35	C
Ricketty Street / Kent Road	22	B	39	C	41	C
Campbell Road / Euston Road	1	A	54	D	67	E
Princes Highway / Campbell Street	25	B	57	E	60	E
Princes Highway / May Street	45	D	14	A	7	A
Princes Highway / Sydney Park Road	26	B	35	C	40	C
Sydney Park Road / Mitchell Road	2	A	39	C	51	D
Euston Road / Sydney Park Road	8	A	>100	F	>100	F

Travel times

In addition to network performance statistics, travel times for selected routes around the St Peters interchange were extracted from the models and compared for the 2026 and 2036 'Do minimum' scenarios. **Figure 8-18** indicates the routes on which forecast travel times were measured, comprising:

- Princes Highway, near Bellevue Street, to Euston Road, north of Maddox Street (and in the opposite direction) – purple route
- WestConnex South (exit ramp from New M5) to Euston Road, north of Maddox Street (and in the opposite direction) – orange route
- Railway Road, near Unwins Bridge Road, to Gardeners Road, east of Botany Road (and in the opposite direction) – blue route.

Figure 8-19 and **Figure 8-20** show a comparison of travel times recorded on these routes in the 2014/15 'Base case' and 2026 and 2036 'Do minimum' scenarios. In both peak hours, in spite of the forecast increase in traffic demands, travel times on these selected routes do not change significantly.

In both peak hours, the 'do minimum' scenario travel times on the selected routes are generally forecast to increase, in some cases significantly, compared to the base case. This is due to the growth in the background traffic and the impact of the St Peters interchange on the local road network.

In the AM peak hour, the travel times from the 2026 'do minimum' to 2036 'do minimum' are forecast to increase slightly, though generally by no more than one minute, except for the Gardeners Road to Railway Road and Railway Road to Gardeners Road routes and the off-ramp from the New M5 (WCX South) to Euston Road east. In the PM peak hour, the differences between the 2026 'do minimum' to 2036 'do minimum' times are smaller and all less than one minute, with some routes showing slight decreases in travel times and others slight increases. The forecast change in travel times between 2026 and 2036 is likely to be minor in the 'do minimum' scenarios.

Chapter 8 of **Appendix D** (Traffic and transport technical report) includes additional detail about travel times and speeds on the routes around the St Peters interchange.

Figure 8-18 St Peters interchange: selected travel time routes

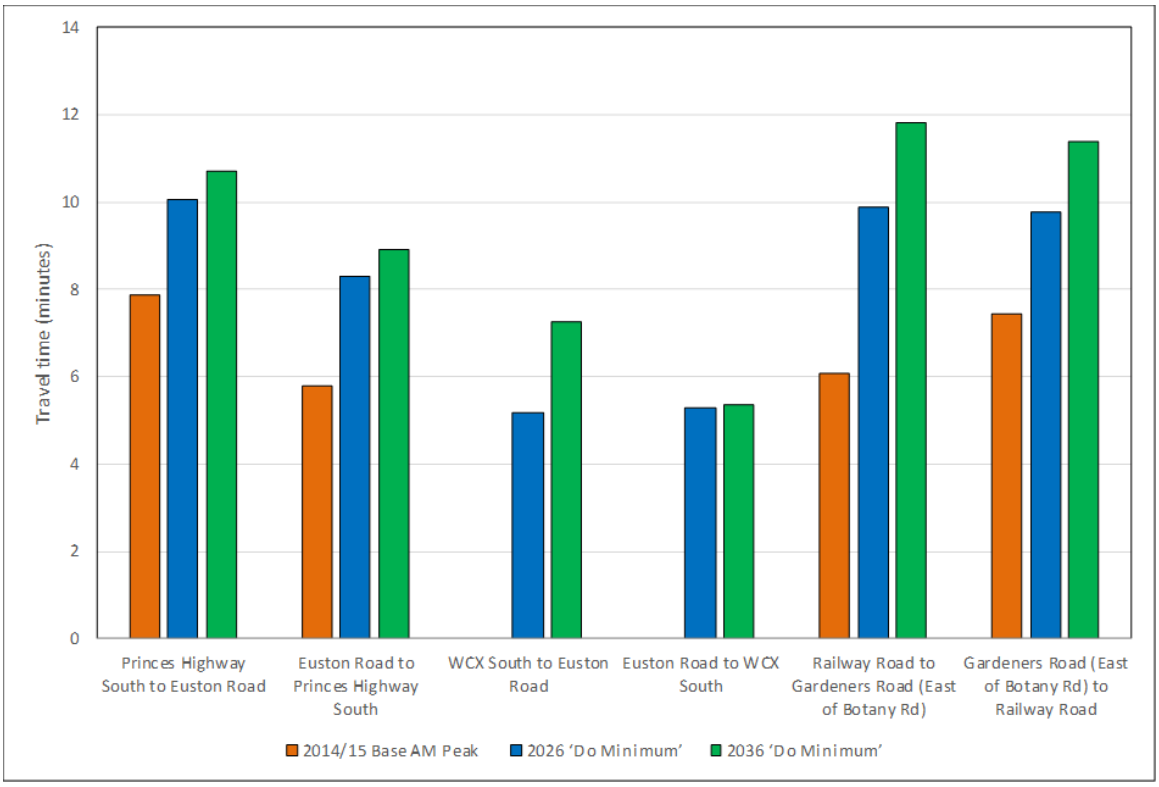


Figure 8-19 St Peters interchange: Average travel time (mins) – AM peak 'Do minimum' scenarios

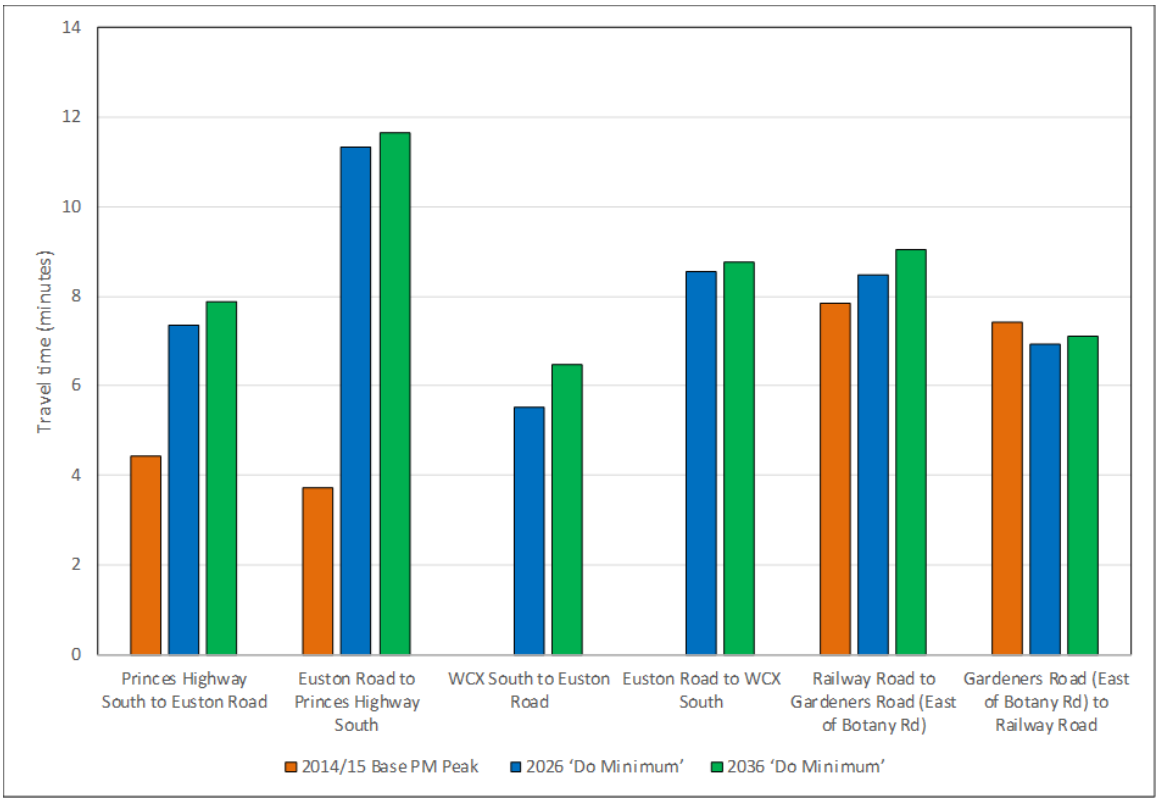


Figure 8-20 St Peters interchange: Average travel time (mins) – PM peak 'Do minimum' scenarios

Traffic crashes

The frequency of crashes on the roads in the vicinity of the St Peters interchange would be expected to increase in proportion to forecast traffic volume growth in the future. The potential for crashes – indicated by the crash rates per vehicle kilometre travelled – would remain.

By 2036, the growth in traffic volumes would create a proportional rise in crash frequencies and costs along the following road sections:

- Princes Highway (Enmore Road to Gannon Street)
  - Crashes would be expected to increase from an average of 76 to 90 per annum
  - The corresponding annual cost of crashes would rise from $11.6 million to $13.2 million per annum.
- Canal Road / Ricketty Street / Gardeners Road (Princes Highway to Botany Road)
  - Crashes would be expected to increase from an average of 34 to 49 per annum
  - The corresponding annual cost of crashes would rise from $3.0 million to $4.3 million per annum.
- Euston Road (Sydney Park Road to Campbell Road)
  - Crashes would be expected to increase from an average of 9 to 97 per annum
  - The corresponding annual cost of crashes would rise from $0.7 million to $8.0 million per annum.
- Bourke Road (Wyndham Street to Gardeners Road)
  - Crashes would be expected to increase from an average of 11 to 12 per annum
  - The corresponding annual cost of crashes would rise from $1.3 million to $1.5 million per annum.

The above analysis has been undertaken assuming the future frequency, type, and severity of crashes would be consistent with historic trends. On this basis the forecast growth in traffic would be expected to result in both the total number and cost of crashes increasing.

Public transport services

Bus services

Figure 8-21 shows the comparison in average bus travel time for all bus routes across the St Peters modelled road network for the 2026 and 2036 'Do minimum' scenario in the AM and PM peak hours.

These results indicate that the average bus travel times are expected to increase in the AM peak between 2026 and 2036 by about four minutes. Similar to the network and intersection performance metrics, the increase in demand between 2026 and 2036 is expected to have a bigger impact during the AM peak hour than the PM peak hour, due to the additional congestion forecast in the network during the AM peak hour.

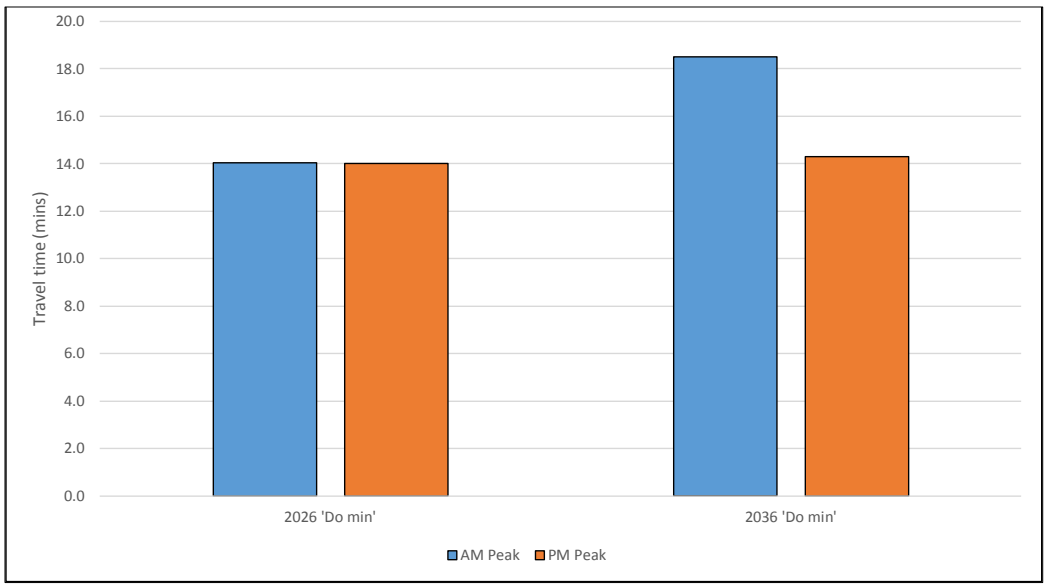


Figure 8-21 St Peters interchange: Average travel time for buses – 'Do minimum' comparison

Active transport facilities

The Airport Cycleway, from along the Alexandra Canal to Coward Street, along with the Bourke Road cycleway, forms a major north-south cycling corridor in the St Peters interchange area. Botany Bay City Council (now part of Bayside Council) has installed separated two-way bike lanes along Bourke Street between Coward Street and Church Avenue to connect with the Coward Street element of the Airport Cycleway. This is planned to continue north to connect with the Bourke Road cycleway and is subject to the proposed re-alignment of the Gardeners Road / Bourke Street intersection as part of the New M5 project.

A number of active transport facilities are planned for construction as part of the New M5 project. The most significant new infrastructure will be the construction of a pedestrian and cycle bridge across the Alexandra Canal and over the on and off ramps at the St Peters interchange and construction of a pedestrian and cycle bridge across Campbell Road to Sydney Park. This would provide a cross-regional separated cycleway connecting the Bourke Road cycleway at Mascot Town Centre across the Alexandra Canal to St Peters at Unwins Bridge Road. This will provide an opportunity to integrate cycling facilities with the Camdenville Park master plan.

Other key pedestrian and cycle infrastructure to be delivered as part of the local road upgrades being delivered as part of the New M5 project would include:

- A shared path along the western side of Euston Road between Campbell Road and Sydney Park Road
- An on-road separate cycle way along Bourke Road between Campbell Road and Church Avenue
- Retention of the on-road cycle lane on Bourke Road, north of the Campbell Road extension
- Provision of footpaths along all local roads upgraded as part of the project.

Three new pedestrian pathways would also be provided around the St Peters interchange to enhance pedestrian connectivity:

- Parallel to the Princes Highway along the north-western site boundary, providing a pedestrian connection between the Princes Highway at the intersection of Canal Road and Campbell Street, near the intersection of Albert Street
- Along the northbound (western) side of Canal Road
- Between the Sydney Gateway and the Princes Highway, providing a pedestrian connection between the Sydney Gateway crossing of Canal Road and the Princes Highway at the intersection with Canal Road.

8.6 Future year traffic volumes and patterns with the project

8.6.1 Introduction

Traffic forecasting data derived directly from SMPM is used in this section to provide evidence of high level patterns across parallel strategic corridors within and external to the study area for peak (AM and PM) and daily (AWT) time periods. The purpose of the screenline analysis is to examine how traffic may shift between alternative parallel routes or corridors through the study area. The analysis also indicates if any toll avoidance behaviour is forecast.

Three screenlines were selected that capture potential traffic shifts to parallel routes adjacent to the project, as well as changes in traffic volumes on roads crossing the Cooks River and the Georges River:

- The F6 Extension Stage 1 screenline consists of the project and key north-south roads running parallel to the project, including the Princes Highway, the project, West Botany Street and General Holmes Drive (north of Bay Street)
- The Cooks River screenline consists of roads crossing the Cooks River east of Wolli Creek including the Princes Highway, Marsh Street, New M5 Motorway and General Holmes Drive, east of the M5 East tunnel
- The Georges River screenline consists of the two available road crossing points over the Georges River, being the Princes Highway (Tom Uglys Bridge) and Taren Point Road (Captain Cook Bridge). The screenline also includes the future stages of the F6 Extension in the 2036 cumulative scenario.

The locations of these screenlines are shown in **Figure 8-22**. For each screenline, directional and two-way traffic volume outputs from the different modelling scenarios for each future year (2026 and 2036) were analysed.

A summary of the results of the screenline assessment are provided in the following sections. Detailed results, including forecast AWT volumes from SMPM for each of the screenline locations under the 2026 and 2036 ‘Do minimum’ and ‘Do something’ scenarios and the 2036 ‘Cumulative’ scenario are included in Chapter 9 of **Appendix D** (Traffic and transport technical report).

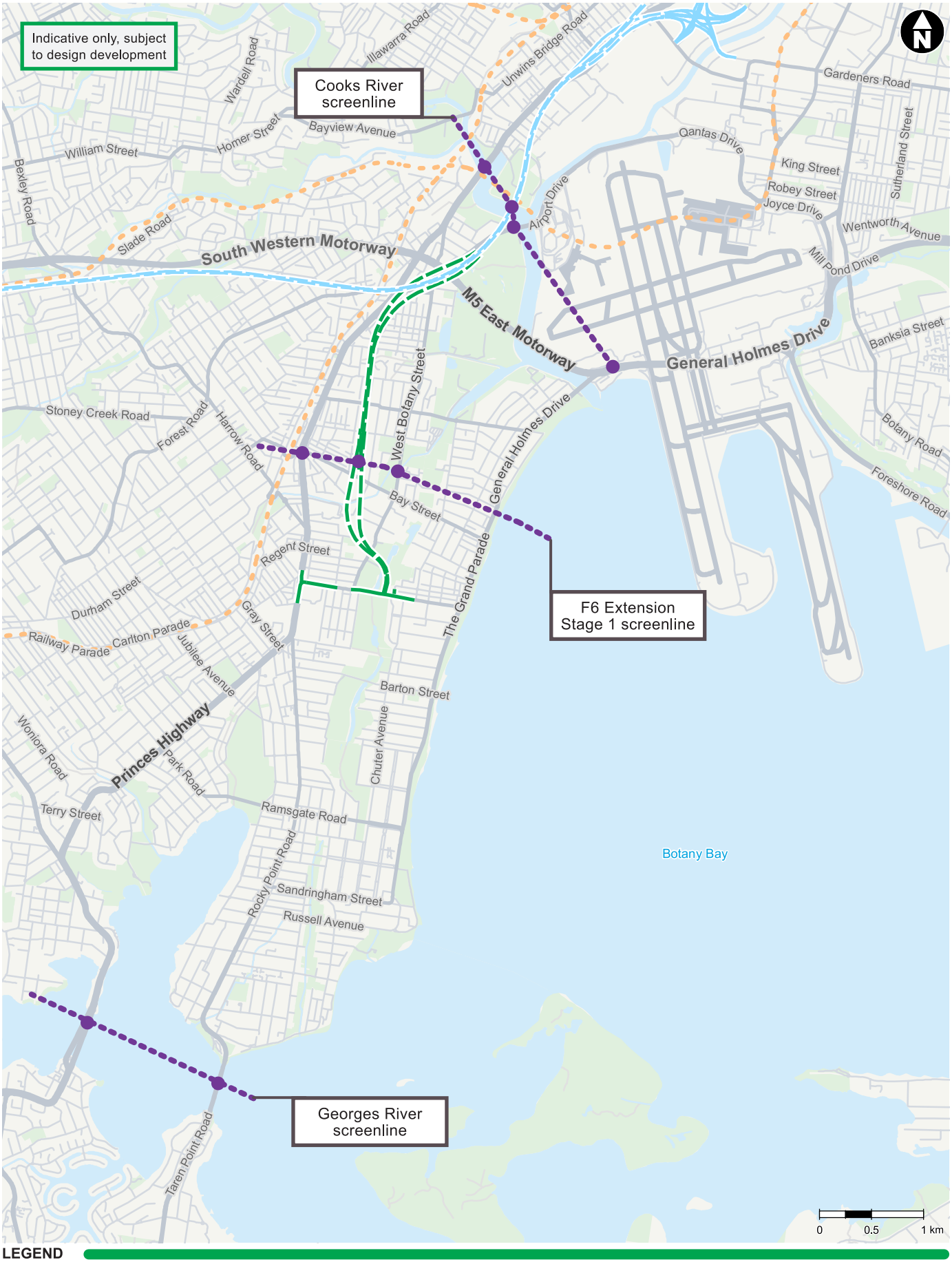


Figure 8-22 Screenline locations

8.6.2 F6 Extension Stage 1 screenline

Average weekday traffic (AWT) analysis

Key observations comparing the 2026 and 2036 'Do minimum' and 'Do something' scenarios include:

- The introduction of the project is forecast to reduce AWT traffic on the arterial surface road links between Kogarah and Arncliffe
- The greatest impact is on General Holmes Drive, where the two-way AWT is forecast to reduce by more than 10,000 vehicles in 2026 and 2036, equating to a decrease in two-way AWT of just under 15 per cent
- There are also reductions in traffic forecast for the Princes Highway and West Botany Street.
  - Two-way daily traffic on the Princes Highway is forecast to decrease by about five per cent in 2026 and 2036 with the project – a decrease of about 2,000 vehicles per day
  - With the project, the two-way AWT on West Botany Street is forecast to fall by more than 10 per cent in 2026 and 2036 – a decrease of about 3,000 vehicles per day in 2026 and 3,500 vehicles per day in 2036.

Key observations comparing the 2036 'Do minimum' and 2036 'Cumulative' scenarios include:

- Patterns of change are similar to those observed in the 'Do something' scenario, with daily traffic on surface roads forecast to decrease as vehicles take up use of the project
- The implementation of motorway extension projects in the 'Cumulative' scenario, including further stages of the F6 Extension from Kogarah to Loftus, would increase the attractiveness of the project, which is reflected in a greater uptake of the project and a greater decrease on surface roads than in the 'Do something' scenario
- Compared to the 'Do minimum' scenario, there is a 25 per cent increase in traffic crossing the screenline, but a 13 per cent decrease in traffic crossing the screenline on surface roads.

Figure 8-23 illustrates the forecast two-way AWT volumes crossing the F6 Extension Stage 1 screenline under all five scenarios.

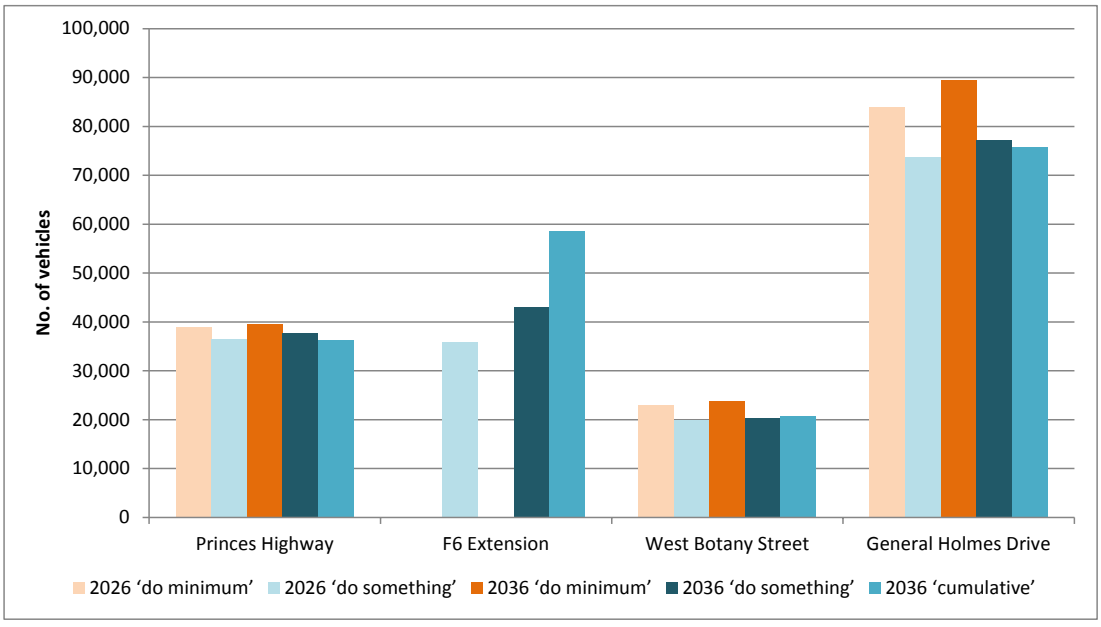


Figure 8-23 F6 Extension Stage 1 screenline comparison of two-way AWT volumes

Source: SMPM v.1, February 2018

Peak hour analysis

Figure 8-24 and **Figure 8-25** illustrate the forecast two-way peak hour volumes crossing the F6 Extension Stage 1 screenline during the AM and PM peak periods. These illustrate that the peak hour impacts with the project are similar to those observed for the AWT volumes, with the project forecast to reduce the volume of peak hour traffic on the key arterial roads running north-south between Arncliffe and Kogarah compared to the 2026 and 2036 'Do minimum' scenarios.

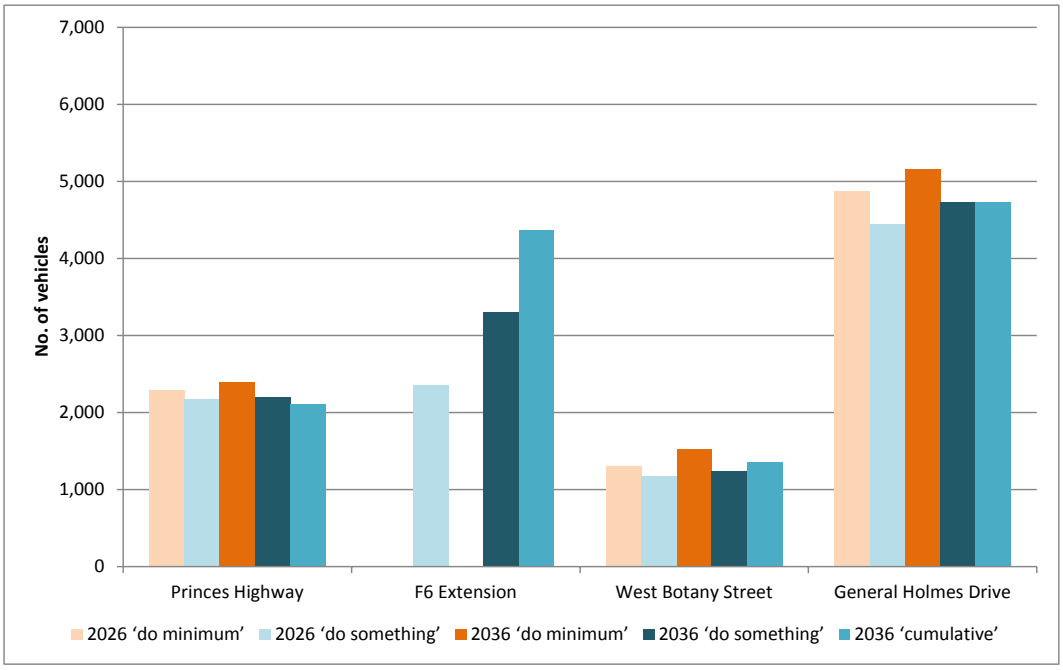


Figure 8-24 F6 Extension Stage 1 screenline comparison of two-way AM peak one hour volumes

Source: SMPM v.1, February 2018

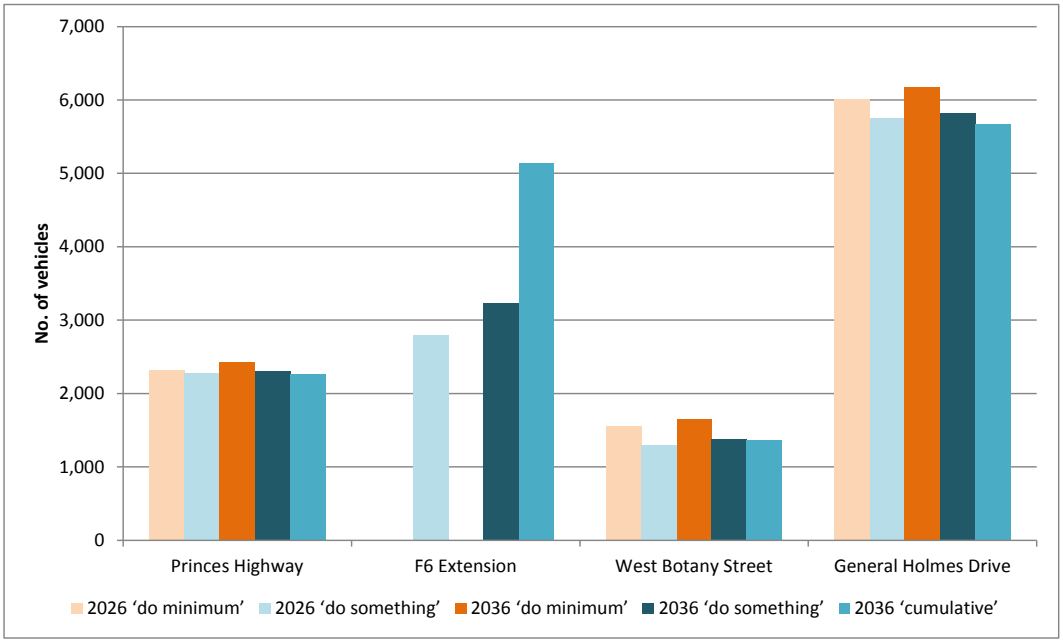


Figure 8-25 F6 Extension Stage 1 screenline comparison of two-way PM peak one hour volumes

Source: SMPM v.1, February 2018

8.6.3 Cooks River screenline

Average weekday traffic (AWT) analysis

Key observations comparing the 2026 and 2036 'Do minimum' and 'Do something' scenarios include:

- The project is forecast to reduce two-way AWT traffic crossing the Cooks River on existing road links in the 2026 and 2036 'Do something' scenarios, compared to the 'Do minimum' scenarios.
- Overall, two-way AWT traffic crossing the screenline is forecast to increase by around three per cent in 2026 and four per cent in 2036 under the 'Do something' scenarios. This increase can primarily be attributed to traffic using the New M5, with traffic on this section of the New M5 forecast to increase by more than 70 per cent in 2026 and 2036, as traffic shifts off non-motorway roads and as additional traffic takes up use of this section of the New M5 travelling to and from the project.

Key observations comparing the 2036 'Do minimum' and 'Cumulative' scenarios comprise:

- Patterns of change are similar to those observed in the 'Do something' scenario comparison, with two-way AWT volumes on existing roads crossing the screenline forecast to decrease, but the overall volume of traffic crossing the screenline forecast to increase as vehicles take up use of the project and the New M5 Motorway
- The reduction in traffic on non-motorway roads is more pronounced when comparing the 2036 'Do minimum' scenario with the 2036 'Cumulative' scenario. Two-way AWT volumes on non-motorway roads is forecast to decrease by about nine per cent under the 2036 'Cumulative' scenario, but overall traffic crossing the screenline is forecast to increase by about seven per cent in the 'Cumulative' scenario. This change is reflective of the increased connectivity for the motorway network provided in the 'Cumulative' scenario by further stages of the F6 Extension from Kogarah to Loftus and the Western Harbour Tunnel and Beaches Link projects.

Figure 8-26 illustrates the forecast two-way AWT volumes crossing the Cooks River screenline under all five scenarios.

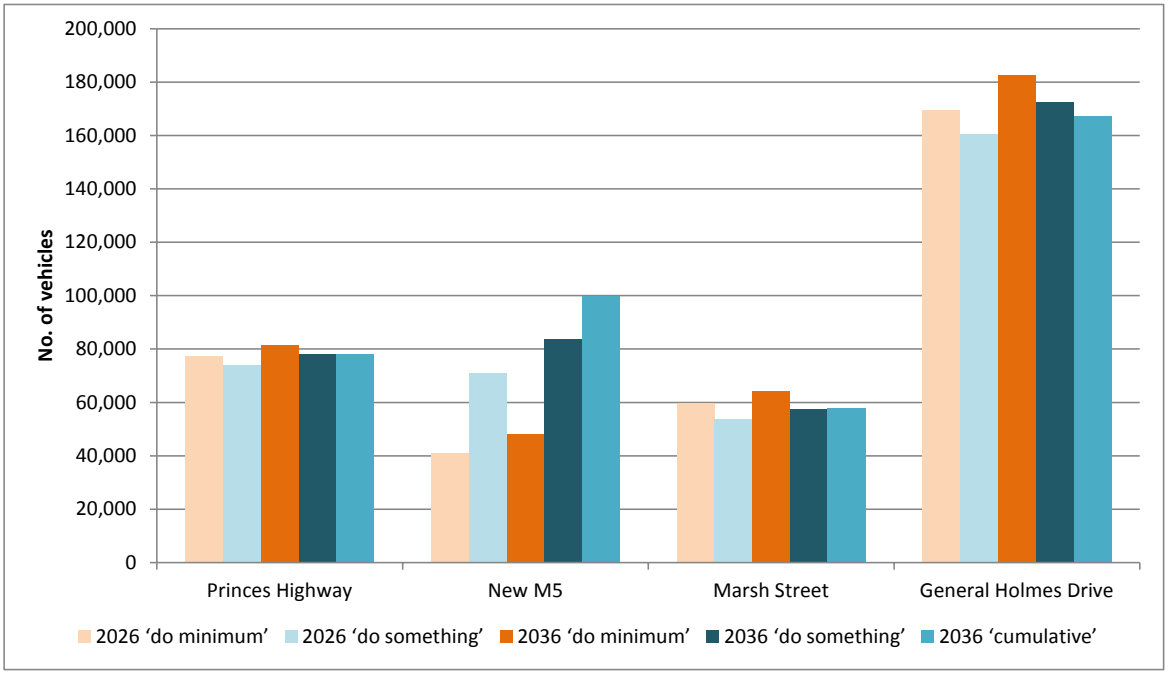


Figure 8-26 Cooks River screenline comparison of two-way AWT volumes

Source: SMPM v.1, February 2018

Peak hour analysis

Figure 8-27 and **Figure 8-28** illustrate the forecast two-way peak hour volumes crossing the Cooks River screenline during the AM and PM peak periods. These illustrate that the peak hour impacts with the project are forecast to be similar to those observed for AWT volumes, with the project reducing the volume of peak hour traffic on existing roads with a significant shift onto the New M5. This shift is greater in the cumulative scenario, where the implementation of subsequent stages of the F6 Extension from Kogarah to Loftus increases the connectivity and attractiveness of the motorway network.

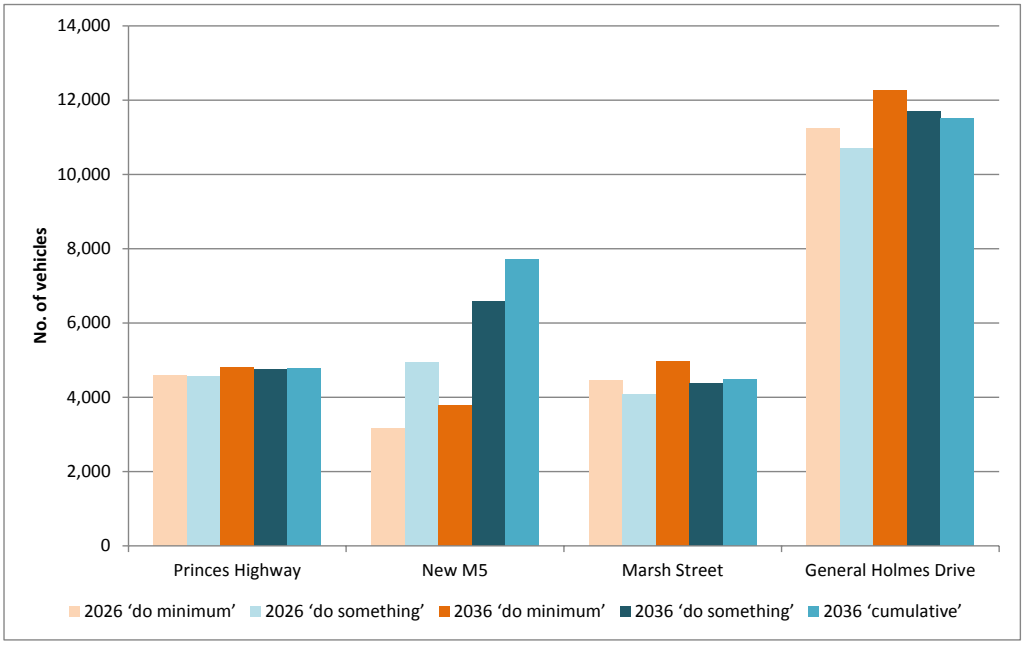


Figure 8-27 Cooks River screenline comparison of two-way AM peak one hour volumes

Source: SMPM v.1, February 2018

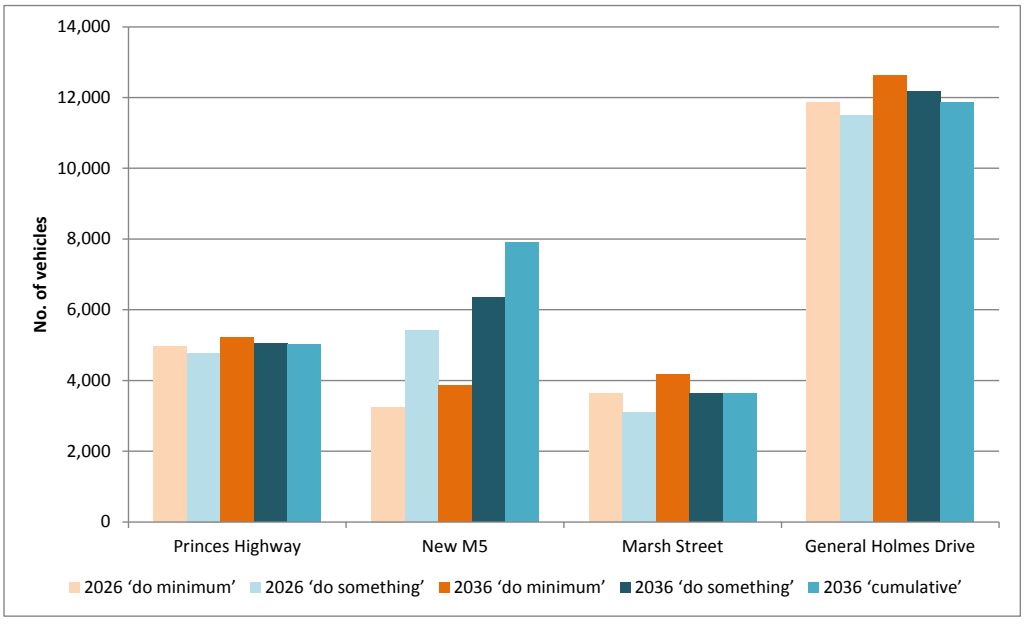


Figure 8-28 Cooks River screenline comparison of two-way PM peak one hour volumes

Source: SMPM v.1, February 2018

8.6.4 Georges River screenline

Average weekday traffic (AWT) analysis

The screenline volumes indicate that the introduction of the project is forecast to result in an increase of about one per cent for traffic crossing the screenline in 2026 and 2036 when comparing the 'Do something' scenario with the 'Do minimum' scenario.

Key observations comparing the 2036 'Do minimum' and 'Cumulative' scenarios include:

- The 'Cumulative' scenario includes further stages of the F6 Extension from Kogarah to Loftus, which provides a new arterial crossing of the Georges River, with the Captain Cook Bridge becoming part of the F6 Extension motorway. As a result, forecasts show a shift in traffic from arterial roads crossing the Georges River onto the F6 Extension, with two-way daily traffic crossing the screenline increasing by eight per cent, but daily traffic on arterial roads decreasing by 15 per cent
- In the 2036 'cumulative' scenario, about 27 per cent of two-way traffic crossing the Georges River at the eastern crossing points included in this screenline analysis is forecast to use the F6 Extension. Compared to the 2036 'do minimum scenario, there is a forecast 12 per cent decrease in traffic using the Princes Highway to cross the Georges River.

Figure 8-29 illustrates the forecast two-way AWT volumes crossing the Georges River screenline under all five scenarios.

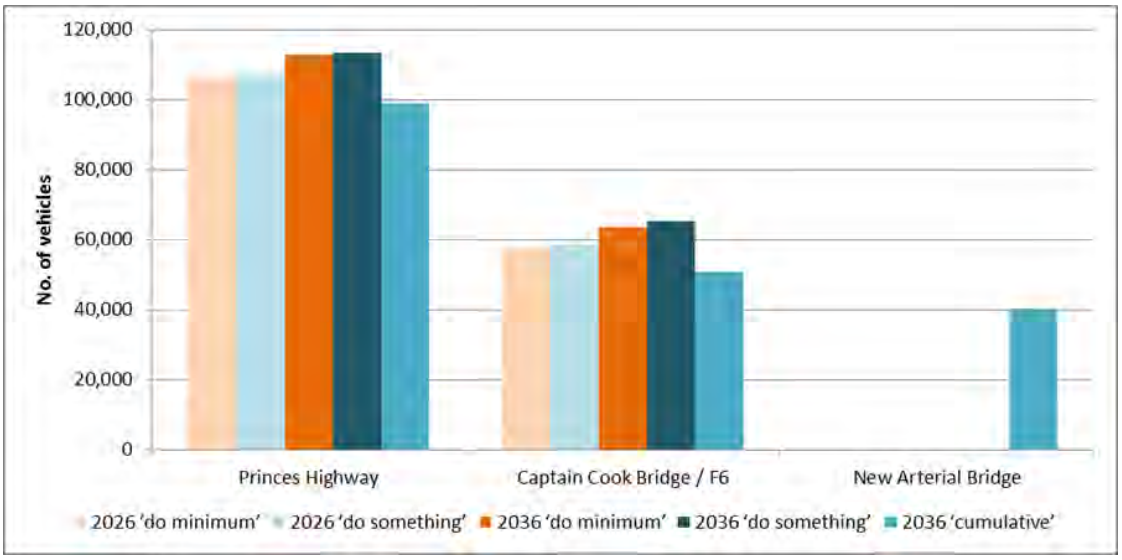


Figure 8-29 Georges River screenline comparison of two-way AWT volumes

Source: SMPM v.1, February 2018

Peak hour analysis

Figure 8-30 and **Figure 8-31** illustrate the forecast two-way peak hour volumes crossing the Georges River screenline. These show that the peak hour impacts with the project are similar to those observed for the AWT volumes. With the project in 2026 and 2036, there is little change to peak hour traffic on these crossing points of the Georges River, indicating that the project is not resulting in a significant amount of additional traffic using the surface road network south of the President Avenue intersection. However, in the 2036 'Cumulative' scenario, there is a forecast decrease in traffic on Princes Highway during the AM and PM peak hours as vehicles take up use of the F6 Extension and the new arterial crossing of the Georges River .

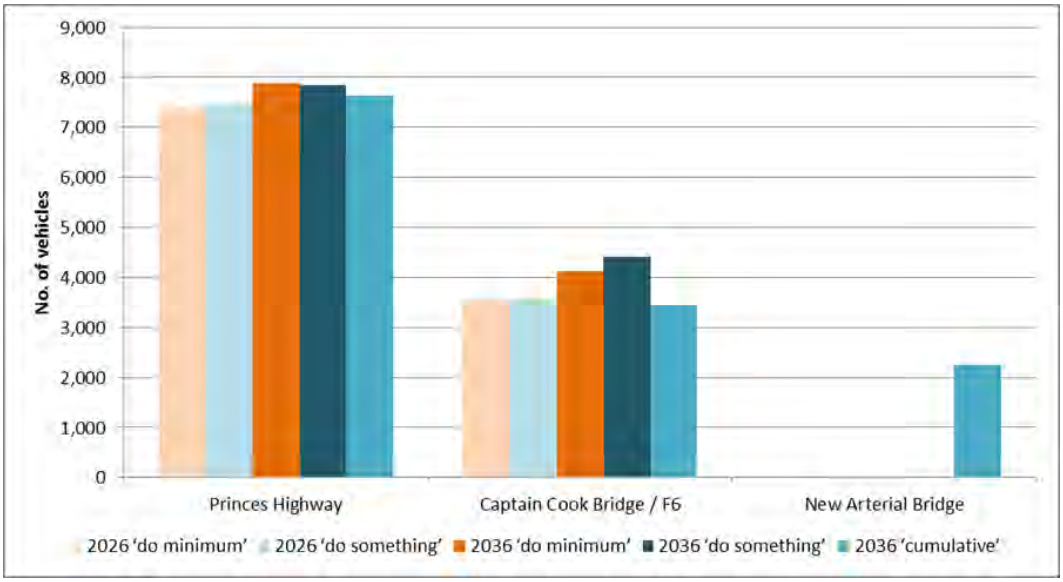


Figure 8-30 Georges River screenline comparison of two-way AM peak one hour volumes

Source: SMPM v.1, February 2018

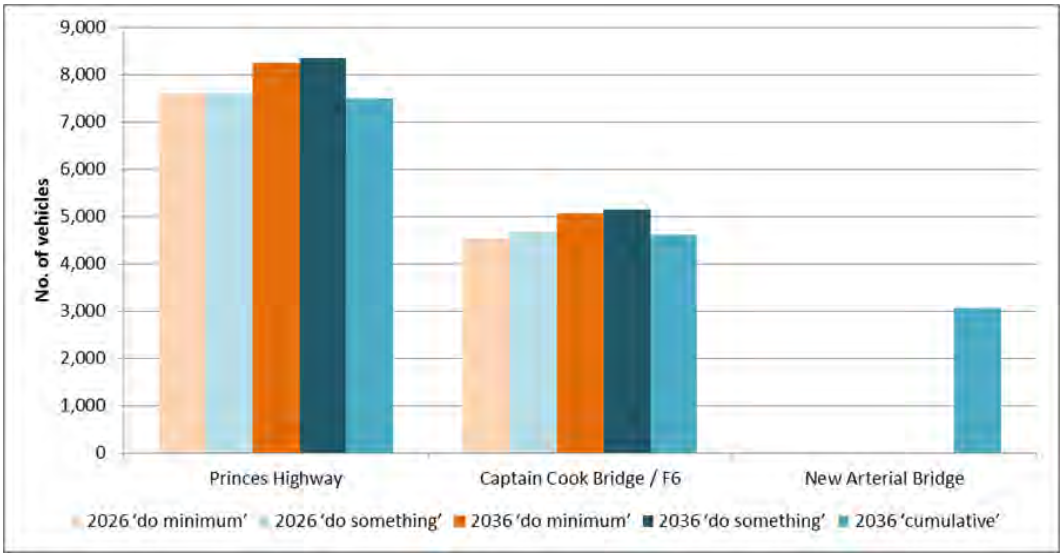


Figure 8-31 Georges River screenline comparison of two-way PM peak one hour volumes

Source: SMPM v.1, February 2018

8.6.5 Heavy vehicle analysis

Figure 8-32, **Figure 8-33** and **Figure 8-34** illustrate the forecast two-way AWT heavy vehicle volumes crossing the F6 Extension Stage 1, Cooks River and the Georges River screenlines.

The forecasts indicate the project has the impact of significantly reducing heavy vehicle volumes on key arterial north-south road links between Arncliffe and Kogarah. While the pattern of reduction forecast for heavy vehicle traffic is similar to that forecast for all vehicles, the percentage reduction on surface roads is much larger for heavy vehicles than for all vehicles.

In the 'Cumulative' scenario, there is a significant shift off the Princes Highway, some of which is forecast to use the new arterial bridge crossing of the Georges River, forecast to carry eight per cent of daily heavy vehicle traffic; however, heavy vehicles are forecast to double on the Captain Cook Bridge, which in the future becomes part of the F6 Extension motorway, increasing from approximately 3,000 to 6,000 trucks per day.

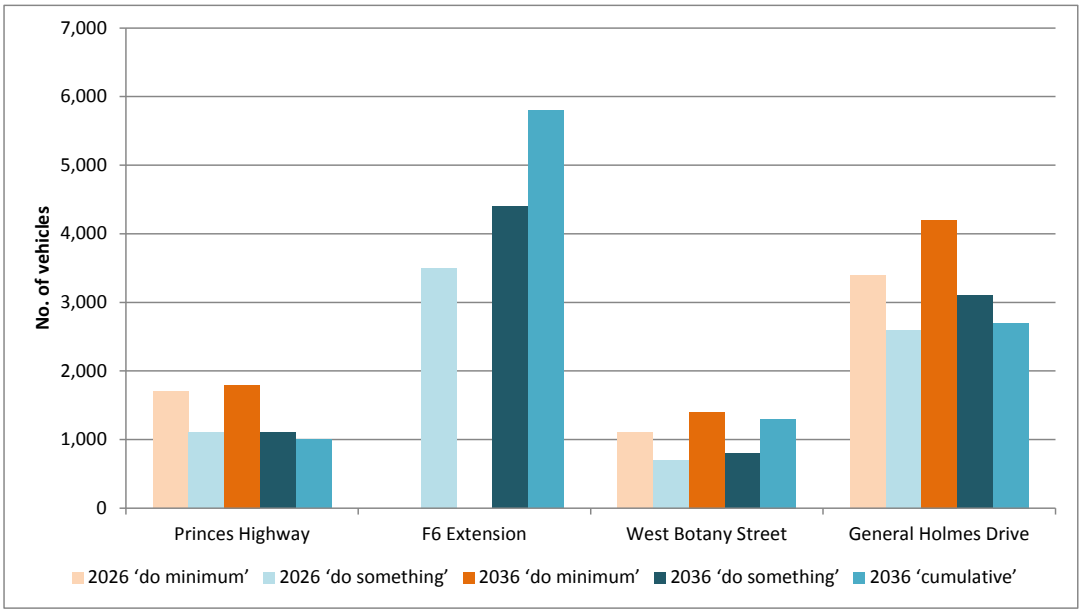


Figure 8-32 Comparison of two-way AWT heavy vehicle volumes at the F6 Extension Stage 1 screenline

Source: SMPM v.1, February 2018

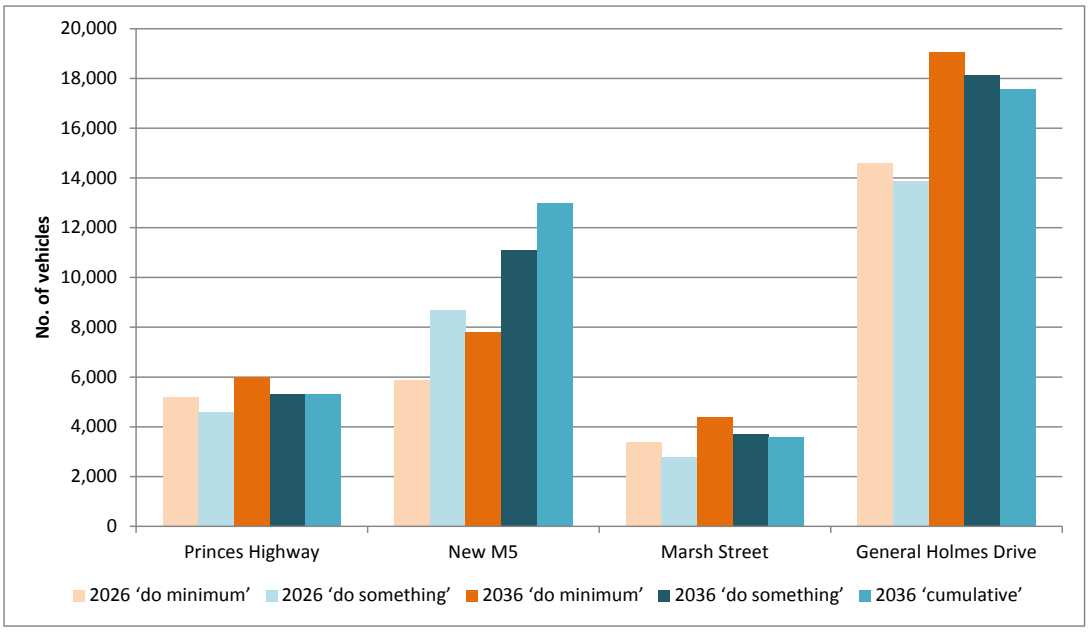


Figure 8-33 Comparison of two-way AWT heavy vehicle volumes at the Cooks River screenline

Source: SMPM v.1, February 2018

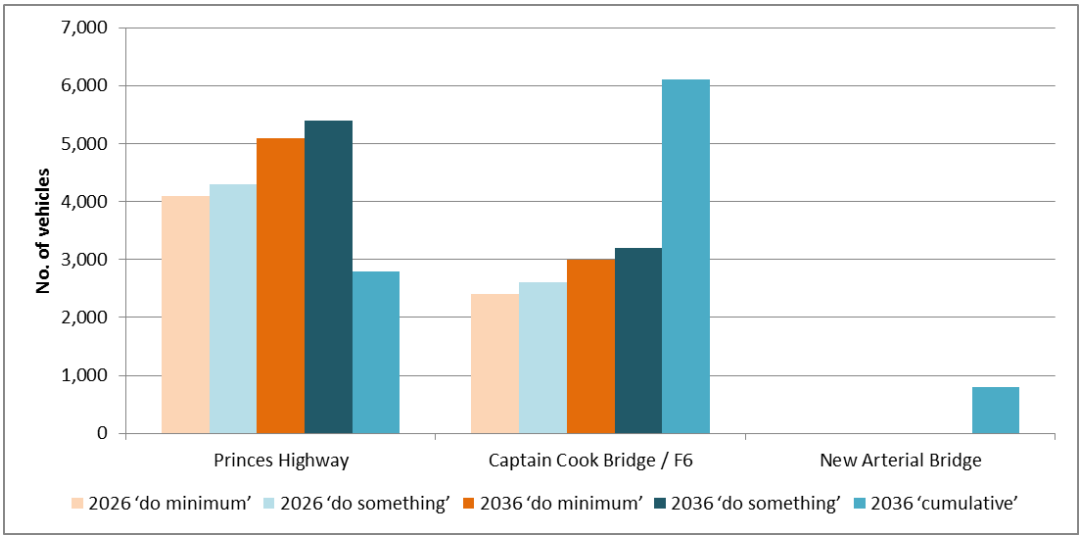


Figure 8-34 Comparison of two-way AWT heavy vehicle volumes at the Georges River screenline

Source: SMPM v.1, February 2018

8.6.6 Toll avoidance

The project is a new piece of tolled infrastructure and so would not generate toll avoidance in the same way as, for example, the M4 Widening project that reinstated the toll back onto the existing M4 Motorway or the New M5 project that introduced a toll on the existing M5 East Motorway. Generally, the traffic using the project in the future would have been travelling on other roads. However, more traffic would use the project if it was not tolled, so a form of toll avoidance would occur.

The screenline analysis found no major shifts in daily forecast traffic onto alternative, parallel routes as a result of the project. Once the project is operational, it is expected that there would be a period where drivers trial using their existing, toll-free routes or the new, tolled project before deciding on a regular route. Congestion in peak periods on existing, toll-free surface roads would provide an incentive to use the new, tolled road.

8.7 Assessment of operational impacts with the project

8.7.1 Introduction

The sections below provide an overview of key findings for forecast conditions on the future road network with the project in the future years (2026 and 2036), including the Sydney metropolitan road network, the F6 Extension Stage 1 motorway and the modelled network around the President Avenue intersection and the St Peters interchange. Chapter 10 of **Appendix D** (Traffic and transport technical report) provides a detailed analysis of forecast future conditions with the project.

8.7.2 Sydney metropolitan road network

This section details the traffic demand changes forecast by the SMPM in a 'Do something' scenario using forecast AM and PM peak hour traffic volumes for 2026 and 2036. The SMPM provides strategic travel demand forecasts across the Sydney metropolitan area based on expected population and employment changes.

A number of key benefits and improvements are forecast as a result of the project:

- Improved network productivity on the Sydney metropolitan network, with more trips forecast to be made or longer distances travelled on the network in a shorter time. The forecast increase in vehicle kilometres travelled (VKT) and reduction in vehicle hours travelled (VHT) is mainly due to traffic using the new motorway, with small reductions in daily VKT and VHT forecast on non-motorway roads. As the project is a comparatively short section of motorway in the context of the metropolitan road network, the impact is small
- The project, along with investment in other road, public transport and active transport projects, would help to accommodate the forecast growth in population and travel demand in the Sydney metropolitan area
- Reduced travel times are forecast between Kogarah and Mascot, Sydney CBD, North Sydney, Macquarie Park and Parramatta in the peak directions of travel in the peak periods
- Reduced daily traffic is forecast on sections of major arterial roads including sections of the Princes Highway, West Botany Street and General Holmes Drive
- Heavy vehicle volumes are forecast to fall by more than 40 per cent on sections of Princes Highway and West Botany Street and by more than 30 per cent on General Holmes Drive, each weekday.

Where the project would connect to the existing road network, some increased congestion is forecast along President Avenue, Kogarah, and on the exit ramps to the St Peters interchange, due to the forecast increase in demand to and from the project.

'Do something' (2026) – Completion of F6 Extension Stage 1 at opening

Figure 8-35 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2026 'Do something' and the 'Do minimum' scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2036 'Do something' scenario are shown in green and roads where volumes are forecast to increase are shown in red. The band thickness is indicative of the magnitude of this change. These forecast traffic volumes include both fixed and induced traffic demand.

General traffic

With the inclusion of the project, a large volume of traffic is forecast to shift to the project, with reductions in daily traffic volumes forecast on General Holmes Drive / The Grand Parade, President Avenue (east of the F6 President Avenue ramps), Princes Highway, West Botany Street, the New M5 Motorway and King Georges Road, north of the Princes Highway. There are also smaller reductions forecast on the Eastern Distributor.

Increases in daily traffic are forecast on President Avenue (west of the F6 President Avenue ramps), Princes Highway (south of President Avenue), Rocky Point Road and O'Connell Street. These localised forecast increases in daily traffic are a result of traffic traveling to and from the project.

Travel times

With the inclusion of the project, travel time reductions in the peak directions in the 2026 peak periods between Kogarah and destinations to the north compared to the 2026 'Do minimum' scenario are forecast by the SMPM including:

- Between Kogarah and Mascot, Kogarah and Macquarie Park or Kogarah and Parramatta, average travel times in the peak direction in the peak period are forecast to reduce by about 10 minutes – a 15 to 35 per cent reduction
- Between Kogarah and the Sydney CBD or Kogarah and North Sydney, average travel times in the peak direction in the peak period are forecast to reduce by about 5 minutes – a 10 to 15 per cent reduction.

Road network productivity

Table 8-35 shows that in 2026, with the inclusion of the project, road network productivity is forecast to improve slightly as indicated by a small drop in the daily VKT and VHT on the arterial (non-motorway) network, with an increase in kilometres and hours travelled along the motorway routes for general traffic. Overall, the road network would accommodate more or longer trips in a shorter time. As the project is a comparatively short section of motorway in the context of the metropolitan road network, the impact is small.

Table 8-35 Comparison of daily 2026 MVKT and MVHT for metropolitan Sydney in 'Do minimum' and 'Do something' scenarios for general traffic

Scenario	Daily MVKT			Daily MVHT		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum	28.290	84.710	113.000	0.520	3.100	3.620
Do something	28.450	84.630	113.080	0.520	3.090	3.610
Percentage change	<+1%	>-1%	<+1%	0%	>-1%	>-1%

Source: SMPM v.1, February 2018

On-road freight

The changes in heavy vehicle traffic in 2026 with the project compared to without the project are similar to those observed for general traffic, with decreases in heavy vehicle traffic forecast on General Holmes Drive / The Grand Parade, President Avenue (east of the President Avenue intersection), King Georges Road (north of the Princes Highway), Princes Highway and the New M5 Motorway, and increases in heavy vehicle traffic forecast on Princes Highway south of President Avenue, and on President Avenue (west of the F6 Extension/President Avenue intersection), due to vehicles using these roads to access the project at President Avenue.

Table 8-36 compares the VKT and the VHT in the 2026 'do minimum' and 'do something' scenarios for heavy vehicles.

Table 8-36 Comparison of daily 2026 MVKT and MVHT for metropolitan Sydney in 'do minimum' and 'do something' scenarios for heavy vehicles

Scenario	Daily MVKT			Daily MVHT		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum	3.450	5.110	8.560	0.060	0.180	0.240
Do something	3.460	5.100	8.560	0.060	0.180	0.240
Percentage change	<+1%	>-1%	0%	0%	0%	0%

Source: SMPM v.1, February 2018

On-road public transport

There are reductions in traffic forecast on key roads with the project. Many of these reductions would be expected to improve bus speed and reliability. Based on the existing bus network, there are several bus routes which operate along The Grand Parade / General Holmes Drive, Princes Highway, Airport Drive and King Georges Road, all of which are forecast to have reductions in traffic with the implementation of the project. There a limited number of regional routes which operate on Princes Highway south of President Avenue, and on Rocky Point Road, and one local bus route which runs along O'Connell Street and President Avenue, which would be negatively impacted by the increase in traffic volumes as more vehicles travel to and from the project along these roads.

Figure 8-35 Difference in AWT between 2026 'Do something' and 'Do minimum' scenarios

Source: SMPM v.1, February 2018

‘Do something’ (2036)

Figure 8-36 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2036 ‘Do something’ and the ‘Do minimum’ scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios.

General traffic

The pattern of change highlighted in the 2036 comparison is generally the same as in the 2026 comparison. However, on some roads, the forecast increases in daily traffic volumes in the 2036 ‘Do something’ scenario are less pronounced due to the growth in background traffic by 2036.

Travel times

With the inclusion of the project, travel time reductions in the peak directions in the 2036 peak periods between Kogarah and destinations to the north are forecast by the SMPM including:

- Between Kogarah and Mascot, average travel times in the peak direction in the peak period are forecast to reduce by about 15 minutes – a 15 to 35 per cent reduction
- Between Kogarah and Macquarie Park, Kogarah and Parramatta, Kogarah and the Sydney CBD or Kogarah and North Sydney, average travel times in the peak direction in the peak period are forecast to reduce by about 10 minutes – a 10 to 15 per cent reduction.

Road network productivity

A slight improvement in road network productivity is forecast in 2036 with the inclusion of the project. Compared to the ‘Do minimum’ scenario, there is a small drop in the daily VKT and VHT on the arterial (non-motorway) network with an increase in kilometres and hours travelled along the motorway routes for general traffic, as seen in **Table 8-37**.

Table 8-37 Comparison of daily 2036 MVKT and MVHT for metropolitan Sydney in ‘Do minimum’ and ‘Do something’ scenarios for general traffic

Scenario	Daily MVKT			Daily MVHT		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum	32.790	100.940	133.740	0.750	4.880	5.630
Do something	33.010	100.820	133.830	0.760	4.860	5.620
Percentage change	<+1%	>-1%	<+1%	>+1%	>-1%	>-1%

Source: SMPM v.1, February 2018

On-road freight

The observed increases and decreases for heavy vehicles for the 2036 'Do something' scenario when compared to the 2036 'do minimum scenario are similar to those observed for general traffic. **Table 8-38** compares the VKT and the VHT in the 2036 'do minimum' and 'do something' scenarios for heavy vehicles.

Table 8-38 Comparison of daily 2036 MVKT and MVHT for metropolitan Sydney in 'do minimum' and 'do something' scenarios for heavy vehicles

Scenario	Daily MVKT			Daily MVHT		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum	4.370	6.250	10.620	0.090	0.280	0.370
Do something	4.380	6.250	10.630	0.090	0.280	0.370
Percentage change	<+1%	0%	<+1%	0%	0%	0%

Source: SMPM v.1, February 2018

On-road public transport

As was observed for 2026, in 2036, based on the existing bus network, the decreases on key roads forecast with the implementation of the project would be expected to improve the speed and reliability of several regional bus routes. Increases in traffic on the Princes Highway (south of President Avenue) and on President Avenue (west of the President Avenue intersection) would be expected to decrease travel times and reliability of a smaller number of regional and local bus routes.

Figure 8-36 Difference in AWT between 2036 'Do something' and 'Do minimum' scenarios

Source: SMPM v.1, February 2018

8.7.3 Operational performance with the project

The wider road network is forecast to perform slightly better with the project than without the project in 2026 and 2036, with improved average travel speeds as traffic switches from using the surface road network to using the new motorway. Reduced daily traffic is forecast on sections of major arterial roads including sections of the Princes Highway, West Botany Street and General Holmes Drive and heavy vehicle volumes are forecast to fall by more than 40 per cent on sections of Princes Highway and West Botany Street and by more than 30 per cent on General Holmes Drive, each weekday. Smaller reductions in traffic volumes are also forecast on strategic roads such as King Georges Road and the Eastern Distributor in 2026 and 2036 when compared to scenarios without the project.

However, while the project would deliver a number of key benefits on the wider strategic road network, some localised increased congestion is forecast where the project would connect to the existing road network, due to the forecast increase in demand to and from the project. To fully evaluate operational impacts on the F6 Extension Stage 1 motorway and on roads around the project connections to the surface road network, detailed operational models were developed. The following sections summarise the key outcomes from the operational modelling.

8.7.3.1 F6 Extension Stage 1

Changes to the road network in the 'Do something' scenario

With the introduction of the project, the section of the New M5 Motorway between the F6 Extension Stage 1 ramps and the SPI ramps would be line marked for four lanes (from two lanes) in each direction.

Mid-block level of service

An assessment of the mid-block level of service for the F6 Extension Stage 1 motorway was carried out for the 2026 and 2036 'Do something' scenarios for the AM and PM peak hours. Detailed modelling results including LoS and modelled speed are presented in the tables in section 10.2.1 of **Appendix D** (Traffic and transport technical report). A summary of key findings from this assessment is as follows:

- In 2026, all motorway segments with the exception of the westbound St Peters interchange entry ramp operate at LoS D or better. Although the St Peters interchange entry ramp is forecast to operate at LoS E in the PM peak hour, traffic is still forecast to operate at 73 km/h, which is 91 per cent of the posted speed limit of 80 km/h
- In 2036, all motorway segments are forecast to operate at LoS D or better, with the exception of the eastbound St Peters interchange exit ramp in the AM peak hour, the westbound St Peters interchange entry ramp in the PM peak hour and the northbound President Avenue entry ramp in the AM peak hour. Although the St Peters interchange exit and entry ramps are forecast to operate at LoS E during certain peak periods, traffic is still forecast to operate at 72 km/h (90% of the posted speed) on both ramps in the peak hours. The President Avenue entry ramp is forecast to operate at 58 km/h (97% of the posted speed), indicating that while traffic is forecast to be dense on the entry ramp, it is not expected to impact on traffic operations.

Traffic crashes

Table 8-39 presents the crashes forecast under the 'Do something' scenario compared to the 'Do minimum' scenario for the:

- F6 Extension Stage 1 mainline
- New M5 Motorway between the interface location with the F6 Extension and the St Peters interchange.

The project is forecast to result in an increase in traffic on the New M5 Motorway between the interface with the F6 Extension Stage 1 mainline and the St Peters interchange. The number and cost of traffic crashes is therefore also forecast to increase on this section of the New M5 Motorway. This increase, together with the crashes forecast for F6 Extension Stage 1 mainline, would be balanced with the decreases in traffic crashes forecast for surface roads surrounding the project.

As the crash rate for motorway tunnels is significantly lower than for surface roads, it would be expected that there would be an overall decrease in traffic crashes. These increases would be balanced with the decreases in traffic crashes forecast for surface roads surrounding the project (see Traffic crash analysis for the President Avenue intersection and surrounds and St Peters interchange and surrounds in **section 8.7.3.2** and **section 8.7.3.3** respectively).

Table 8-39 F6 Extension Stage 1 motorway: crash comparison between 'Do something' and 'Do minimum' scenarios

Road Section	Section length (km)	ADT (veh)[1]	Average annual crashes	Average annual cost
2026 'Do minimum'				
New M5 (planned interface with F6 Extension - St Peters interchange)	4.5	39,900	69	$1,203,329
2026 'Do something'				
New M5 (interface with F6 Extension - St Peters interchange)	4.5	68,600	118	$2,068,748
F6 Extension Stage 1 mainline (President Ave interchange - interface with New M5)	3.4	34,800	45	$791,759
2036 'Do minimum'				
New M5 (planned interface with F6 Extension - St Peters interchange)	4.5	46,600	80	$1,404,878
2036 'Do something'				
New M5 (interface with F6 Extension - St Peters interchange)	4.5	81,300	140	$2,449,989
F6 Extension Stage 1 mainline (President Ave interchange - interface with New M5)	3.4	41,800	54	$950,906

Table note:

[1] ADT (veh) rounded to the nearest 100

8.7.3.2 President Avenue intersection and surrounds

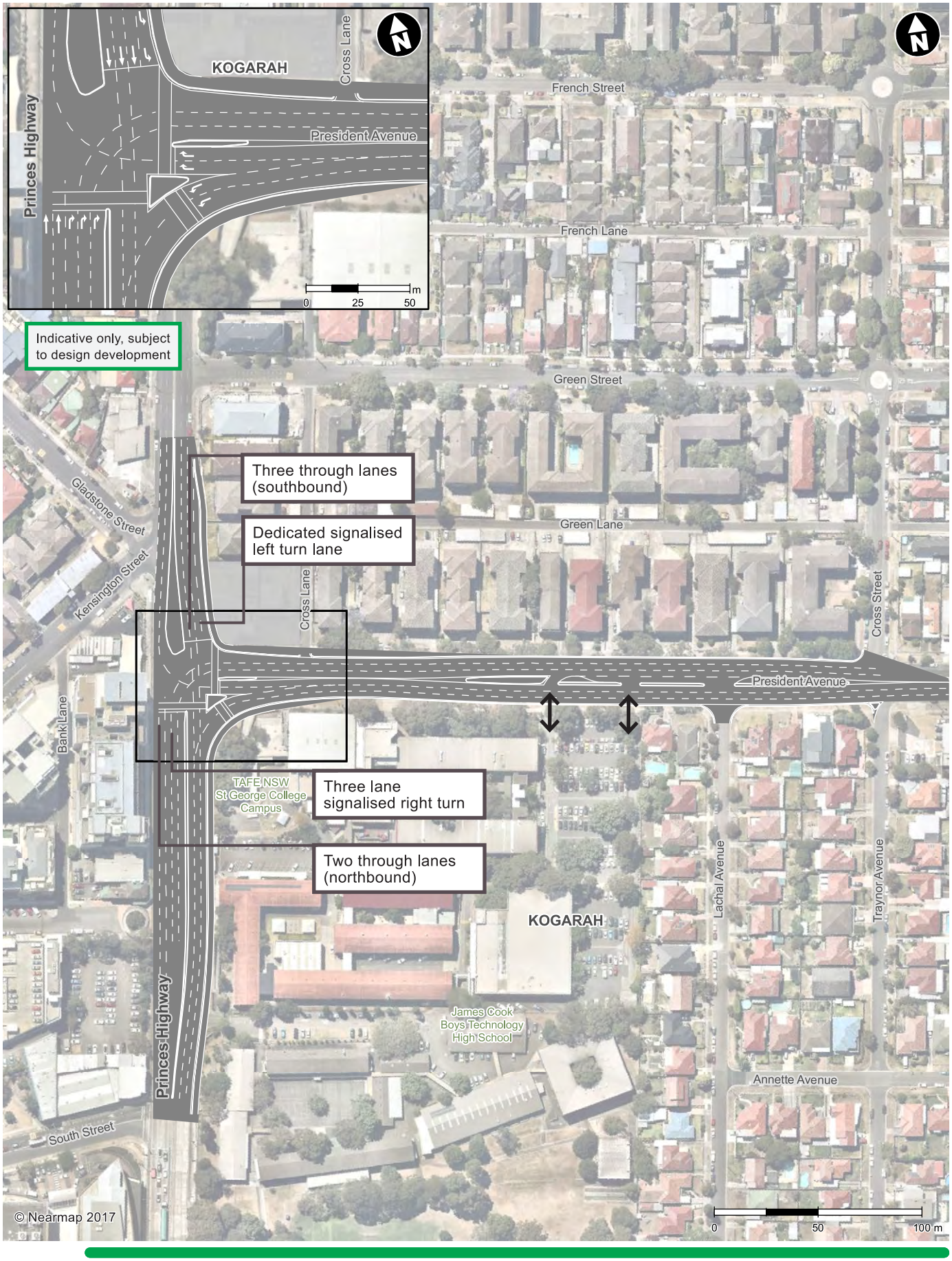
Changes to the road network in the 'Do something' scenario

Changes to the 'Do minimum' road network within the President Avenue intersection study area, which are proposed as part of the project, are shown in **Figure 8-37** and **Figure 8-38** and include:

- Princes Highway / President Avenue intersection – adding a third right turn lane (around 130 metres long) on the northbound Princes Highway approach, with an additional exit lane created on President Avenue eastbound through the extension of parking controls, and an additional left turn (around 70 metres long) on the southbound Princes Highway approach. Current clearway restrictions on Princes Highway would be retained, with future clearway restrictions on President Avenue applied in both directions in the AM and PM peak periods.
- President Avenue / West Botany Street intersection – additional westbound through lane created through future clearway restrictions on President Avenue applied in both directions in AM and PM peak periods. The dedicated left turn lane on the eastbound President Avenue approach would be converted to a left turn and ahead shared lane. Current clearway restrictions on West Botany would be retained.
- F6 Extension Stage 1 ramps / President Avenue intersection – double left turn lanes from President Avenue eastbound into the northbound entry ramp, and a short additional eastbound through lane on President Avenue, double right turn lanes from President Avenue westbound onto the northbound entry ramp and three right turn lanes and one left turn slip lane from the southbound exit ramp. Future clearway restrictions on President Avenue are applied in both directions in the AM and PM peak periods
- President Avenue / O'Connell Street intersection – the current short right turn lane on the eastbound President Avenue approach would be extended back to the F6 Extension Stage 1 ramps intersection.

To ensure safe and efficient connections with the road infrastructure proposed as part of the project, the following surface works on President Avenue are planned:

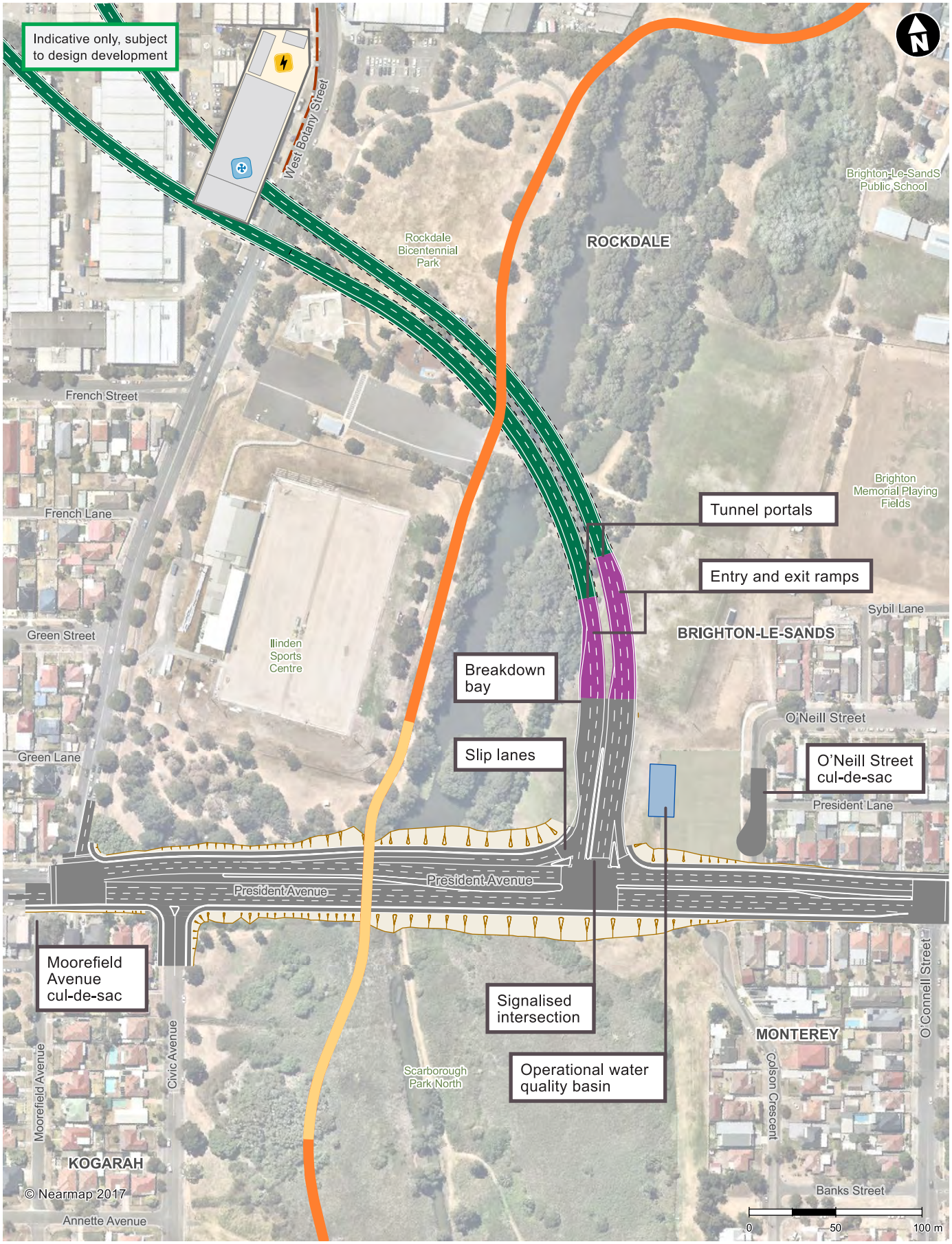
- Creating culs-de-sac at the intersections of President Avenue / Moorefield Avenue and President Avenue / O'Neill Street
- Converting Civic Avenue to allow left in / left out movements only at President Avenue
- At the TAFE car park entry and exit, a right turn bay would be provided to formalise the right turn into the TAFE car park from President Avenue to ensure safe vehicle movements. A refuge bay would be provided for the right turn out of the TAFE car park to ensure safe vehicle movements
- At Lachal Avenue, a right turn bay would be provided to formalise the right turn into Lachal Avenue from President Avenue and to ensure safe vehicle movements. A refuge bay would be provided for the right turn out of Lachal Avenue onto President Avenue to ensure safe vehicle movements. Lachal Avenue would be converted from one-way northbound to two-way. This may result in a loss of some parking. This would be determined in consultation with Council to address potential impacts
- At Traynor Avenue, due to the right turn arrangements at Lachal Avenue, the right turn into Traynor Avenue would not be possible, but the left in movement would remain. Similarly, at Cross Street, the right turn in and out of Cross Street would not be possible, due to the right turn arrangements at Lachal Avenue, but the left in and left out movements would remain
- No changes to the access arrangements at Oakdale Avenue are proposed.



The project on surface

Access retained

Figure 8-37 President Avenue / Princes Highway intersection indicative layout



LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Building
- Embankment
- Water quality basin
- Motorway operations complex
- Substation
- Permanent power supply line
- Rockdale ventilation facility

Figure 8-38 F6 Extension Stage 1 ramps / President Avenue intersection indicative layout

Network performance

The following sections summarise forecast localised impacts on the road network around the President Avenue intersection in the 2026 and 2036 'Do something' scenarios for the AM and PM peak hours. The focus of this operational analysis is on identifying impacts on the immediate road network around the President Avenue intersection. Wider benefits of the project, including forecast improved network productivity on the Sydney metropolitan network and reduced daily traffic on sections of major arterial roads, including Princes Highway, West Botany Street and General Holmes Drive, are captured in the strategic modelling, reported in **section 8.7.2**.

2026 'Do something' scenario

Table 8-40 and **Table 8-41** present a comparison of the performance of the VISUM modelled road network between the 2026 'Do minimum' and 'Do something' scenarios for the AM and PM peak hours.

AM peak hour

In the AM peak hour, the 2026 'Do something' scenario network performance is similar to the 'Do minimum' scenario performance, but with more than 1,000 additional vehicles delivered to their destinations. In the 'Do something' scenario, while there is a four per cent increase in forecast demand into the modelled network, the future 'Do something' network is able to accommodate the forecast increase in demand. There is an eight per cent increase in average travel speed forecast to be experienced by a vehicle travelling through the modelled network.

Table 8-40 President Avenue intersection and surrounds: VISUM modelled network performance – AM peak hour (2026 'Do minimum' vs 'Do something' scenario)

Network measure	2026 'Do minimum'	2026 'Do something'	Percentage change
All vehicles			
Total traffic demand (veh)	32,100	33,290	+4%
Total vehicle kilometres travelled in network (km)	90,670	100,730	+11%
Total time travelled approaching and in network (hr)	4,630	4,750	+3%
Total vehicles arrived	29,580	31,020	+5%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	3.0	+7%
Average time travelled in network (mins)	8.7	8.6	-1%
Average speed (km/h)	19.6	21.2	+8%
Unreleased vehicles			
Unreleased demand (veh)	200	110	–
% of total traffic demand	<1%	<1%	–

PM peak hour

In the PM peak hour, there is a four per cent increase in forecast demand into the modelled network, however the future 'Do something' network is able to accommodate the forecast increase in demand, with around 1,700 additional vehicles delivered to their destinations. The average travel speed forecast to be experienced by a vehicle travelling through the modelled network is more than 10 per cent higher than in the 2026 'Do minimum' scenario.

Table 8-41 President Avenue intersection and surrounds: VISUM modelled network performance – PM peak hour (2026 'Do minimum' vs 'Do something' scenario)

Network measure	2026 'Do minimum'	2026 'Do something'	Percentage change
All vehicles			
Total traffic demand (veh)	32,670	34,080	+4%
Total vehicle kilometres travelled in network (km)	93,110	106,540	+14%
Total time travelled approaching and in network (hr)	3,940	4,090	+4%
Total vehicles arrived	31,090	32,800	+6%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	3.1	+7%
Average time travelled in network (mins)	7.2	7.2	0%
Average speed (km/h)	23.6	26.1	+11%
Unreleased vehicles			
Unreleased demand (veh)	220	180	–
% of total traffic demand	<1%	<1%	–

2036 'Do something' scenario

Table 8-42 and **Table 8-43** present a comparison of the performance of the VISUM modelled road network between the 2036 'Do minimum' and 'Do something' scenarios for the AM and PM peak hours.

The forecast changes between the 2036 'Do minimum' and 2036 'Do something' scenarios for the AM and PM peak hours would be experienced by motorists using the road network around the President Avenue intersection but is not necessarily representative of a motorists broader journey within the network. As noted in **section 8.7.2** the project is forecast to improve network productivity in 2036 compared to the 'Do minimum' scenario, where more or longer trips could be made on the road network in a shorter time.

AM peak hour

Similar to the 2026 comparison, in the AM peak hour, the 2036 'Do something' scenario network performance is similar to the 'Do minimum' scenario performance, but with more than 2,000 additional vehicles delivered to their destinations. In the 'Do something' scenario, while there is a five per cent increase in forecast demand into the modelled network, the future 'Do something' network is able to accommodate the forecast increase in demand. The network and average vehicle performance metrics between the two scenarios are similar, with a small increase in forecast average travel speed through the network.

Table 8-42 President Avenue intersection and surrounds: VISUM modelled network performance – AM peak hour (2036 'Do minimum' vs 'Do something' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	Percentage change
All vehicles			
Total traffic demand (veh)	35,010	36,670	+5%
Total vehicle kilometres travelled in network (km)	96,120	109,430	+14%
Total time travelled approaching and in network (hr)	5,480	5,870	+7%
Total vehicles arrived	31,180	32,630	+5%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	3.0	+7%
Average time travelled in network (mins)	9.4	9.6	+2%
Average speed (km/h)	17.5	18.7	+7%
Unreleased vehicles			
Unreleased demand (veh)	510	270	–
% of total traffic demand	1%	<1%	–

PM peak hour

Similar to the 2026 comparison, in the PM peak hour, while there is five per cent increase in forecast demand into the modelled network, the future 'Do something' network is able to accommodate the forecast increase in demand, with more than 2,000 additional vehicles delivered to their destinations. The average travel speed forecast to be experienced by a vehicle travelling through the modelled network is about seven per cent faster than in the 'Do minimum' scenario.

Table 8-43 President Avenue intersection and surrounds: VISUM modelled network performance – PM peak hour (2036 'Do minimum' vs 'Do something' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	Percentage change
All vehicles			
Total traffic demand (veh)	35,460	37,100	+5%
Total vehicle kilometres travelled in network (km)	98,530	112,630	+14%
Total time travelled approaching and in network (hr)	4,810	5,150	+7%
Total vehicles arrived	32,720	34,400	+5%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	3.0	+7%
Average time travelled in network (mins)	8.1	8.3	+2%
Average speed (km/h)	20.5	21.9	+7%
Unreleased vehicles			
Unreleased demand (veh)	370	260	–
% of total traffic demand	1%	<1%	–

Intersection performance

Table 8-44 presents the modelled Vissim intersection performance in the AM and PM peak hours for key intersections in the President Avenue corridor study area in the 2026 and 2036 'Do something' scenarios compared to 'Do minimum' scenarios.

The surface network in the 'Do minimum' and 'Do something' scenarios is not the same. The additions in the 'Do something' scenario are the project entry and exit ramps on President Avenue and the surface road intersection upgrades required to accommodate the additional forecast traffic demand along President Avenue.

The modelling results show that intersections are generally forecast to experience similar levels of service with the project compared with the 'Do minimum' scenario, with the following exceptions:

- The President Avenue / O'Connell Street intersection is forecast to deteriorate in the 2026 AM peak hour from LoS B to LoS C, due to a forecast increase in traffic on O'Connell Street. While the intersection performance is forecast to be acceptable, more traffic is forecast to use O'Connell Street, which is an unclassified regional road. In consultation with Council, Roads and Maritime would implement Local Area Traffic Management (LATM) measures, such as speed reductions, chicanes and speed humps, to reduce traffic demand and minimise the impacts of the project on O'Connell Street.
- The Princes Highway / President Avenue intersection, with the project upgrades, is forecast to improve in the 2036 AM peak hour, but deteriorate in the 2036 PM peak hour, due to the higher forecast westbound demand on President Avenue. However, the intersection is still forecast to operate at LoS D.

Table 8-44 President Avenue corridor: Vissim modelled key intersection performance – 2026 and 2036 'Do something' scenarios

Key intersections	2014/15 'base case'		2026 'Do minimum'		2026 'Do something'		2036 'Do minimum'		2036 'Do something'	
	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS
AM peak hour										
The Grand Pde / President Ave	25	B	29	C	21	B	37	C	26	B
President Ave / Crawford Rd	10	A	11	A	18	B	19	B	18	B
President Ave / O'Connell St	32	C	23	B	41	C	44	D	43	D
President Ave / F6 Stage 1	-	-	-	-	27	B	-	-	34	C
President Ave / West Botany St	16	B	32	C	38	C	18	B	28	B
Princes Hwy / President Ave	20	B	25	B	26	B	45	D	32	C
PM peak hour										
The Grand Pde / President Ave	22	B	24	B	26	B	37	C	30	C
President Ave / Crawford Rd	14	A	15	B	12	A	18	B	10	A
President Ave / O'Connell St	14	B	15	B	22	B	15	B	20	B
President Ave / F6 Stage 1	-	-	-	-	31	C	-	-	33	C
President Ave / West Botany St	26	B	28	B	16	B	24	B	19	B
Princes Hwy / President Ave	27	C	34	C	46	D	37	C	54	D

Table 8-45 presents VISUM modelled intersection performance in the AM and PM peak hours for key intersections in the wider modelled road network in the 2026 and 2036 'Do something' scenarios compared to 'Do minimum' scenarios.

The modelling results show that under the 'do something' scenario, intersections in the wider modelled network are generally forecast to experience similar or improved levels of service compared with the 'do minimum' scenario.

Table 8-45 President Avenue intersection and surrounds: VISUM modelled key intersection performance – 2026 and 2036 'Do something' scenarios

Key intersections	2014/15 'base case'		2026 'Do minimum'		2026 'Do something'		2036 'Do minimum'		2036 'Do something'	
	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS
AM peak hour										
Princes Hwy / West Botany St	15	B	17	B	16	B	18	B	16	B
Wickham St / West Botany St	46	D	52	D	42	C	54	D	43	D
Princes Hwy / Wickham St / Forest Rd	48	D	67	E	58	E	68	E	67	E
General Holmes Dr / Bestic St	58	E	66	E	54	D	65	E	65	E
Princes Hwy / Bay St	33	C	44	D	44	D	66	E	54	D
Princes Hwy / Rocky Point Rd	32	C	33	C	30	C	30	C	44	D
West Botany St / Bay St	47	D	70	E	70	E	73	F	68	E
West Botany St / Bestic St	40	C	48	D	60	E	61	E	54	D
PM peak hour										
Princes Hwy / West Botany St	11	A	11	A	10	A	11	A	11	B
Wickham St / West Botany St	27	B	33	C	35	C	40	C	41	C
Princes Hwy / Wickham St / Forest Rd	68	E	78	F	68	E	85	F	78	F
General Holmes Dr / Bestic St	28	B	39	C	30	C	42	C	33	C
Princes Hwy / Bay St	44	D	55	D	50	D	68	E	64	E
Princes Hwy / Rocky Point Rd	18	B	19	B	20	B	21	B	21	B
West Botany St / Bay St	61	E	64	E	66	E	67	E	69	E
West Botany St / Bestic St	37	C	55	D	56	D	69	E	70	E

Travel times

Figure 8-39 and **Figure 8-40** show a comparison of VISUM travel times recorded on the Princes Highway, West Botany Street and The Grand Parade routes identified in **Figure 8-14** comparing the 2026 and 2036 'Do minimum' and 'Do something' scenarios.

In the AM peak hour, reductions in travel times in the peak northbound direction along Princes Highway, West Botany Street and The Grand Parade are generally forecast, while increased travel times are forecast in the southbound direction on these roads in the 'Do something' scenarios due to more signal time allocation to the dominant traffic movements.

In the PM peak hour, similar travel times are generally forecast in the 'Do minimum' and 'Do something' scenarios.

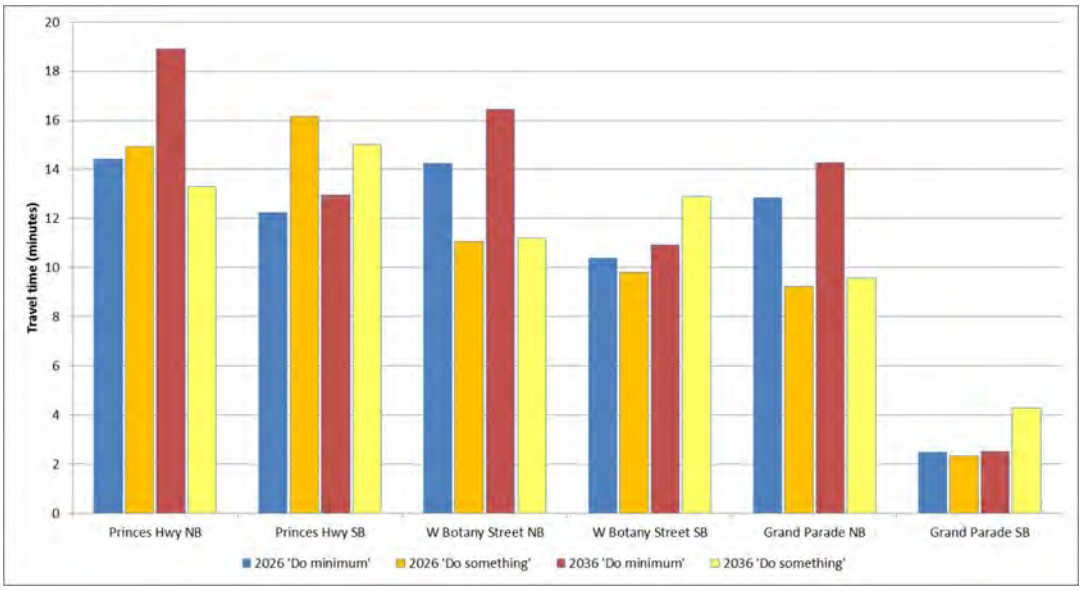


Figure 8-39 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – AM peak 'Do minimum' vs 'Do something' scenarios

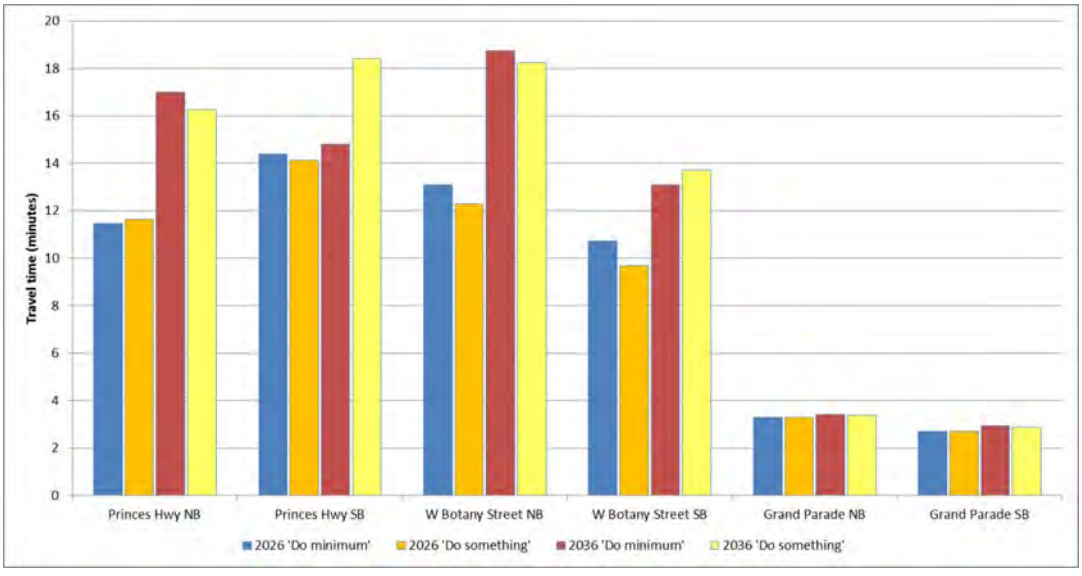


Figure 8-40 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – PM peak 'Do minimum' vs 'Do something' scenarios

Table 8-46 presents a comparison of average travel times and speeds on the President Avenue route from Princes Highway to the Grand Parade between the 2026 and 2036 'Do minimum' and 'Do something' scenarios, extracted from the President Avenue corridor Vissim models.

Increased travel times and reduced average speeds are generally forecast along President Avenue due to more traffic forecast to access the project in the 'Do something' scenarios.

Table 8-46 Comparison of average travel times and speeds on the President Avenue route between the 2026 and 2036 'Do minimum' and 'Do something' scenarios

President Avenue Routes	2014/15 'base case'		2026 'Do minimum'		2026 'Do something'		2036 'Do minimum'		2036 'Do something'	
	TT (min)	Speed (km/h)	TT (min)	Speed (km/h)	TT (min)	Speed (km/h)	TT (min)	Speed (km/h)	TT (min)	Speed (km/h)
AM peak hour										
Westbound	2.41	38	2.63	35	3.93	23	3.70	25	3.63	25
Eastbound	2.68	34	3.06	30	3.25	28	2.78	33	3.20	29
PM peak hour										
Westbound	2.71	34	2.89	32	3.41	27	3.13	29	3.68	25
Eastbound	2.73	34	2.60	36	2.94	31	2.44	38	3.25	28

Note: TT = Travel time

Traffic crashes

Table 8-47 and **Table 8-57** present the crashes forecast under the 2026 and 2036 'Do something' scenarios compared to the 'Do minimum' scenarios.

Daily traffic on the roads around the President Avenue interchange area and surrounds is forecast to decrease overall, in the 2026 and 2036 'Do something' scenarios compared to the 'Do minimum' scenarios resulting in a decrease in the total number and cost of crashes. The most significant decreases occur on The Grand Parade / General Holmes Drive, West Botany Street and Marsh Street / Airport Drive, with the average annual number and cost of crashes forecast to decrease by about 10 to 15 per cent in 2026 and just under five per cent in 2036.

As a result of some changes in travel patterns, and vehicle movements as people take up use of the project, there are increases on some roads. However, these increases are small with the largest increase on President Avenue (an increase of two crashes per annum in 2026 and 2036), due to the forecast increase in traffic volumes on this road.

Table 8-47 President Avenue intersection and surrounds: crash comparison between 2026 'Do something' and 'Do minimum' scenarios

Road Section	Section length (km)	ADT (veh)[1]	Average annual crashes	Average annual cost
2026 'Do minimum'				
Princes Hwy (Gannon St to Jubilee Ave)	6.4	54,800	132	$14,361,000
Rocky Point Rd (Princes Hwy to Jubilee Ave)	0.9	27,000	12	$2,628,000
West Botany St (Princes Hwy to President Ave)	3.6	20,600	54	$4,769,000
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	6	89,800	92	$11,615,000
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	2.4	59,500	31	$2,898,000
President Ave (Princes Hwy to The Grand Pde)	1.5	37,000	22	$5,825,000
O'Connell St / Chuter Ave (President Ave to Barton St)	0.9	13,600	4	$159,000
Bay St (Princes Hwy to The Grand Pde)	2	19,400	30	$5,850,000
2026 'Do something'				
Princes Hwy (Gannon St to Jubilee Ave)	6.4	53,200	127	$13,763,000
Rocky Point Rd (Princes Hwy to Jubilee Ave)	0.9	26,900	12	$2,618,000
West Botany St (Princes Hwy to President Ave)	3.6	17,700	46	$4,025,000
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	6	81,900	84	$10,635,000
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	2.4	53,800	28	$2,621,000
President Ave (Princes Hwy to The Grand Pde)	1.5	41,800	24	$6,012,000
O'Connell St / Chuter Ave (President Ave to Barton St)	0.9	16,500	5	$193,000
Bay St (Princes Hwy to The Grand Pde)	2	19,700	31	$5,953,000

Table note:

[1] ADT (veh) rounded to the nearest 100

Table 8-48 President Avenue intersection and surrounds: crash comparison between 2036 'Do something' and 'Do minimum' scenarios

Road Section	Section length (km)	ADT (veh)[1]	Average annual crashes	Average annual cost
2036 'Do minimum'				
Princes Hwy (Gannon St to Jubilee Ave)	6.4	57,700	139	$15,126,000
Rocky Point Rd (Princes Hwy to Jubilee Ave)	0.9	28,600	13	$2,787,000
West Botany St (Princes Hwy to President Ave)	3.6	22,000	58	$5,080,000
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	6	96,300	100	$13,470,000
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	2.4	63,900	33	$3,114,000
President Ave (Princes Hwy to The Grand Pde)	1.5	38,900	23	$6,163,000
O'Connell St / Chuter Ave (President Ave to Barton St)	0.9	15,100	4	$177,000
Bay St (Princes Hwy to The Grand Pde)	2	21,900	34	$6,522,000
2036 'Do something'				
Princes Hwy (Gannon St to Jubilee Ave)	6.4	56,300	135	$14,592,000
Rocky Point Rd (Princes Hwy to Jubilee Ave)	0.9	28,600	13	$2,787,000
West Botany St (Princes Hwy to President Ave)	3.6	18,400	48	$4,171,000
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	6	87,400	92	$12,844,000
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	2.4	57,300	30	$2,793,000
President Ave (Princes Hwy to The Grand Pde)	1.5	43,500	25	$6,177,000
O'Connell St / Chuter Ave (President Ave to Barton St)	0.9	19,000	5	$222,000
Bay St (Princes Hwy to The Grand Pde)	2	22,800	35	$6,780,000

Table note:

[1] ADT (veh) rounded to the nearest 100

Public transport services

Figure 8-41 shows the comparison in forecast average bus travel time for the five bus routes (303/X03, 478, 400/410, 422 and 947) across the President Avenue intersection and surrounds modelled road network extracted from the VISUM models in the AM and PM peak hours for the 2026 and 2036 'Do minimum' and 'Do something' scenarios. The routes were selected as those with the highest frequency and which travelled a significant part of the modelled road network.

In the AM peak hour, the results indicate that there is generally a small forecast increase in average bus travel times of less than a minute between the 'do minimum' and 'do something' scenarios in 2026 and 2036. In the PM peak hour, no change in average bus travel time is forecast in 2026, while average bus travel times are forecast to increase by about a minute between the 2036 'do minimum' and 'do something' scenarios. The project is therefore forecast to result in minimal change in bus travel times across the modelled road network.

Forecast peak period travel times for the entire length of the bus routes that travel through the President Avenue intersection and surrounds (i.e. 422 and 303) indicate savings of between one and six minutes with the project compared to the 'do minimum' scenario. Other bus routes within the project corridor would also see benefits of similar magnitude.

Bus stops that are temporarily relocated during construction of the project are planned to be reinstated in the existing locations. No permanent relocations of bus stops are planned as part of the project.

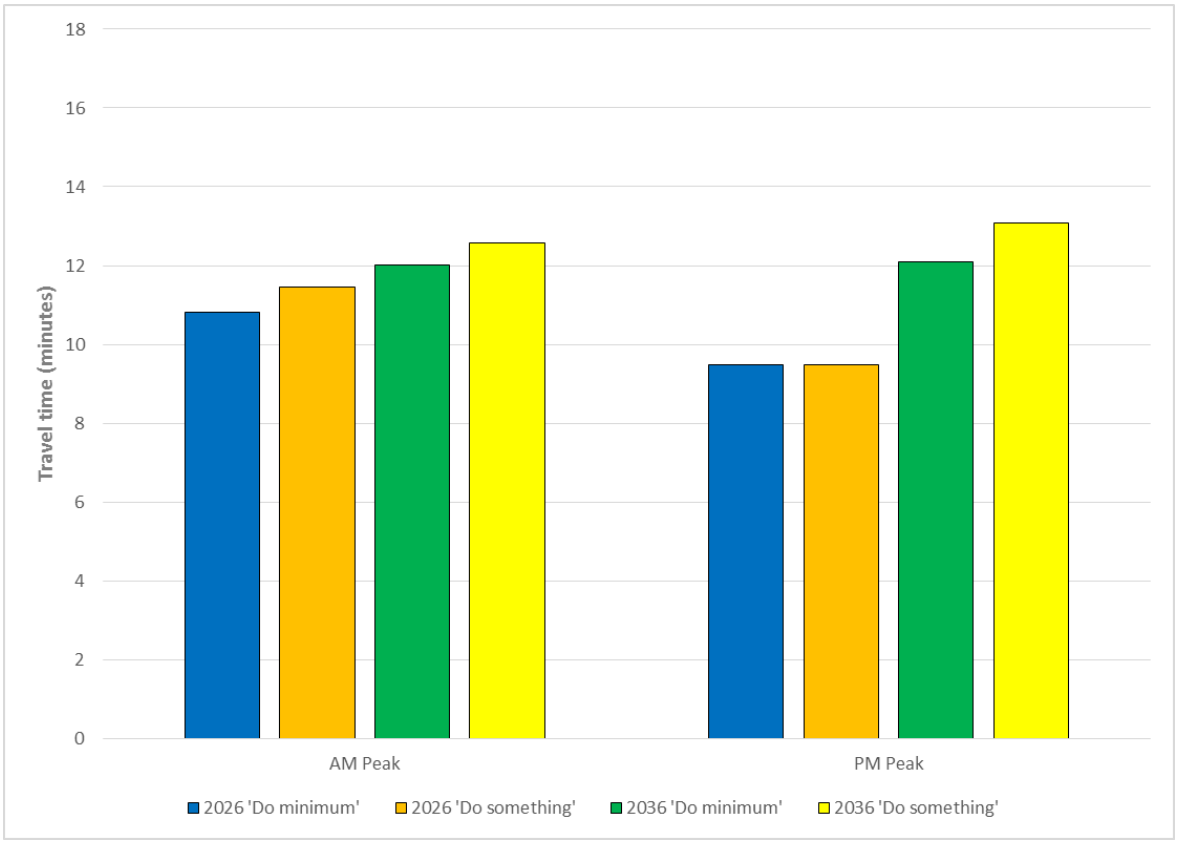


Figure 8-41 President Avenue intersection and surrounds: VISUM modelled average bus travel times – 'Do minimum' vs 'Do something' comparison

Active transport facilities – shared cycle and pedestrian pathways

The project would deliver new pedestrian and cyclist infrastructure, in the form of shared cycle and pedestrian pathways. The shared cycle and pedestrian pathways would be developed from Bestic Street, Brighton-le-Sands south to Civic Avenue, Kogarah through the reinstated Rockdale Bicentennial Park. A dedicated shared bridge would be built over President Avenue.

The shared bridge over President Avenue is intended to provide a corridor scale connection for pedestrians and cyclists, rather than a pedestrian crossing for short trips back and forth across President Avenue. For these movements, pedestrians would be able to cross President Avenue via the signalised intersections at West Botany Street and O'Connell Street. However, if so desired, pedestrians would also be able to access the shared bridge, on the northern side via footpaths or on the southern side via Civic Avenue.

The new cycle and pedestrian infrastructure would improve the north to south connectivity between Bestic Street and south of President Avenue and provide an alternative link to the Cook Park cycleway. The shared cycle and pedestrian pathways would provide direct and indirect connections with several existing and proposed routes including:

- Bestic Street and cycleways north of Bestic Street, along Muddy Creek including the Cooks River cycleway
- West Botany Street, opposite Ador Reserve
- Bruce Street, Francis Street, Bay Street and England Street, Brighton-le-Sands
- West Botany Street, next to Rockdale Bicentennial Park
- Rockdale Bicentennial Park
- Civic Avenue, Kogarah.

In addition, it would provide opportunity for east to west linkages between Kogarah and Rockdale train stations, and the Botany Bay foreshore.

Key components of the shared cycle and pedestrian pathways are shown in **Figure 8-42** and **Figure 8-43** and would comprise:

- The average width would be five metres, comprising a three metre two-way cycle lane, 1.5 metre pedestrian path and 0.5 metre buffer (see **Figure 8-42**).
- The height of the President Avenue shared cycle and pedestrian bridge would be 5.5 metres at its highest point (from underside of bridge to road surface)
- Lighting would be provided along the length of the shared cycle and pedestrian pathways.

Figure 8-42 Typical section of the shared pedestrian and cycle pathways

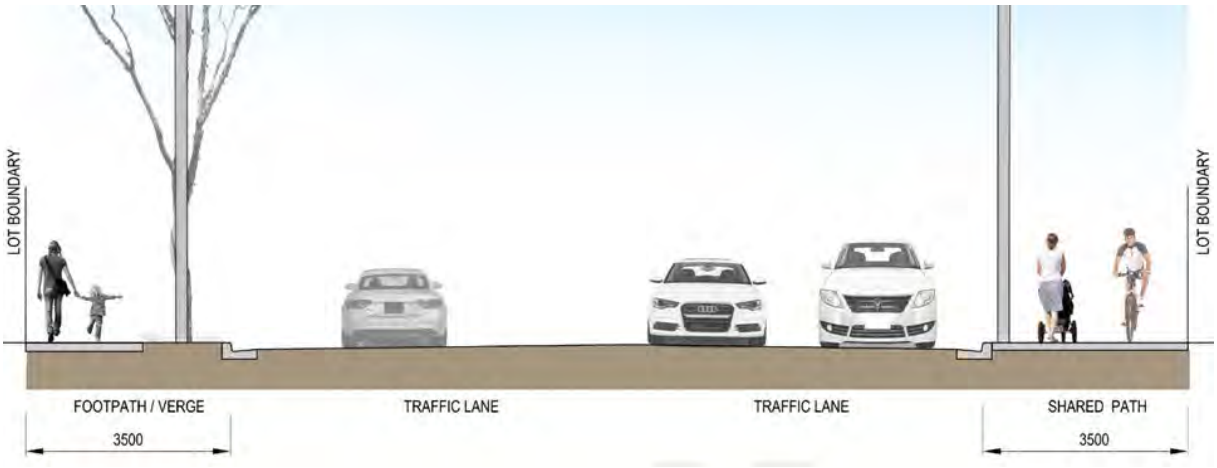


Figure 8-43 Typical section of the shared pedestrian and cycle pathways along Bay Street

The general alignment of the shared cycle and pedestrian pathways is shown on **Figure 8-44**. Detailed descriptions are also provided in **Appendix C** (Place making and urban design strategy).

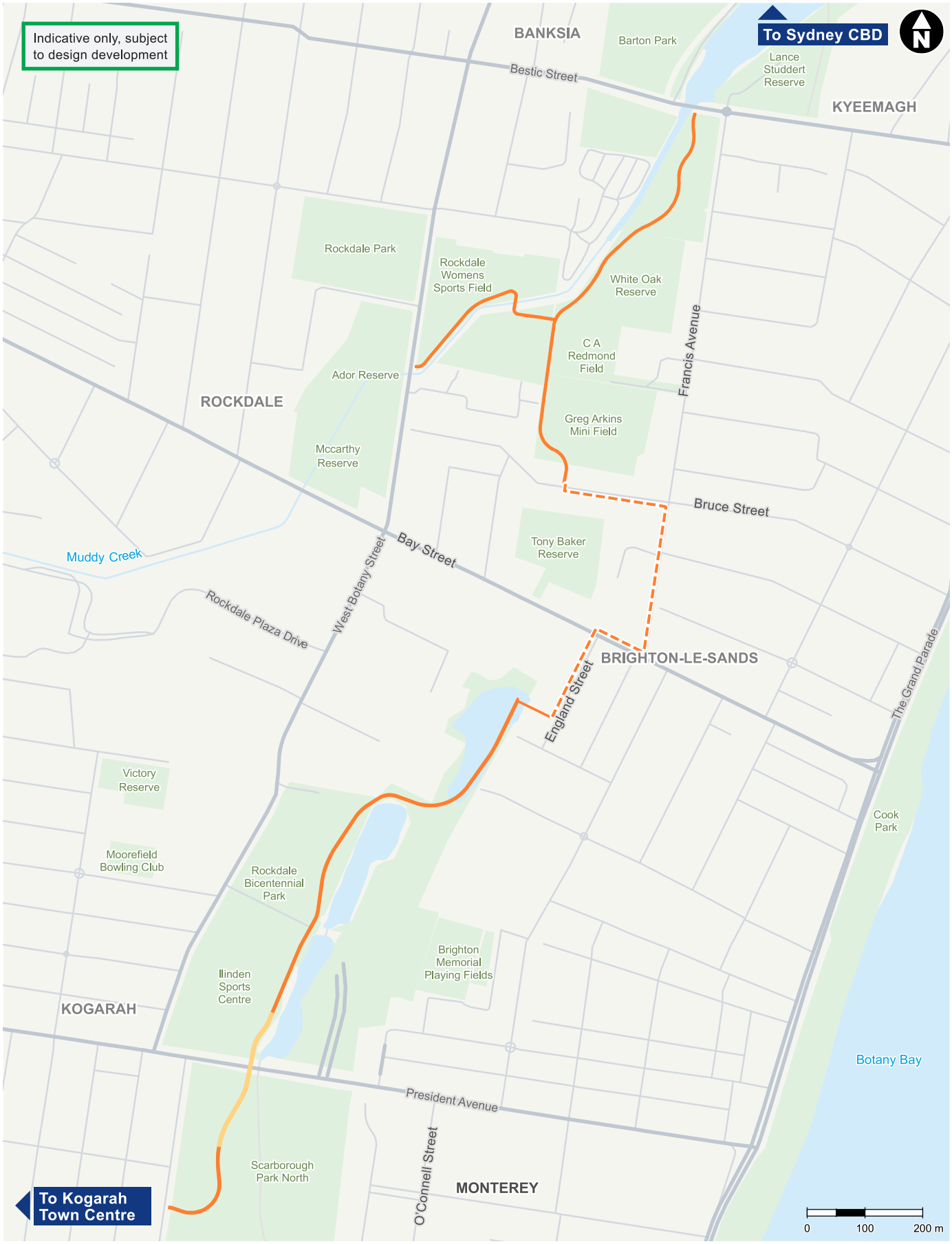


Figure 8-44 Shared cycle and pedestrian pathways

Impact on local property access

Surface works to be implemented on President Avenue as part of the project will result in changes to access to some streets linking into President Avenue. Justification for the options chosen for these changes is included in **Table 8-49**.

Table 8-49 Justification for access changes along President Avenue

Road considered	Justification for option chosen
Moorefield Avenue	• Moorefield Avenue would be converted to a cul-de-sac at President Avenue to relocate movements to a safer location for vehicles as they turn in or out of the upgraded President Avenue
O'Neill Street	• O'Neill Street would be converted to a cul-de-sac at President Avenue to relocate movements to a safer location for vehicles as they turn in or out of the upgraded President Avenue, and due to the proximity of the new President Avenue intersection
Civic Avenue	• Civic Avenue was originally included as a cul-de-sac at President Avenue, however the final concept design for the project determined that to operate more effectively, traffic movement would be restricted to left in / left out only. The right turn out movement could not be safely accommodated due to the new arrangements on President Avenue
Lachal Avenue	• A right turn bay would be provided to formalise the right turn into Lachal Avenue from President Avenue, and to ensure safe vehicle movements • A refuge bay would be provided for the right turn out of Lachal Avenue onto President Avenue to ensure safe vehicle movements • Lachal Avenue would be converted from one-way northbound to two-way
TAFE car park entry and exit	• A right turn bay would be provided to formalise the right turn into the TAFE car park from President Avenue to ensure safe vehicle movements • A refuge bay would be provided for the right turn out of the TAFE car park to ensure safe vehicle movements
Oakdale Avenue	• No changes to the access arrangements at Oakdale Avenue are proposed. There is no space available to formalise the right turn movements at the intersection
Traynor Avenue	• Due to the right turn arrangements at Lachal Avenue, the right turn into Traynor Avenue would not be possible, but the left in movement would remain
Cross Street	• Due to the right turn arrangements at Lachal Avenue, the right turn in and out of Cross Street would not be possible, but the left in and left out movements would remain
O'Connell Street	• No changes to the access arrangements are proposed at O'Connell Street. In consultation with Council, LATM measures would be introduced along O'Connell Street to reduce through traffic.

The creation of culs-de-sac at the President Avenue / Moorefield Avenue and President Avenue / O'Neill Avenue intersections would occur during construction and are described and assessed in **section 8.4**. Traffic surveys indicate less than 10 vehicles currently exit from Moorefield Avenue and less than 20 vehicles currently exit from O'Neill Avenue during each of the AM and PM peak hours. Roads and Maritime is working with Council and the community through formal working groups and community sessions to address any potential impacts as a result of the above proposed access changes.

Existing parking restrictions (one hour parking between 9.30 am and 3.00 pm Monday to Friday) would be retained in front of the local shopping area on President Avenue between Moorefield Avenue and Oakdale Avenue, however peak hour clearways would be added.

Delivery times for service vehicles would need to be arranged to occur outside of the clearway AM and PM peak periods along President Avenue. Alternatively, access to the rear of local shops off Warren Avenue is also available, where it appears deliveries are currently made to some of the stores.

Impact on on-street parking

With the project, there would also be changes to on-street parking along President Avenue during peak periods. These are summarised in **Table 8-50**. Unrestricted parking is currently available along sections of President Avenue during peak periods. Current parking restrictions include:

- Clearways near the intersections of President Avenue with Princes Highway and General Holmes Drive
- Several bus zones
- Time restricted parking in two short sections of President Avenue – one to the west of West Botany Street, and the other west of General Holmes Drive
- The southern side of President Avenue, between Lachal Avenue and Princes Highway, which operates with no parking restrictions in the AM peak period but with no stopping conditions in the PM peak period.

With the project, President Avenue will operate with clearway conditions during AM and PM peak periods, west of O'Connell Street. Based on the current unrestricted and time-restricted parking locations listed above, this would impact on on-street parking provision.

These impacts are during peak periods only. In off-peak periods and at night, on-street parking along President Avenue would be reinstated as per existing conditions, with the following exceptions:

- Eastbound between West Botany Street and O'Connell Street
- Westbound between O'Connell Street and the F6 Stage 1 intersection, about 20 spaces would be retained
- Westbound between the F6 Stage 1 intersection and West Botany Street, about 25 spaces would be retained
- Eastbound along President Avenue from the Princes Highway, there would be no parking for about 100-150 metres to accommodate the triple right turn from Princes Highway into President Avenue.

Table 8-50 President Avenue intersection and surrounds: indicative impact on on-street parking during peak periods

Road section	Indicative impact
Eastbound	
President Avenue, between Cross Lane and Cross Street	Currently parking (no time limit) in both peaks. Loss of approximately 28 spaces
President Avenue, between Cross Street and Oakdale Avenue	Currently parking (no time limit) in both peaks. Loss of approximately seven spaces
President Avenue, between Oakdale Avenue and West Botany Street	Currently parking (1P) in both peaks. Loss of approximately four spaces
President Avenue, between West Botany Street and O'Neill Street	Currently parking (no time limit) in both peaks. Loss of approximately 54 spaces
President Avenue, between O'Neill Street and O'Connell Street	Currently parking (no time limit) in both peaks. Loss of approximately four spaces
Westbound	
President Avenue, between O'Connell Street and West Botany Street	Currently parking (no time limit) in both peaks. Loss of approximately 70 spaces
President Avenue, between West Botany Street and Oakdale Avenue	Currently parking (1P) in both peaks. Loss of approximately six spaces
President Avenue, between Oakdale Avenue and Lachal Avenue	Currently parking (no time limit) in both peaks. Loss of approximately seven spaces
President Avenue, between Lachal Avenue and Cross Lane	Currently parking (no time limit) in AM peak period. Loss of approximately 12 spaces. No stopping in PM peak period.

8.7.3.3 St Peters interchange and surrounds

Changes to the road network in the 2026 and 2036 'Do something' scenarios

No changes were made to the St Peters interchange modelled road network in the 2026 and 2036 'Do something' scenarios compared to the 'Do minimum' scenarios. However, the modelling indicated that by 2036 some improvements may be required at the Campbell Road / Euston Road intersection to accommodate the additional AM peak hour demands. This is discussed in the 2036 'Do something' scenario section.

Network performance

The following sections summarise forecast localised impacts on the road network around the St Peters interchange in the 2026 and 2036 'Do something' scenarios for the AM and PM peak hours. The focus of this operational analysis is on identifying impacts on the immediate road network around the St Peters interchange. Wider benefits of the project, including forecast improved network productivity on the Sydney metropolitan network and reduced daily traffic on sections of major arterial roads, including Princes Highway, West Botany Street and General Holmes Drive, are captured in the strategic modelling, reported in **section 8.7.2**.

Table 8-51 and **Table 8-52** present a comparison of the performance of the modelled road network between the 2026 'Do minimum' and 'Do something' scenarios for the AM and PM peak hours.

2026 'Do something' scenario

AM peak hour

In the AM peak hour, the 2026 'Do something' scenario network performance is forecast to be similar to the 'Do minimum' scenario performance. There is a slight reduction in traffic demand to the surface network in the 'Do something' scenario and the network performance metrics between the two scenarios are similar.

Table 8-51 St Peters interchange network performance – AM peak hour (2026 'Do minimum' vs 2026 'Do something' scenario)

Network measure	2026 'Do minimum'	2026 'Do something'	% change
All vehicles			
Total traffic demand (veh)	31,410	31,020	-1%
Total vehicle kilometres travelled in network (km)	120,120	120,280	<1%
Total time travelled approaching and in network (hr)	4,420	4,370	-1%
Total vehicles arrived	30,910	30,670	-1%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	3.4	3.4	0%
Average time travelled in network (mins)	7.3	7.1	-3%
Average speed (km/h)	28.4	28.5	<1%
Unreleased vehicles			
Unreleased demand (veh)	760	600	-
% of total traffic demand	2%	2%	-

PM peak hour

As in the AM peak, there is a slight drop in demand to the surface network in the 'Do something' scenario and the forecast differences between the network and average vehicle performance metrics are minimal.

Table 8-52 St Peters interchange network performance – PM peak hour (2026 'Do minimum' vs 2026 'Do something' scenario)

Network measure	2026 'Do minimum'	2026 'Do something'	% change
All vehicles			
Total traffic demand (veh)	31,620	31,520	<1%
Total vehicle kilometres travelled in network (km)	118,900	120,610	+1%
Total time travelled approaching and in network (hr)	4,120	4,300	+4%
Total vehicles arrived	31,130	31,000	-1%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	3.4	3.4	0%
Average time travelled in network (mins)	6.9	6.9	0%
Average speed (km/h)	29.7	29.4	-1%
Unreleased vehicles			
Unreleased demand (veh)	570	840	-
% of total traffic demand	2%	3%	-

2036 'Do something' scenario

Table 8-53 and **Table 8-54** present a comparison of the performance of the modelled road network between the 2036 'Do minimum' and 'Do something' scenarios for the AM and PM peak hours.

AM peak hour

In 2036, there is effectively no change in traffic demand forecast in the 'Do something' scenario compared to the 'Do minimum' scenario. As in the 2026 AM peak hour comparison, the forecast differences between the average vehicle performance metrics are minimal.

Table 8-53 St Peters interchange network performance – AM peak hour (2036 'Do minimum' vs 2036 'Do something' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	% change
All vehicles			
Total traffic demand (veh)	33,910	33,910	0%
Total vehicle kilometres travelled in network (km)	131,580	134,210	+2%
Total time travelled approaching and in network (hr)	6,880	7,340	+7%
Total vehicles arrived	32,050	32,490	+1%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	3.5	3.4	-3%
Average time travelled in network (mins)	10.2	10.2	0%
Average speed (km/h)	20.4	20.2	-1%
Unreleased vehicles			
Unreleased demand (veh)	1,730	2,320	-
% of total traffic demand	5%	7%	-

PM peak hour

Similar to the 2026 comparison, comparable network and vehicle performance metrics for the two scenarios are forecast, indicating that the project is forecast to have minimal impact on the modelled network performance around the St Peters interchange during the PM peak hour.

Table 8-54 St Peters interchange network performance – PM peak hour (2036 'Do minimum' vs 2036 'Do something' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	% change
All vehicles			
Total traffic demand (veh)	34,420	34,320	<1%
Total vehicle kilometres travelled in network (km)	129,370	132,010	+2%
Total time travelled approaching and in network (hr)	4,930	5,370	+9%
Total vehicles arrived	33,150	32,860	-1%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	3.4	3.4	0%
Average time travelled in network (mins)	7.3	7.7	+5%
Average speed (km/h)	27.9	26.5	-5%
Unreleased vehicles			
Unreleased demand (veh)	1,340	1,660	-
% of total traffic demand	4%	5%	-

Intersection performance

Table 8-55 presents the modelled AM and PM peak hour LoS for key intersections within the St Peters interchange modelled network comparing the 2026 and 2036 'Do minimum' and 'Do something' scenarios.

In the AM peak hour, the modelled intersections are forecast to generally perform similarly in the 'Do something' and 'Do minimum' scenarios in 2026. Significant queuing is forecast in 2036 on the exit ramp approach from the Campbell Road / Euston Road intersection to the New M5 mainline. As a result, vehicles are likely to divert to the Gardeners Road exit ramp, which impacts the intersections on Gardeners Road. This is reflected in the increased delay forecast at these intersections.

The New M5 Road Network Performance Review Plan (conditioned as part of the New M5 Motorway approval) and the M4-M5 Link Road Network Performance Review (conditioned as part of the M4-M5 Link approval) would provide Roads and Maritime with updated data on operational traffic impacts from these projects on the St Peters interchange and the surrounding road network, as these projects become operational. These reviews are scheduled at 12 months and five years after the commencement of operation of the New M5 Motorway and the M4-M5 Link respectively. This data would be derived from observed changes on the road network and would be used to confirm the forecast impacts from these projects, as well as to inform the need for potential mitigation measures around the St Peters interchange.

In the PM peak hour, the modelled intersections are forecast to generally perform similarly in the 'Do something' and 'Do minimum' scenarios, except for the Gardeners Road / O'Riordan Street, Princes Highway / Campbell Street and Sydney Park Road / Mitchell Road intersections in 2036.

Table 8-55 St Peters interchange: key intersection performance – 'Do minimum' and 'Do something' scenarios

Key intersections	2014/15 'base case'		2026 'do minimum'		2026 'do something'		2036 'do minimum'		2036 'do something'	
	Ave delay (sec)	LOS	Ave delay (sec)	LOS	Ave delay (sec)	LOS	Ave delay (sec)	LOS	Ave delay (sec)	LOS
AM peak hour										
O'Riordan St / Bourke Rd	16	B	23	B	21	B	38	C	32	C
Gardeners Rd / O'Riordan St	43	D	66	E	59	E	>100	F	>100	F
Gardeners Rd / Bourke Rd	51	D	50	D	43	D	56	D	47	D
Gardeners Rd / Kent Rd			61	E	66	E	>100	F	>100	F
Ricketty Street / Kent Road	24	B	55	D	59	E	55	D	56	D
Campbell Rd / Euston Rd	1	A	48	D	59	E	70	E	>100	F
Princes Hwy / Campbell St	44	D	>100	F	>100	F	>100	F	>100	F
Princes Hwy / May St	89	F	61	E	64	E	76	F	77	F
Princes Hwy / Sydney Park Rd	23	B	28	B	34	C	41	C	42	C
Sydney Park Rd / Mitchell Rd	24	B	32	C	35	C	32	C	32	C
Euston Rd / Sydney Park Rd	8	A	50	D	58	E	58	E	56	D
PM peak hour										
O'Riordan St / Bourke Rd	19	B	13	A	13	A	14	A	14	A
Gardeners Rd / O'Riordan St	39	C	49	D	65	E	77	F	>100	F
Gardeners Rd / Bourke Rd	67	E	37	C	38	C	37	C	42	C
Gardeners Rd / Kent Rd			34	C	36	C	35	C	38	C
Ricketty Street / Kent Road	22	B	39	C	39	C	41	C	44	D
Campbell Rd / Euston Rd	1	A	54	D	63	E	67	E	69	E
Princes Hwy / Campbell St	25	B	57	E	58	E	60	E	89	F
Princes Hwy / May St	45	D	14	A	12	A	7	A	14	B
Princes Hwy / Sydney Park Rd	26	B	35	C	35	C	40	C	40	C
Sydney Park Rd / Mitchell Rd	2	A	39	C	52	D	51	D	72	F
Euston Rd / Sydney Park Rd	8	A	>100	F	>100	F	>100	F	>100	F

Travel times

Figure 8-45 and **Figure 8-46** show a comparison of travel times recorded on the travel time routes identified in **Figure 8-18** comparing the 2026 and 2036 'Do minimum' and 'Do something' scenarios.

The graphs indicate that almost all of the travel times remain similar when comparing the 'Do minimum' to the 'Do something' scenarios, except for a significant increase in the AM peak hour travel time from the WestConnex South (exit ramp from New M5 Motorway) to Euston Road, north of Maddox Street, in the 2036 'Do something' scenario. This is due to the increase in demand exiting the motorway as a result of the project, with long queues forecast on the motorway exit ramp from the approach to the Campbell Road / Euston Road intersection.

The majority of additional journey time occurs on the exit ramp and the approach to the Euston Road / Campbell Road intersection. In the PM peak hour, the differences are smaller and all less than one minute, with some routes showing slight decreases in travel times and others slight increases. The

forecast change in travel times between the 2026 and 2036 'Do something' and 'Do minimum' scenarios in the PM peak is therefore forecast to be minor.

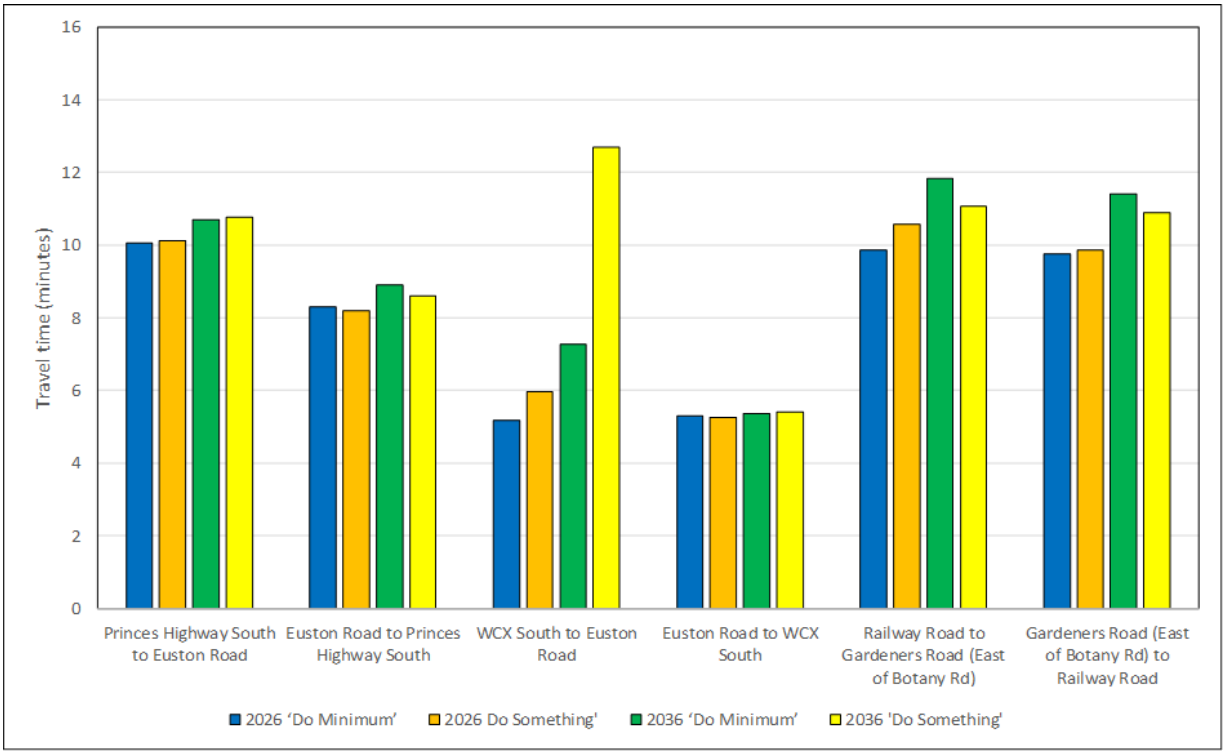


Figure 8-45 St Peters interchange: Average travel time (mins) – AM peak 'Do minimum' vs 'Do something' scenarios

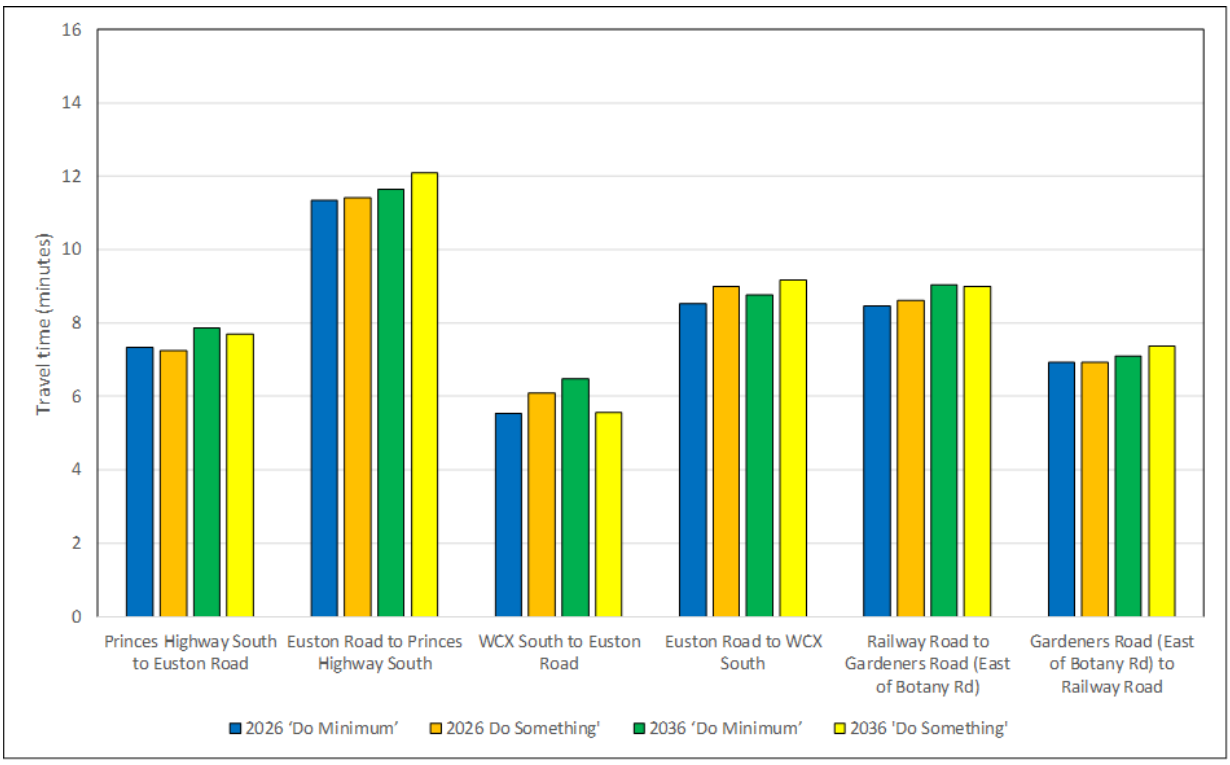


Figure 8-46 St Peters interchange: Average travel time (mins) – PM peak 'Do minimum' vs 'Do something' scenarios

Traffic crashes

Table 8-56 presents the crashes forecast under the 2026 'Do something' scenario compared to the 'Do minimum' scenario.

Forecast changes in daily traffic on the roads around the St Peters interchange vary, with some roads forecast to experience increases and some roads decreases. Changes of about 5 per cent or less are forecast in the 2026 'Do something' scenario compared to the 'Do minimum' scenario. The net effect of these increases and decreases is a minimal overall change in the total number and cost of crashes in the area of less than one per cent.

Table 8-56 St Peters interchange and surrounds: crash comparison between 2026 'Do something' and 'Do minimum' scenarios

Road Section	Section length (km)	ADT (veh)[1]	Average annual crashes	Average annual cost
2026 'Do minimum'				
Princes Highway (Enmore Rd to Gannon St)	4.1	43,700	90	$13,182,000
Canal Road / Ricketty Street / Gardeners Road (Princes Hwy to Botany Rd)	4.7	44,300	49	$4,346,000
Euston Road (Sydney Park Rd to Campbell Rd)	0.9	53,300	97	$7,952,000
Bourke Road (Wyndham St to Gardeners Rd)	2.2	12,300	12	$1,476,000
2026 'Do something'				
Princes Highway (Enmore Rd to Gannon St)	4.1	42,100	86	$12,670,000
Canal Road / Ricketty Street / Gardeners Road (Princes Hwy to Botany Rd)	4.7	45,200	50	$4,407,000
Euston Road (Sydney Park Rd to Campbell Rd)	0.9	55,800	102	$8,329,000
Bourke Road (Wyndham St to Gardeners Rd)	2.2	11,600	11	$1,390,000

Table note:

[1] ADT (veh) rounded to the nearest 100

Table 8-57 compares the crashes forecast under the 2036 scenarios. Similar to 2026, small decreases on some roads and small increases on other roads are forecast for daily traffic in the 'Do something' scenario compared to the 'Do minimum' scenario. In 2036, the greatest percentage change is forecast on Bourke Road, where a decrease in daily traffic results in a forecast decrease in crashes of about eight per cent. This results in an overall change in the total number of and cost of crashes in the St Peters interchange and surrounds of about one per cent or less.

Table 8-57 St Peters interchange and surrounds: crash comparison between 2036 'Do something' and 'Do minimum' scenarios

Road Section	Section length (km)	ADT (veh)[1]	Average annual crashes	Average annual cost
2036 'Do minimum'				
Princes Highway (Enmore Rd to Gannon St)	4.1	47,400	98	$14,351,000
Canal Road / Ricketty Street / Gardeners Road (Princes Hwy to Botany Rd)	4.7	46,500	52	$4,597,000
Euston Road (Sydney Park Rd to Campbell Rd)	0.9	58,000	106	$8,657,000
Bourke Road (Wyndham St to Gardeners Rd)	2.2	13,000	13	$1,586,000
2036 'Do something'				
Princes Highway (Enmore Rd to Gannon St)	4.1	45,400	93	$13,682,000
Canal Road / Ricketty Street / Gardeners Road (Princes Hwy to Botany Rd)	4.7	47,600	53	$4,678,000

Road Section	Section length (km)	ADT (veh)[1]	Average annual crashes	Average annual cost
Euston Road (Sydney Park Rd to Campbell Rd)	0.9	60,200	110	$8,991,000
Bourke Road (Wyndham St to Gardeners Rd)	2.2	12,100	12	$1,484,000

Table note:

[1] ADT (veh) rounded to the nearest 100

Public transport services

Figure 8-47 shows the comparison in forecast average bus travel time across the St Peters interchange modelled road network in the AM and PM peak hours for the 2026 and 2036 'Do minimum' and 'Do something' scenarios.

The results indicate that there is little difference in bus travel times between the 'Do minimum' and 'Do something' scenarios in either the AM or PM peak hours. The project is therefore forecast to result in minimal change in bus travel times across the St Peters interchange modelled road network.

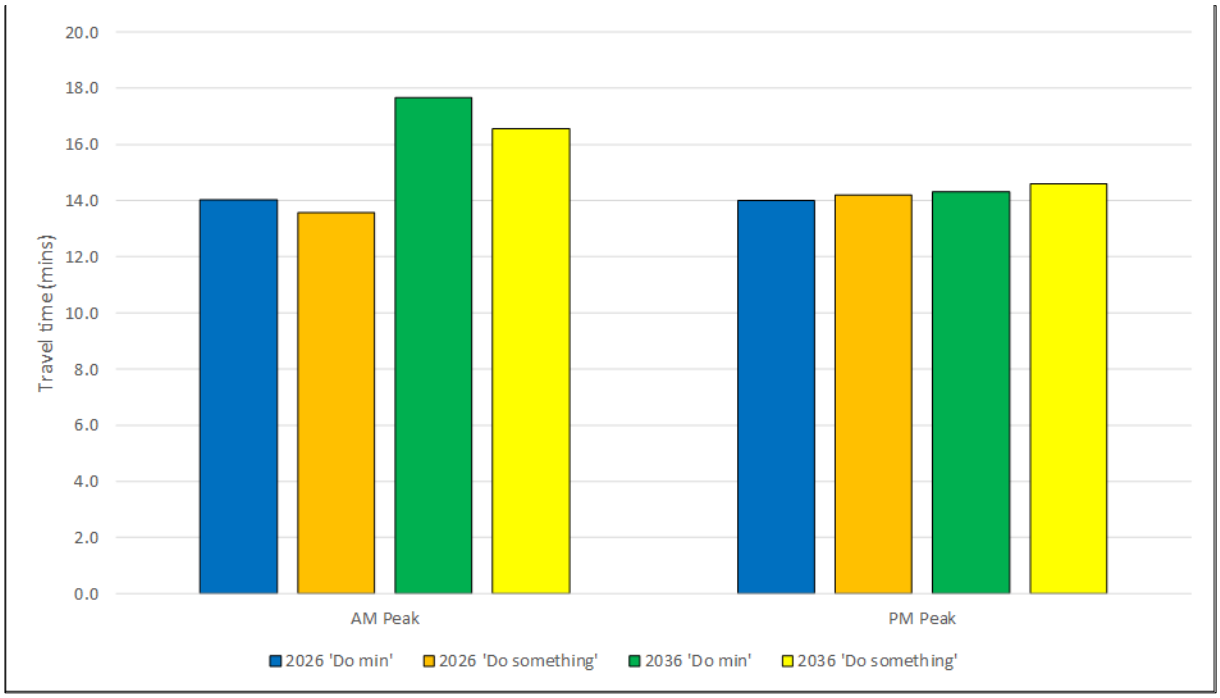


Figure 8-47 St Peters interchange: Average travel time for buses – 'Do minimum' vs 'Do something' comparison

Active transport facilities

No changes to active transport facilities are planned as part of the project in the vicinity of the St Peters interchange.

Impact on local property access and on-street parking

No changes to local property access or on-street parking are planned as part of the project in the vicinity of the St Peters interchange.

8.8 Assessment of cumulative impacts

8.8.1 Introduction

The sections below provide an overview of key findings for forecast conditions on the future road network during the 2036 'Cumulative' scenario. Chapter 12 of **Appendix D** (Traffic and transport technical report) includes detailed assessment of the 2036 'Cumulative' scenario.

The 2036 'Cumulative' scenario is comprised of a road network that includes the 2036 'Do something' projects, as well as Western Harbour Tunnel and Beaches Link and future stages of the F6 Extension between Kogarah and Loftus complete and open to traffic. Future stages of the F6 Extension would comprise a surface and tunnel motorway network between President Avenue at Kogarah and the existing M1 Princes Highway at Loftus, currently assumed to follow the general alignment of the existing F6 reserved corridor. These projects are subject to separate environmental assessments and approvals and Government decisions on funding. Design alignments are indicative only for purposes of cumulative traffic analysis.

8.8.2 Sydney metropolitan road network

8.8.2.1 General traffic and on-road freight

With the inclusion of future stages of the F6 Extension between Kogarah and Loftus, more traffic is forecast to shift to the project, with reductions in daily traffic volumes forecast on the Princes Highway (south of President Avenue) and Rocky Point Road (south of the Princes Highway). Increases in daily traffic are forecast on President Avenue (east of the project's President Avenue ramps), and West Botany Street (south of Bay Street) as traffic travels to and from the project.

The observed increases and decreases for heavy vehicles are similar to those observed for general traffic.

8.8.2.2 On-road public transport

Based on the existing bus network, the decreases in traffic volumes on key roads forecast with the implementation of the cumulative projects would be expected to improve the speed and reliability of several regional bus routes. Forecast decreases in traffic on President Avenue (west of the President Avenue intersection) would be expected to decrease travel times and improve reliability of a smaller number of regional and local bus routes.

8.8.3 Operational performance – F6 Extension Stage 1

8.8.3.1 Mid-block level of service

Table 12-1 and Table 12-2 in **Appendix D** (Traffic and transport technical report) present the forecast mid-block LoS for the 2036 'Cumulative' scenario in the AM and PM peak hours.

The modelling shows that all motorway segments are forecast to operate at LoS D or better, with the exception of:

- St Peters interchange ramps (northbound exit ramp in the AM peak and southbound entry ramp in the PM peak) – LoS F
- Merge and diverge to and from the New M5 Motorway in both peaks – LoS F
- The New M5 mainline tunnels between the project ramps and St Peters interchange ramps in both peaks – LoS E.

The modelling indicates that, while the vehicle densities are high, the operating speeds at these locations would still be at 85 per cent or higher of the posted speed limit. This indicates that the motorway and ramps should continue to function acceptably in the 2036 'Cumulative' scenario. Notwithstanding, a higher potential exists for congestion and queueing should an incident occur in these sections, due to the higher density.

8.8.3.2 Traffic crashes

In the 2036 'Cumulative' scenario, the future stages of the F6 Extension between Kogarah and Loftus result in a forecast increase in traffic on the F6 Extension Stage 1 mainline and the New M5 between the F6 Extension and the St Peters interchange. This results in a corresponding forecast increase in traffic crashes on these sections of motorway, with an increase of about 20 per cent on the New M5 between the F6 Extension and the St Peters interchange and about 35 per cent on the F6 Extension Stage 1 mainline.

8.8.4 Operational performance – President Avenue intersection and surrounds

8.8.4.1 Changes to road network in 'Cumulative' scenario

In the 2036 'Cumulative' scenario, changes to the modelled road network would comprise the provision of turning lanes at the President Avenue / West Botany Street intersection to provide access to and from the future stages of the F6 Extension to the south.

8.8.4.2 Network performance

2036 'Cumulative' scenario

Table 8-58 and **Table 8-59** present a comparison of the performance of the VISUM modelled road network between the 2036 'Do minimum', 'Do something' and 'Cumulative' scenarios for the AM and PM peak hours.

In the AM and PM peak hours, the 2036 'Cumulative' modelled network is forecast to perform similarly to the 'Do something' modelled network. The additional traffic accessing future stages of the F6 Extension is balanced by the traffic bypassing the modelled network in the F6 Extension mainline tunnels. The improved performance of traffic on these mainline tunnels is not included in these modelled network results.

Table 8-58 President Avenue intersection and surrounds: VISUM modelled network performance – AM peak hour (2036 'Do minimum', 'Do something' vs 'Cumulative' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	Percentage change (do min to do something)	2036 'Cumulative'	Percentage change (do something to cumulative)
All vehicles					
Total traffic demand (veh)	35,010	36,670	+5%	36,140	-1%
Total vehicle kilometres travelled in network (km)	96,120	109,430	+14%	105,190	-4%
Total time travelled approaching and in network (hr)	5,480	5,870	+7%	5,670	-3%
Total vehicles arrived	31,180	32,630	+5%	32,530	<1%
Average per vehicle in network					
Average vehicle kilometres travelled in network (km)	2.8	3.0	+7%	2.9	-3%
Average time travelled in network (mins)	9.4	9.6	+2%	9.4	-2%
Average speed (km/h)	17.5	18.7	+7%	18.6	-1%
Unreleased vehicles					
Unreleased demand (veh)	510	270	–	290	–
% of total traffic demand	1%	<1%	–	<1%	–

Table 8-59 President Avenue intersection and surrounds: VISUM modelled network performance – PM peak hour (2036 'Do minimum', 'Do something' vs 'Cumulative' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	Percentage change (do min to do something)	2036 'Cumulative'	Percentage change (do something to cumulative)
All vehicles					
Total traffic demand (veh)	35,460	37,100	+5%	36,630	-1%
Total vehicle kilometres travelled in network (km)	98,530	112,630	+14%	108,730	-3%
Total time travelled approaching and in network (hr)	4,810	5,150	+7%	4,730	-8%
Total vehicles arrived	32,720	34,400	+5%	34,250	<1%
Average per vehicle in network					
Average vehicle kilometres travelled in network (km)	2.8	3.0	+7%	3.0	0%
Average time travelled in network (mins)	8.1	8.3	+2%	7.8	-6%
Average speed (km/h)	20.5	21.9	+7%	23.0	+5%
Unreleased vehicles					
Unreleased demand (veh)	370	260	–	489	–
% of total traffic demand	1%	<1%	–	1%	–

8.8.4.3 Intersection performance

Table 8-60 presents Vissim modelled intersection performance in the AM and PM peak hour for key intersections in the President Avenue corridor study area for the 2036 scenarios. The surface network in the 'Cumulative' scenario includes the southbound entry and northbound exit ramps on President Avenue from the further stages of the F6 Extension from Kogarah to Loftus.

The modelling results show that in the 2036 'Cumulative' scenario, the intersections are generally forecast to experience similar or improved levels of service compared to the 'Do something' scenario, except for:

- The President Avenue / Crawford Road intersection in the PM peak hour, where the delay is forecast to increase significantly, due to increased westbound traffic accessing further stages of the F6 Extension at the West Botany Street intersection. The intersection is still forecast to operate at LoS D.
- The President Avenue / West Botany Street / F6 Extension Stage 1 ramps intersection, where the delay is forecast to increase, due to the addition of access to the further stages of the F6 Extension.

Table 8-60 President Avenue corridor: Vissim modelled key intersection performance – 2036 'Do minimum', 'Do something' and 'Cumulative' scenarios

Key intersections	2036 'Do minimum'		2036 'Do something'		2036 'Cumulative'	
	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS
AM peak hour						
The Grand Parade / President Avenue	37	C	26	B	25	B
President Avenue / Crawford Road	19	B	18	B	26	B
President Avenue / O'Connell Street	44	D	43	D	47	D
President Ave / F6 Stage 1	-	-	34	C	26	B
President Avenue / West Botany Street / F6	18	B	28	B	39	C
Princes Highway / President Avenue	45	D	32	C	35	C
PM peak hour						
The Grand Parade / President Avenue	37	C	30	C	39	C
President Avenue / Crawford Road	18	B	10	A	44	D
President Avenue / O'Connell Street	15	B	20	B	26	B
President Ave / F6 Stage 1	-	-	33	C	29	C
President Avenue / West Botany Street / F6	24	B	19	B	35	C
Princes Highway / President Avenue	37	C	54	D	39	C

Table 8-61 presents the VISUM modelled intersection performance in the AM and PM peak hour for key intersections in the wider modelled road network for the 2036 scenarios. The modelling results show that in the 2036 'cumulative' scenario, intersections are generally forecast to experience similar levels of service compared with the 2036 'do something' scenario, except for:

- The West Botany Street / Bay Street and the West Botany Street / Bestic Street intersections in the AM peak hour, where the delay is forecast to increase significantly due to traffic accessing and egressing further stages of the F6 Extension from West Botany Street.
- The West Botany Street / Bay Street intersection is also forecast to experience more delay in the PM peak hour, due to traffic accessing and egressing further stages of the F6 Extension from West Botany Street.

Table 8-61 President Avenue intersection and surrounds: VISUM modelled key intersection performance – 2036 'Do minimum', 'Do something' and 'Cumulative' scenarios

Key intersections	2036 'Do minimum'		2036 'Do something'		2036 'Cumulative'	
	Ave delay (sec)	LoS	Ave delay (sec)	LoS	Ave delay (sec)	LoS
AM peak hour						
Princes Highway / West Botany Street	18	B	16	B	17	B
Wickham Street / West Botany Street	54	D	43	D	42	C
Princes Highway / Wickham Street / Forest Road	68	E	67	E	61	E
General Holmes Drive / Bestic Street	65	E	65	E	71	E
Princes Highway / Bay Street	66	E	54	D	54	D
Princes Highway / Rocky Point Road	30	C	44	D	39	C
West Botany Street / Bay Street	73	F	68	E	98	F
West Botany Street / Bestic Street	61	E	54	D	99	F
PM peak hour						
Princes Highway / West Botany Street	11	A	11	B	11	A
Wickham Street / West Botany Street	40	C	41	C	40	C
Princes Highway / Wickham Street / Forest Road	85	F	78	F	76	F
General Holmes Drive / Bestic Street	42	C	33	C	29	C
Princes Highway / Bay Street	68	E	64	E	65	E
Princes Highway / Rocky Point Road	21	B	21	B	22	B
West Botany Street / Bay Street	67	E	69	E	86	F
West Botany Street / Bestic Street	69	E	70	E	70	E

8.8.4.4 Travel times

Figure 8-48 and **Figure 8-49** show a comparison of VISUM travel times during the AM and PM peak hours recorded on the Princes Highway, West Botany Street and The Grand Parade routes identified in **Figure 8-14**, comparing the 2036 'Do something' and 'Cumulative' scenarios.

In the AM peak hour, there are generally forecast increases in travel times on the routes in the 2036 'cumulative' scenario, with the exception of The Grand Parade southbound. These are primarily linked to the forecast changes in traffic patterns with the future stages of the F6 Extension, with traffic able to access the new motorway to the south at the President Avenue / West Botany Street intersection.

In the PM peak hour, the forecast differences are generally smaller, with some routes showing decreases in travel times and others increases.

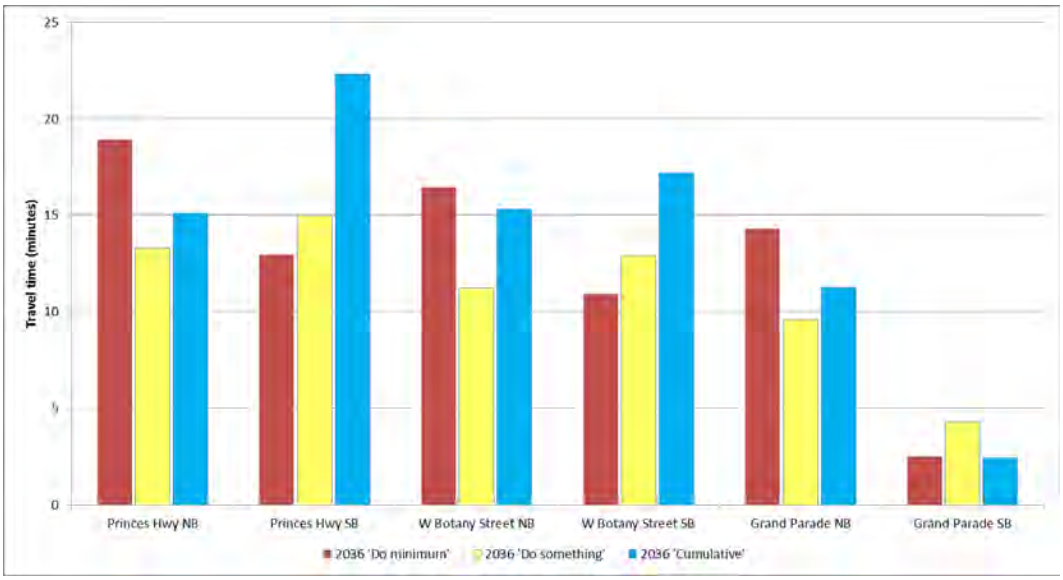


Figure 8-48 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – 2036 AM peak hour 'Do minimum', 'Do something' vs 'Cumulative' scenarios

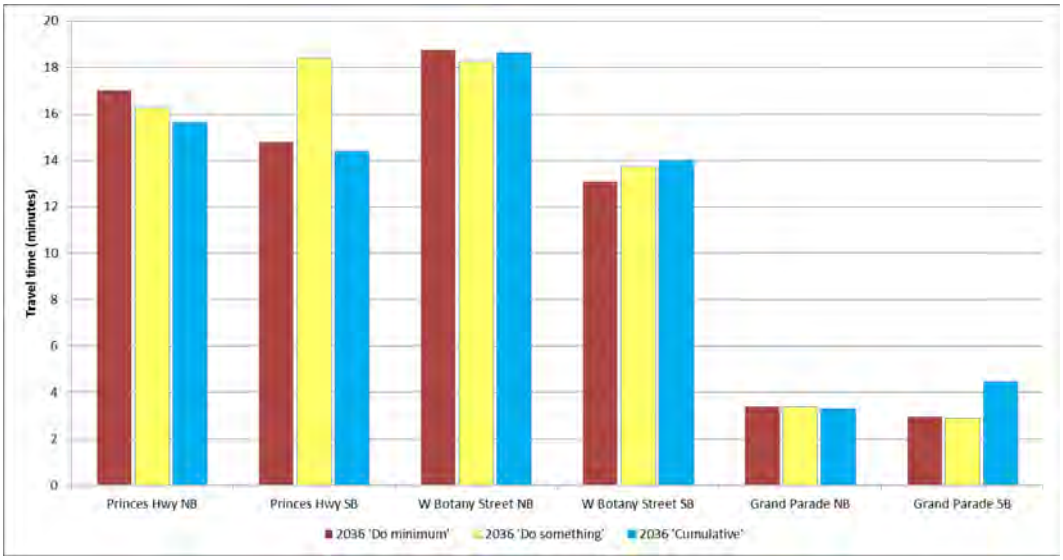


Figure 8-49 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – 2036 PM peak hour 'Do minimum', 'Do something' vs 'Cumulative' scenarios

Reduced travel times and increased average speeds are generally forecast along President Avenue, except for the westbound direction in the 2036 PM peak hour. These are primarily linked to the forecast changes in traffic patterns with the future stages of the F6 Extension, with traffic able to access the new motorway to the south at the President Avenue / West Botany Street intersection. A comparison of average travel times and speeds on the President Avenue route is provided in Table 12-8 of **Appendix D** (Traffic and transport technical report).

8.8.4.5 Traffic crashes

Forecasts indicate that daily traffic on the roads around the President Avenue intersection area and surrounds is forecast to decrease overall in the 2036 'Cumulative' scenario compared to the 'Do something' scenario. This results in a decrease in the total number and cost of crashes of about four per cent.

8.8.4.6 Public transport services

The impact of the 'Cumulative' scenario on the average bus travel times is forecast to be small when compared to the 2036 'Do something' scenario.

8.8.4.7 Active transport facilities

Changes to active transport facilities in the vicinity of the President Avenue intersection beyond those described and assessed in **section 8.2** would be considered as part of the development of future stages of the F6 Extension. While no detail in this regard is currently available, the shared cycle and pedestrian pathways would continue to be a key deliverable of the F6 Extension and would be extended along the existing F6 reserved corridor in conjunction with the motorway extension.

8.8.4.8 Impact on local property access and on-street parking

Impacts on local property access and on-street parking in the vicinity of the President Avenue intersection beyond those described and assessed in **section 8.7** would be considered as part of the development of future stages of the F6 Extension. No detail in this regard is currently available.

8.8.5 Operational performance – St Peters interchange and surrounds

8.8.5.1 Network performance

Table 8-62 and **Table 8-63** present a comparison of the performance of the modelled road network for the AM and PM peak hours in the 2036 'Do something' and 'Cumulative' scenarios.

In the AM and PM peak hours, the 2036 'Cumulative' scenario is expected to result in a minor increase in surface traffic demand (less than two per cent), with only slight changes in the overall forecast network performance compared to the 2036 'Do something' scenario during both peak periods.

Table 8-62 St Peters interchange network performance – AM peak hour (2036 'Do minimum', 'do something with potential mitigation measures' vs 'Cumulative' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	Percentage change (do min to do something)	2036 'Cumulative'	Percentage change (do something to cumulative)
All vehicles					
Total traffic demand (veh)	33,910	33,910	0%	34,510	+2%
Total vehicle kilometres travelled in network (km)	131,580	134,210	+2%	137,030	+2%
Total time travelled approaching and in network (hr)	6,880	7,340	+7%	6,830	-7%
Total vehicles arrived	32,050	32,490	+1%	33,170	+2%
Average per vehicle in network					
Average vehicle kilometres travelled in network (km)	3.5	3.4	-3%	3.4	0%
Average time travelled in network (mins)	10.2	10.2	0%	9.2	-10%
Average speed (km/h)	20.4	20.2	-1%	22.4	+11%
Unreleased vehicles					
Unreleased demand (veh)	1,730	2,320	–	2,680	–
% of total traffic demand	5%	7%	–	8%	–

Table 8-63 St Peters interchange network performance – PM peak hour (2036 'Do minimum', 'do something with potential mitigation measures' vs 'cumulative with potential mitigation measures' scenario)

Network measure	2036 'Do minimum'	2036 'Do something'	Percentage change (do min to do something)	2036 'Cumulative'	Percentage change (do something to cumulative)
All vehicles					
Total traffic demand (veh)	34,420	34,320	<1%	34,720	+1%
Total vehicle kilometres travelled in network (km)	129,370	132,010	+2%	137,600	+4%
Total time travelled approaching and in network (hr)	4,930	5,370	+9%	5,690	+2%
Total vehicles arrived	33,150	32,860	-1%	33,280	+2%
Average per vehicle in network					
Average vehicle kilometres travelled in network (km)	3.4	3.4	0%	3.4	0%
Average time travelled in network (mins)	7.3	7.7	+5%	7.7	0%
Average speed (km/h)	27.9	26.5	-5%	26.5	0%
Unreleased vehicles					
Unreleased demand (veh)	1,340	1,660	–	1,850	–
% of total traffic demand	4%	5%	–	5%	–

8.8.5.2 Intersection performance

Table 8-64 presents the modelled average intersection delay and LoS in the AM and PM peak hours for key intersections at St Peters comparing the 2036 'Do minimum', 'Do something' and 'Cumulative' scenarios. The modelling results show that in both peaks, the performance of each intersection is forecast to be similar.

Table 8-64 St Peters interchange: key intersection performance – 2036 'Do minimum', 'Do something' and 'Cumulative' scenarios

Key intersections	2036 'do minimum'		2036 'do something'		2036 'cumulative'	
	Ave delay (sec)	LOS	Ave delay (sec)	LOS	Ave delay (sec)	LOS
AM peak hour						
O'Riordan St / Bourke Rd	38	C	32	C	21	B
Gardeners Rd / O'Riordan St	>100	F	>100	F	72	F
Gardeners Rd / Bourke Rd	56	D	47	D	46	D
Gardeners Rd / Kent Rd	83	F	>100	F	>100	F
Ricketty Street / Kent Road	55	D	56	D	54	D
Campbell Rd / Euston Rd	70	E	>100	F	>100	F
Princes Hwy / Campbell St	>100	F	>100	F	>100	F
Princes Hwy / May St	76	F	77	F	71	F
Princes Hwy / Sydney Park Rd	41	C	42	C	43	C
Sydney Park Rd / Mitchell Rd	32	C	32	C	40	C
Euston Rd / Sydney Park Rd	58	E	56	D	57	E
PM peak hour						
O'Riordan St / Bourke Rd	14	A	14	A	15	B
Gardeners Rd / O'Riordan St	77	F	>100	F	>100	F
Gardeners Rd / Bourke Rd	37	C	42	C	45	D
Gardeners Rd / Kent Rd	35	C	38	C	41	C
Ricketty Street / Kent Road	41	C	44	D	48	D
Campbell Rd / Euston Rd	67	E	69	E	75	F
Princes Hwy / Campbell St	60	E	89	F	97	F
Princes Hwy / May St	7	A	14	B	14	A
Princes Hwy / Sydney Park Rd	40	C	40	C	44	D
Sydney Park Rd / Mitchell Rd	51	D	72	F	94	F
Euston Rd / Sydney Park Rd	>100	F	>100	F	>100	F

8.8.5.3 Travel times

Figure 8-50 and **Figure 8-51** show a comparison of travel times recorded on the travel time routes identified in **Figure 8-18** comparing the 2036 'Do something' and 'Cumulative' scenarios.

In the AM peak hour, generally slight reductions in travel times are forecast in the 2036 'Cumulative' scenario, while in the PM peak hour, generally slight increases in travel times are forecast in the 2036 'Cumulative' scenario, when compared to the 2036 'Do something' scenario. However, these changes in travel times between the scenarios are forecast to be minor (generally less than one minute).

The exception are trips between the exit ramp from the F6 / New M5 and Euston Road (north) where the travel times are about three minutes longer in the PM peak hour in the 'Cumulative' scenario. This is due to a different traffic pattern in the 'Cumulative' scenario demands compared to the 'Do something' scenario demands.

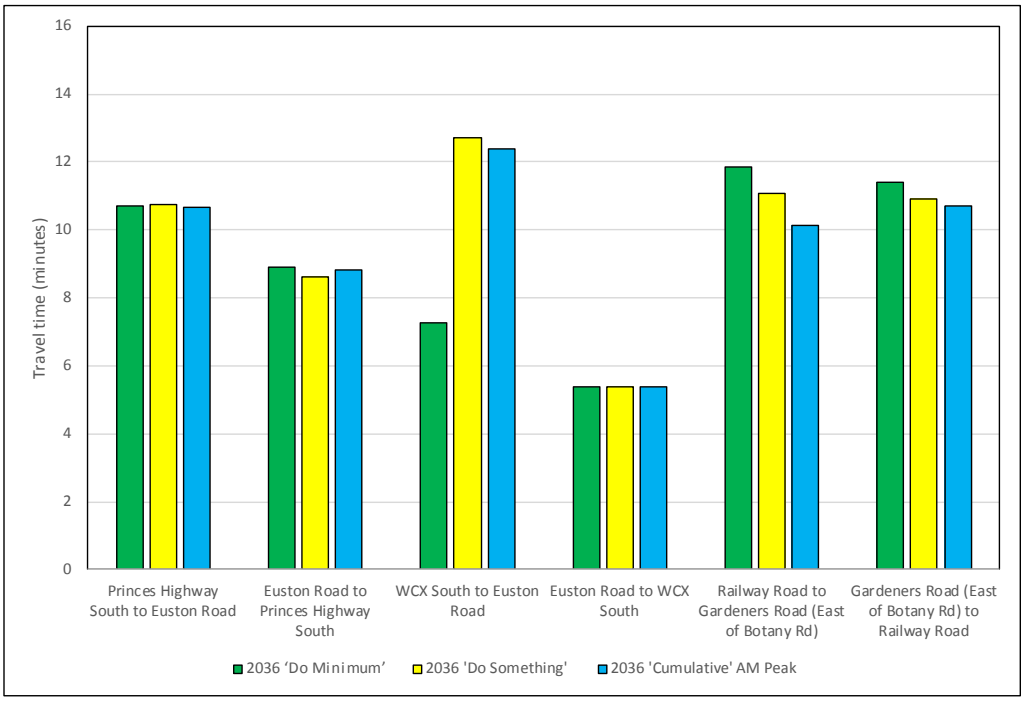


Figure 8-50 St Peters interchange: Average travel time (mins) – 2036 AM peak hour 'Do minimum', 'Do something' and 'Cumulative' scenarios

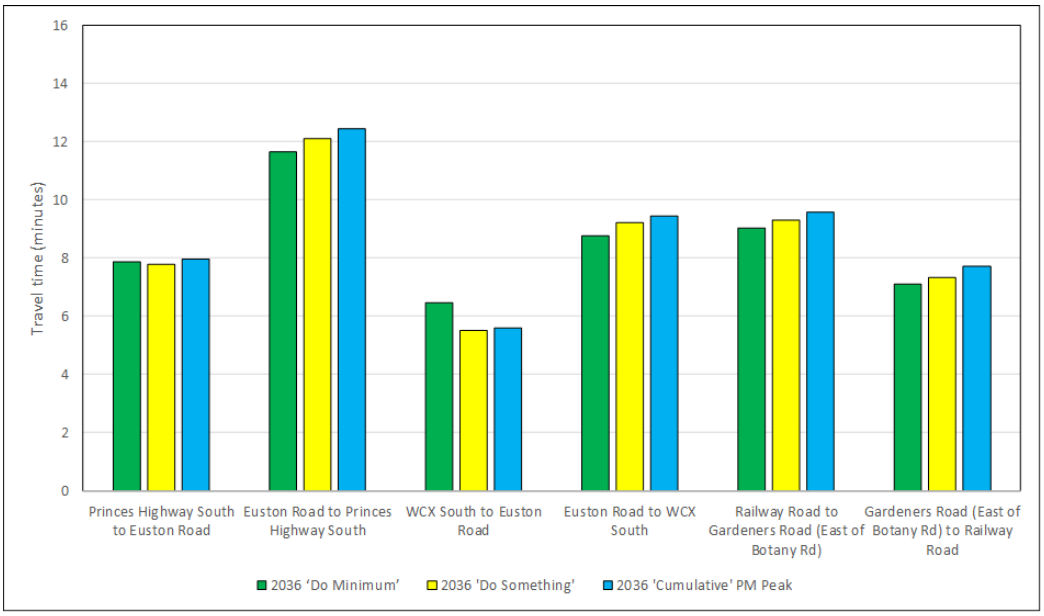


Figure 8-51 St Peters interchange: Average travel time (mins) – 2036 PM peak hour 'Do minimum', 'Do something' and 'Cumulative' scenarios

8.8.5.4 Traffic crashes

Forecasts indicate that the changes in the 'Cumulative' scenario would have a small impact on the daily traffic on the roads around the St Peters interchange, with changes in daily traffic of one per cent or less forecast for the roads assessed. These result in corresponding changes in the forecast number and cost of traffic crashes on these roads of less than one per cent.

8.8.5.5 Public transport services

There is little difference in forecast bus travel times between the 2036 'Do minimum', 'Do something' and 'Cumulative' scenarios, with travel times forecast to change by less than one minute.

8.8.5.6 Active transport facilities

No changes to active transport facilities in the vicinity of the St Peters interchange are forecast in the 'Cumulative' scenario.

8.8.5.7 Impact on local property access and on-street parking

No changes to local property access or on-street parking in the vicinity of the St Peters interchange are forecast in the 'Cumulative' scenario.

8.8.6 Cumulative scenario mitigation

While specific mitigation measures for the cumulative scenarios assessed in this report are beyond the scope of this EIS, the issues identified would be examined as part of the design development for the future stages of the F6 Extension between Kogarah and Loftus and the Western Harbour Tunnel and Beaches Link projects and as part of Roads and Maritime network mitigation strategies.

Consultation with the design teams for these projects would occur with the objective of minimising cumulative traffic impacts.

8.9 Management of impacts

Table 8-65 Environmental management measures - Traffic and transport

Impact	Reference	Environmental management measures	Timing
Construction Traffic and Access	TT1	A Construction Traffic and Access Management Plan (CTAMP) will be prepared as part of the Construction Environmental Management Plan. The CTAMP will detail processes to minimise delays and disruptions and identify and respond to changes in road safety as a result of project construction works. The CTAMP will be prepared in accordance with applicable guidelines and relevant standards, guides and manuals. The CTAMP will: • Ensure all relevant stakeholders are considered during all stages of the project • Provide safe routes for pedestrians and cyclists during construction • Develop project staging plans in consultation with relevant traffic and transport stakeholders, which would include measures to manage impacts during special events (such as sporting events) • Plan and stage works to minimise the need for road occupancy, where possible • Minimise the number of changes to the road users' travel paths and, where changes are required, implement a high standard of traffic controls which effectively warn, inform and guide • Comprehensively communicate changes in traffic conditions on roads or paths to emergency services, public transport operators, other road user groups and other affected stakeholders • Identify measures to manage the movements of construction-related traffic to minimise traffic and access disruptions in the public road network • Minimise the use of local roads by the project's heavy vehicles and identify haulage routes • Propose a car parking strategy for construction staff at the various worksites, in consultation with local councils and stakeholders associated with any facilities adjacent to the project site Minimise the loss of on-road parking for local residents • Stage the construction works on key parts of the network – such as Princes Highway, President Avenue and West Botany Street – to enable these key roads to continue to function with as minimal impact as possible.	Prior to construction
	TT2	Changes in bus stops will be undertaken in consultation with Transport NSW and bus operators, with the community to be informed of any potential changes in advance. Wayfinding signage will be provided directing commuters to adjacent or relocated bus stops. Footpaths will be provided to any relocated bus stops such that accessibility standards are met.	Construction
	TT3	During construction, work with the TMC to observe traffic flows and incidents from CCTV footage and where reasonable and feasible, modify sites and activities to address issues identified by TMC	Construction
	TT4	Spoil haulage vehicles will be managed to minimise movements in the AM and PM peak periods.	Construction

Impact	Reference	Environmental management measures	Timing
	TT5	Minimise local road closures and maintain adequate property access to the road network. Property owners will be consulted and agree to any changes to access.	Construction
	TT6	The movements of haulage vehicles accessing ancillary construction sites will be coordinated to minimise potential queuing and traffic and access disruptions in the local area.	Construction
Damage or impacts to road infrastructure resulting from construction works.	TT7	Prior to impacting roads, a road dilapidation report will be prepared, in consultation with relevant council(s) and road owners, identifying existing conditions of local roads and mechanisms to repair damage to the road network caused by heavy vehicle movements associated with the project.	Prior to construction Construction
Operational road network performance impacts including potential increased traffic on some parts of the network, particularly President Avenue, West Botany Street and Bestic Street as a result of the project.	TT8	A review of operational network performance will be undertaken 12 months and five years from commencement of operation to confirm the operational traffic impacts of the project on the President Avenue corridor and the surrounding arterial roads and major intersections. The review will identify relevant mitigation measures, if required to address impacts on road network performance. The results of the review will be considered in future operational network performance planning carried out by Roads and Maritime.	Operation

8.10 Environmental risk analysis

An environmental risk analysis was undertaken for Traffic and transport and is provided in **Table 8-66.**

A level of assessment was undertaken commensurate with the potential degree of impact the project may have on that issue. This included an assessment of whether the identified impacts could be avoided or minimised (for example, through design amendments). Where impacts could not be avoided, environmental management measures have been recommended to manage impacts to acceptable levels.

The residual risk is the risk of the environmental impact after the proposed mitigation measures have been implemented. The methodology used for the environmental risk analysis is outlined in **Appendix O** (Methodologies).

Table 8-66 Environmental risk analysis – Traffic and transport

Summary of key impacts	Construction/ Operation	Management and mitigation measures	Likelihood	Consequence	Residual risk
Traffic and transport					
Construction impacts on road network performance including public transport and active transport.	Construction	A Construction Traffic and Access Management Plan (CTAMP) will be prepared and will include the guidelines, general requirements and principles of traffic management to be implemented during construction. It will be prepared in accordance with Austroads Guide to Road Design (with appropriate Roads and Maritime supplements). Alternative public transport and active transport facilities are to be provided where possible.	Likely	Minor	Medium
Traffic-related safety incidents (involving both workers and road users) during construction.	Construction	The CTAMP is to include measures to address safety risks. Construction staging and temporary works is to be implemented to minimise conflicts with the existing road network and maximise spatial separation between work areas and travel lanes.	Unlikely	Major	Medium
Temporary impacts to property access, pedestrian and cyclist access, locations of bus stops during construction.	Construction	A Construction Traffic and Access Management Plan (CTAMP) will be developed and implemented during construction. Property access will be maintained where possible. Local road closures will be managed in consultation with Roads and Maritime, local councils and property owners likely to be impacted Changes in bus stop locations will be undertaken in consultation with Transport NSW and bus operators, with the community to be informed of any potential changes in advance Pedestrian and cyclist access are to be maintained where possible throughout construction. Where not feasible, alternative routes are to be provided and communicated to the community.	Likely	Minor	Low
Damage or impacts to road infrastructure resulting from construction works.	Construction	Road dilapidation reports will be prepared for potentially impacted road infrastructure. Mechanisms to repair damage to the road network caused by the project will be identified.	Likely	Minor	Low
Operational road network performance impacts including potential increased traffic on some parts of the network, particularly President Avenue, West Botany Street and Bestic Street as a result of the project.	Operation	A review of operational network performance will be undertaken 12 months and five years from the opening of the project to confirm the network operational impacts of the project. A network integration strategy will be prepared in consultation with local council regarding optimisation measures. This may include measures to improve traffic flow on areas experiencing higher flow as a result of the project.	Likely	Moderate	Medium