NSW GOVERNMENT

Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Environmental Impact Statement

Appendix D
Traffic and Transport Technical Report

Volume 3

D

(blank page)

Contents

Glossary of terms and abbreviations

Term	Definition
A	
AADT	Annual Average Daily Traffic. The total volume of traffic (24 hours) passing a roadside observation point over a period of a year; divided by the number of days per year. It is calculated from mechanically obtained axle counts
ADT	Average Daily Traffic. The total volume of traffic (24 hours) passing a roadside observation point over a seven-day period during a set number of weeks; divided by the total number of days. It is calculated from mechanically obtained axle counts
AM peak hour	Unless otherwise stated, this refers to vehicle trips arriving at their destination during the average peak one hour in the AM peak period between 7.00 am–9.00 am on a normal working weekday
At-grade	A road at ground level, not on an embankment or in a cutting
ATC	Automatic Traffic Count
AWT	Average Weekday Traffic. The total volume of traffic (24 hours) passing a roadside observation point over a five-day weekday period during a set number of weeks (outside of school/public holidays); divided by the total number of days. It is generally calculated from axle counts of passing vehicles
B	
Bus lane	A traffic lane dedicated to buses, but which can also be used by taxis, bicycles and motorcycles
C	
Capacity	The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a given time period under prevailing roadway conditions
Carriageway	The portion of a roadway used by vehicles including shoulders and ancillary lanes
CBD	Central Business District
CCTV	Closed-Circuit Television
CEMP	Construction Environmental Management Plan. A site specific plan developed for the construction phase of a project to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the project and that environmental risks are properly managed
CNVG	Construction Noise and Vibration Guideline (Roads and Maritime, 2016)
CNVIS	Construction Noise and Vibration Impact Statements
CNVMP	Construction Noise and Vibration Management Plan
Concept design	Initial functional layout of a road/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimating and to determine further investigations needed for detailed design
Construction	Includes all physical work required to construct the project
Construction ancillary facilities	Temporary facilities during construction that include, but are not limited to construction sites (civil and tunnel), sediment basins, temporary water treatment plants, precast yards and material stockpiles, laydown areas, workforce parking, maintenance workshops and offices
Construction fatigue	Impact on receivers in the vicinity of concurrent and/or consecutive construction activities
Corridor	A substantial segment of the transport network, in which parallel, possibly competing, transport routes (and modes, where appropriate) operate between two locations
CSSI	Critical State significant infrastructure

Term	Definition
CTAMP	Construction Traffic and Access Management Plan
Cul-de-sac	A street or road that is open for vehicular traffic at one end only
Culvert	A structure that allows water to flow under a road
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessed on its own
Cut-and-cover	A method of tunnel construction whereby the structure is built in an open excavation and subsequently covered
D	
Design speed	A nominal speed which determines the geometric design features of a road
Detailed design	The phase of the project following concept design where the design is refined, and plans, specifications and estimates are produced, suitable for construction
Detour	An alternative route, using existing roads, made available to traffic
Design speed	A nominal speed which determines the geometric design features of a road
Divided road	A road with a separate carriageway for each direction of travel created by placing a physical separation (e.g. median) between the opposing traffic directions
Do minimum	A model scenario that does not incorporate the proposed project infrastructure
Do something	A model scenario that incorporates the proposed project infrastructure
Do something cumulative	A model scenario that incorporates the proposed project infrastructure and other relevant project infrastructure
DP&E	NSW Department of Planning and Environment
E	
EB	Eastbound
EIS	Environmental Impact Statement
Enabling works	Works which are required to enable the commencement of the main construction works
Entry ramp	A ramp by which one enters a limited-access highway/tunnel
Environment	Includes all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings (from EP&A Act)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
Exit blocking	Queuing traffic from a downstream link or intersection that blocks traffic from being able to travel through and exit an intersection
Exit ramp	A ramp by which one exits a limited-access highway/tunnel
F	
F6 Extension (previously referred to as SouthLink)	A proposed motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor. The project is being delivered by NSW Roads and Maritime Services and would be subject to separate assessment and planning approval
Footpath	The paved area in a footway
Footprint	The extent of the impact that a development (in plan-view) makes on the land
Footway	An area open to the public designated for the movement of pedestrians or has one of its main uses for pedestrians
Freeways	Fast, high volume, access controlled roads that primarily link regional hubs and cities usually with grade separated intersections and without traffic lights
Freight Strategy	NSW Freight and Ports Strategy (Transport for NSW 2013b)

Term	Definition
G	
Gateway to the South	An accelerated pinch points program, the Gateway to the South Pinch Points Program aims to ease congestion and improve journey reliability on Sydney's key southern corridors. The NSW Government has committed $300 million to address critical pinch points along the A1, A3 and A6 routes south of the M5 Motorway
Grade separation	The separation of road, rail or other transport modes, so that crossing movements at intersections are at different levels
GMA	Greater Metropolitan Area. This area includes the Sydney Greater Capital City Statistical Area and the Illawarra and Lower Hunter regions.
GVM	Gross Vehicle Mass
H	
h	Hour
ha	Hectare/s
HCV	Heavy Commercial Vehicle. Class 3 vehicle (a two axle truck) or larger, in accordance with the Austroads Vehicle Classification System
Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two axle truck) or larger, in accordance with the Austroads Vehicle Classification System
I	
IDM	Intersection Diagnostic Monitor
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
Inner West Council	The amalgamation of the former local government areas of Ashfield, Leichhardt and Marrickville, proclaimed on 12 May 2016
Inside shoulder	The area of pavement outside the traffic lanes that is closest to the 'fast' lane
Interchange	An intersection of two or more roads that typically uses grade separation, and one or more ramps, to permit traffic on at least one carriageway to pass through the junction without directly crossing any other traffic stream
Iron Cove Link	Around one kilometre of twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge
J	
Junction	A place where two or more roads meet
K	
km/h	Kilometres per hour
L	
Local road	A road or street used primarily for access to abutting properties
LCV	Light Commercial Vehicle. Vehicles up to 4.5 tonnes Gross Vehicle Mass (GVM), including cars which have been registered for business use
LGA	Local Government Area
Local road	A road or street used primarily for access to abutting properties
LoS	Level of service. A qualitative measure describing operational conditions within a traffic stream or intersection and the perception by motorists and/or passengers
M	
M5 East Motorway	Part of the M5 Motorway corridor. Located between Beverly Hills and Sydney Airport (General Holmes Drive)

Term	Definition
M5 motorway corridor	The M5 East Motorway and the M5 South West Motorway
M5 South West Motorway	Part of the M5 Motorway corridor. Located between Prestons and Beverly Hills
Managed motorway	A managed motorway uses active traffic management to reduce congestion, improve reliability of travel times and inform travellers of real-time incidents and expected travel times to set destination along the motorway
Median	The central reservation which divides a carriageway for traffic travelling in opposite directions
Midblock	A general location on a road between two intersections
Mode	A type or method of transport movement – including for the road corridor: cars, buses, bikes and pedestrians
Motorway	Fast, high volume controlled access roads. May be tolled or untolled
N	
National Road Network	AusLink National Land Transport Network
NB	Northbound
Network productivity	Indication of efficiency of a road network, which can be expressed in terms of vehicle kilometres travelled and vehicle hours travelled per day
NSW	New South Wales
O	
OOHW	Out-of-hours work
Outside shoulder	The area of pavement outside the traffic lanes that is closest to the 'slow' lane
Overbridge	Bridge that conveys another road, rail or pedestrians over the described road
P	
Parramatta Road corridor	The Parramatta Road corridor is the area from Parramatta CBD to Sydney CBD, generally between the Main Western Rail line in the south and the Parramatta River to the north
Peak spreading	Increases in traffic demand in time periods immediately before or after the critical AM peak and PM peak periods, with commensurate decreases in the forecast peak period traffic demand
PCU	Passenger Car Unit
PM peak hour	Unless otherwise stated, this refers to trips travelling on the network during the average peak one hour in the PM peak period between 3.00 pm–6.00 pm on a weekday hour
Portal	The entry and/or exit to a tunnel
Pre-construction	All work prior to, and in respect of the State significant infrastructure, that is excluded from the definition of construction
Private vehicle	Includes all motorised vehicles such as cars, 4WDs, vans, motorbikes, motor scooters, utes and trucks, not registered for business use
Proponent	The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is NSW Roads and Maritime Services
Public transport	Includes train, bus (government and private), ferry (government and private) and light rail (government and private) services
PV	Passenger vehicle
R	
REF	Review of Environmental Factors
RNP	Road Noise Policy
Roads and Maritime	NSW Roads and Maritime Services (formerly NSW Roads and Traffic Authority (RTA))

Term	Definition
Roadside furniture	A general term covering all signs, street lights, protective devices for the control, guidance and safety of traffic and convenience of road users
Road reserve	An area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel
Roadside	The area from the edge of the carriageway to the boundary of the road reserve
Roundabout	An intersection where all traffic travels in one direction clockwise around a central island
RTA	NSW Roads and Traffic Authority (now NSW Roads and Maritime Services)
S	
s	Seconds
SACL	Sydney Airport Corporation Limited
Saturation flow	The number of vehicles per hour that could pass through a signalised intersection on a specific approach lane if the signal remained green for the entire 60 minutes
SB	Southbound
SCATS	Sydney coordinated adaptive traffic system
Screenline	Theoretical boundaries specifically designed to collectively analyse directional and two-way traffic volumes
SEARs	Secretary's Environmental Assessment Requirements Requirements and specifications for an environmental assessment prepared by the Planning Secretary under section 115Y of the Environmental Planning and Assessment Act 1979 (NSW)
Sensitive receiver/receptor	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises)
Shoulder	The portion of the carriageway beyond the traffic lanes adjacent to and flush with the surface of the pavement
Smart Motorway Operations	A Smart Motorway uses technology to monitor, provide intelligence and control the motorway to ease congestion and keep traffic flowing more effectively. Technology, including lane use management signs, vehicle detection equipment, CCTV cameras and on-ramp signals, allows road operators to manage, in real-time, traffic entering, exiting and traversing the motorway
SMC	Sydney Motorway Corporation
SMPO	Sydney Motorways Project Office
SMPM	Sydney Strategic Motorway Planning Model, version 1
STM	Strategic Travel Model, operated by Transport for NSW Transport Performance and Analytics
St Peters interchange	A component of the New M5 project, located at the former Alexandria Landfill site at St Peters. Approved and under construction as part of the New M5 project.
Staging	Refers to the division of the project into multiple contract packages for construction purposes, and/or the construction or operation of the overall project in discrete phases
Stub tunnel	Driven tunnels constructed to connect to potential future motorway links
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct
T	
Traffic efficiency	Measured by savings (and delays) in travel time

Term	Definition
Transport infrastructure	Permanent installations including roads, rail, buildings and storage associated with transport
TCS	Traffic Control Signal
TfNSW	Transport for New South Wales
TMC	Transport Management Centre
TPA	Transport Performance and Analytics business unit within Transport for NSW (formerly Transport for NSW's Bureau of Transport Statistics and Bureau of Freight Statistics)
Transport for NSW	NSW Government Department Transport for NSW
Truck and dog construction vehicle	A vehicle with 20 cubic metre capacity and maximum length of 19 metres
U	
Unreleased demand	In a microsimulation traffic model, this is the number of vehicles unable to enter the model due to congestion extending back into model entry points. The number of unreleased vehicles is an indication of the effectiveness of the modelled network in meeting the forecast traffic demand. The lower the number of unreleased vehicles, the better the modelled network is able to accommodate the forecast demand flows
V	
Veh	Vehicle
Veh/h	Vehicle per hour
Ventilation facility	Facility for the mechanical removal of air from the mainline tunnels, or mechanical introduction of air into the tunnels. May comprise one or more ventilation outlets
VHT	Vehicle Hours Travelled
VKT	Vehicle Kilometres Travelled
V/C	Volume to Capacity ratio
VTTS	Value of Travel Time Savings
W	
WB	Westbound
Western Harbour Tunnel and Beaches Link	The Western Harbour Tunnel component would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component would comprise a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest
WestConnex program of works	A program of works that includes the M4 Widening, King Georges Road Interchange Upgrade, M4 East, New M5 and M4-M5 Link projects

Executive summary

Roads and Maritime Services (Roads and Maritime) is seeking approval to construct and operate the F6 Extension Stage 1 from New M5 Motorway at Arncliffe to President Avenue at Kogarah (the project). The project would comprise a new, multi-lane road between the New M5 Motorway underground at Arncliffe and a new surface level intersection at President Avenue at Kogarah.

Once complete, the F6 Extension Stage 1 would improve connections and travel times between Sydney and the Princes Highway and, together with further stages of the F6 Extension, enhance connections for residents and businesses within the broader regional area as well as promote and support economic development in areas to the south, such as Sutherland and the Illawarra.

Project objectives have been developed to address the key transport challenges faced by the Greater Sydney region and to align with objectives developed for the overall F6 Extension. These are:

- **Transport** – Improve journey times and reliability for all road users travelling to, from and through southern Sydney
- **Productivity** – Support future growth and productivity by providing better connections to the rest of Sydney
- **City Shaping** – Support improved land use and urban renewal around selected centres on the Princes Highway and The Grand Parade by reducing through traffic along these corridors that perform a key place function.

These objectives are discussed further in Chapter 4 (Strategic context and project need) of the environmental impact statement (EIS).

Existing traffic and transport environment

The project would be located within the Bayside local government area (LGA), around nine kilometres to the southwest of the Sydney Central Business District (CBD). The project would be predominately located underground, with the majority of the motorway operational surface infrastructure located within land that has been previously reserved for the F6 Extension (the existing F6 reserved corridor).

The traffic and transport study area for this assessment was informed by the potential forecast traffic changes from the Sydney Strategic Motorway Planning Model, version 1 (SMPM), a strategic traffic model that covers the Sydney metropolitan area. The study area broadly encompasses an area extending from St Peters in the north to Kogarah in the south. It is predominantly focused on the corridor between St Peters and Kogarah, as well as the surface road networks around the President Avenue and St Peters interchanges.

The study area contains several major transport corridors and infrastructure, including the Princes Highway, General Holmes Drive and The Grand Parade, the M5 Motorway, the Sydney Trains suburban railway network, freight rail and road access to Port Botany, and Sydney Airport. The Princes Highway between President Avenue and the M5 East is identified as a secondary road freight route. General Holmes Drive and The Grand Parade between the M5 East and President Avenue, form part of a tertiary road freight route. Both these routes connect Sydney to the Sutherland Shire to the south, and beyond to the Illawarra.

Bus services around the President Avenue intersection site and surrounds are provided by State Transit and Transdev NSW bus operators. The bus routes provide a mixture of regional connections between activity centres, and local connections that complement the rail service provision.

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 has gaps in the active transport corridors 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. Aside from the Cook Park Trail and trails through Bicentennial Park or Rockdale Bicentennial Park East, the cycle links parallel to the project are listed as medium to high difficulty on-road cycle routes. The Rockdale Wetlands Open Space Corridor is part of the Sydney Green Grid, which states that parts of this corridor, which are currently zoned for a future motorway, should be designed to retain and protect recreational open spaces and the ecological values of the corridor.

Existing road network performance

The road network in the study area currently functions under high levels of traffic demand, which often exceeds the operational capacity, especially city bound during the AM peak period. In the Kogarah and St Peters modelled road networks, current average speeds of less than 30 kilometres per hour in the AM and PM peak periods are reported on several key roads, indicating significant congestion and poor level of service. These congested conditions may cause traffic to seek alternate routes.

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

- 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. 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.
- Local road congestion where different trip types converge – the current road hierarchy does not efficiently separate competing traffic movements, with through traffic conflicting with local traffic. This contributes to congestion, resulting in long and unreliable through journeys, inefficient and unreliable local journeys and low resilience on the road network linking southern Sydney and the Eastern City District. 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 other north-south road links, with those roads subsequently performing the role of the arterial road network, a task for which they were not designed. Use of these roads, in particular West Botany Street and The Grand Parade (south of President Avenue), is not limited to private vehicles.

Over the past five years, the majority of crashes on the major roads in the study area were rear-end crashes, which is consistent with roadways operating at or beyond capacity and on which significant queuing occurs. Available operational bus data indicated that services outside of the AM and PM peak periods were generally able to, on average, run 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.

Strategic context

Investment in transport infrastructure that improves road travel reliability is a NSW Government State Priority and essential to sustaining economic growth and prosperity by reducing travel times, boosting productivity and reducing business costs. The Greater Sydney Region Plan (Greater Sydney Commission 2017a) indicates that by 2036, Greater Sydney's population is forecast to increase from 4.7 to 6.4 million, which equates to an average of about 90,000 additional residents per year. Moreover, by 2036, the number of trips made across Greater Sydney each day is forecast to increase to 22 million trips, up 40 per cent compared to 2016.

This growth will put increasing pressure on the NSW transport network and particularly strategic transport corridors, which support the movement of people and goods connecting major centres or trip generators across the greater Sydney metropolitan area. Strategic road corridors accommodate high levels of daily demand and the majority of trips using these corridors experience congestion, delay and occasional traffic incidents, with these corridors put under strain during the busy weekday and weekend peak periods. Transport improvements including new capacity, improved services and a future-ready transport network will support movements on this strategic road network and alleviate pressure on local roads, providing an improved user experience for local road users. The project area forms part of the strategic road corridor between the Sydney CBD and the south (to Kogarah and beyond to Wollongong). There is currently no motorway grade link in this corridor, which means that vehicles travelling between the Sydney motorway network and the existing M1 Princes Motorway south of Waterfall are required to use the arterial road network, resulting in traffic congestion and delayed travel times.

The project would provide a motorway grade connection that is currently performed by arterial roads (namely Princes Highway, General Holmes Drive and The Grand Parade, and West Botany Street) and lower-order roads, which are nearing capacity as ongoing development and population growth places additional pressure on the road network. The project would also provide for network redundancy by providing for an alternative route and improved network management in the event of an incident on the surface road network.

Methodology

The traffic forecasting and modelling undertaken for this assessment consisted of both strategic and operational modelling. Strategic modelling using SMPM was carried out to derive future traffic demands, based on planned and forecast changes in population and employment, and to understand the metropolitan-wide impacts of the project, while operational modelling (using microsimulation models) was carried out to understand the more detailed impacts such as the performance of interchanges and the level of service performances of tunnels and at merges and weaves.

The assessment has covered the following scenarios:

- Base case (2014/15): current road network with no new projects or upgrades. For the operational modelling, 2014/15 was adopted as the base case to match the year of traffic survey data collection.
- Construction (2021): future road network assessed with NorthConnex, the M4 Widening, M4 East and New M5 complete and operational. Nominal construction year adopted as representative of the peak construction traffic generation of the project
- Operation 'do minimum' (2026): a future network including NorthConnex, the WestConnex program of works, Sydney Gateway, and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth. It is called 'do minimum' rather than 'do nothing' as it assumes that ongoing improvements would be made to the broader road and public transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.
- Operation 'do something' (2026): With the 2026 'do minimum' projects completed and the F6 Extension Stage 1 (New M5, Arncliffe to President Avenue, Kogarah) complete and open to traffic
- Operation 'do minimum' (2036): a future network including NorthConnex, the WestConnex program of works, Sydney Gateway, and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth. It is called 'do minimum' rather than 'do nothing' as it assumes that ongoing improvements would be made to the broader road and public transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.
- Operation 'do something' (2036): With the 2036 'do minimum' projects completed and the F6 Extension Stage 1 (New M5, Arncliffe to President Avenue, Kogarah) complete and open to traffic
- Operation 'cumulative' (2036): With the 2036 'do something' projects completed and Western Harbour Tunnel and Beaches Link, and future stages of the F6 Extension between Kogarah and Loftus complete and open to traffic.

The operational traffic assessment scenarios are summarised in **Table E-1**.

Table E-1 Operational traffic assessment scenarios

Scenario	Year	Existing road network	Future network						
			F6 Extension		NorthConnex	WestConnex program of works	Sydney Gateway	Western Harbour Tunnel	Beaches Link
			Stage 1	from Kogarah to Loftus					
Base Case	2014/15	✓							
Operation 'do minimum'	2026	✓			✓	✓	✓		
Operation 'do something'		✓	✓		✓	✓	✓		
Operation 'do minimum'	2036	✓			✓	✓	✓		
Operation 'do something'		✓	✓		✓	✓	✓		
Operation 'cumulative'		✓	✓	✓	✓	✓	✓	✓	✓

Future conditions without the project

In the future, there is a forecast growth in travel demand for both traffic and public transport, due to a forecast increase in population and employment. This causes increased congestion levels on the road network. The section below provides an overview of conditions on the future road network without the project.

Sydney metropolitan road network

The overall forecast growth in traffic demand is consistent with the forecast increase in population in the Sydney Metropolitan Area. Importantly, this growth in traffic is not confined to major routes – increased traffic on many roads in Sydney is forecast without the project in the 2026 and 2036 peak periods, as vehicles seek to avoid the congested arterial road network by travelling along lower order roads.

A reduction in daily traffic is forecast along the M5 East Motorway (east of King Georges Road) in 2026 and 2036 as a result of traffic switching to use the New M5 Motorway. Increased daily traffic is also forecast along the surface roads south of the M5 East Motorway, such as the Princes Highway, General Holmes Drive / The Grand Parade, Bestic Street, Bay 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.

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 East 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 greater increase in heavy vehicle traffic compared to the increase in general traffic.

President Avenue intersection and surrounds

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 (less than 20 kilometres per hour) and queuing forecast during 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. Intersection performance is expected to be an issue at the Princes Highway / President Avenue intersection (AM peak), the Princes Highway / Forest Road and Wickham Street / West Botany Street set of intersections (AM and PM peaks) and at intersections along West Botany Street, north of President Avenue (AM and PM peaks).

St Peters interchange and surrounds

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 comparable with the 2014/2015 base case even with a forecast traffic growth of 20-30 per cent by 2026. 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.

Modelling results show that in both the AM and PM peak hours, the performance for all 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), 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.

Future conditions with the project (operational traffic assessment)

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 approximately 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.

Forecast traffic in the mainline tunnels

Table E-2 presents the two-way daily average weekday traffic (AWT) volumes that are forecast on the mainline tunnel sections of the project. Analysis indicates that operational performance levels of the mainline tunnels are forecast to be satisfactory in the 2026 and 2036 'do something' scenarios. Although the St Peters interchange exit and entry ramps are forecast to operate at LOS E during certain peak hours, traffic is still forecast to operate at 72 km/h, which is 90 per cent of the posted speed limit of 80 km/h.

In the 2036 'cumulative' scenario, certain sections of the motorway, such as the merge and diverge with the New M5 Motorway are forecast to be denser compared to the 2036 'do something' scenario, with a corresponding reduction in level of service in the peak hours. This is due to the additional motorway links in the 'cumulative' scenario (future stages of the F6 Extension and the Western Harbour Tunnel and Beaches Link projects), resulting in more traffic in the motorway. Even with this increased density, and lower levels of service, average motorway speeds are still forecast to be 85 per cent or above of the posted speed limit in the peak hours.

Table E-2 Two-way daily average weekday traffic (AWT) forecast in the F6 Extension Stage 1 mainline tunnels (between President Avenue ramps and New M5 Motorway ramps)

Year	Scenario	Two-way daily AWT
2026	'Do something'	36,000
2036	'Do something'	43,000
	'Cumulative'	58,500

Source: SMPM v1, February 2018

Parallel routes analysis

As a result of the additional road network capacity provided by the project, the two-way future year AWT traffic demand compared to a 'do minimum' scenario is predicted to decrease on:

- General Holmes Drive (north of Bay Street) by more than 10,000 vehicles (about 15 per cent) in the 2026 and 2036 'do something' and 'cumulative' scenarios
- Princes Highway (north of Bay Street) by about five per cent in 2026 and 2036 with the project – a decrease of about 2,000 vehicles per day. This increases to about a 10 per cent reduction in the 2036 'cumulative' scenario.
- West Botany Street (north of Bay Street) by more than 10 per cent in 2026 and 2036 with the project – a decrease of about 3,000 vehicles per day in 2026 and 3,500 vehicles per day in 2036. A similar reduction is forecast in the 2036 'cumulative' scenario.
- Marsh Street (at the Cooks River) by about 10 per cent in 2026 and 2036 with the project – a decrease of about 3,000 vehicles per day in 2026 and 7,000 vehicles per day in 2036. A similar reduction is forecast in the 2036 'cumulative' scenario.

The project would provide an alternative parallel option to the roads listed above in the 'do something' scenario and with the further stages of the F6 Extension from Kogarah to Loftus in the 'cumulative' scenario. The screenline analysis, presented in Chapter 9.0, found no major shifts in daily traffic onto parallel routes as a result of the project.

The reduction in traffic demand on these major traffic routes is likely to improve speed, journey reliability and safety on these corridors compared to a 'without project' scenario. The project would also provide additional route options along the corridor and therefore increase network resilience in the event of accidents or network disturbances.

Forecasts indicate the project has the impact of significantly reducing heavy vehicle volumes on key north-south road links between Arncliffe and Kogarah. While the pattern of reduction forecast for heavy vehicle traffic is similar to those forecast for all vehicles, the percentage reduction on surface roads is much larger than for all vehicles. With the project, heavy vehicle volumes are forecast to drop by more than 40 per cent on the Princes Highway and more than 30 per cent on General Holmes Drive in 2026 and 2036.

With the project, average travel times in the peak directions in 2036 peak periods are forecast to reduce:

- 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, Parramatta, the Sydney CBD or 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.

President Avenue intersection and surrounds

The wider road network is forecast to perform slighter better with the project than without the project in 2026 and 2036 with improved average travel speeds, as traffic reassigns to use the new motorway. The President Avenue corridor is forecast to perform slightly worse with the project as a new intersection is introduced and traffic reassigns to access the project.

Intersections are generally forecast to experience improved or 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 an increase in demand to the project forecast to use 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.

Daily traffic on the roads around the President Avenue intersection and surrounds is forecast to decrease overall in the 'do something' scenario compared to the 'do minimum' scenario, with the most significant decreases in traffic forecast on The Grand Parade / General Holmes Drive, West Botany Street and Marsh Street / Airport Drive. There is a forecast overall decrease in the number and cost of traffic crashes on the roads around the President Avenue intersection and surrounds of just under five per cent.

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. Overall bus travel times along the entire length of the bus routes are forecast to improve.

St Peters interchange and surrounds

The analysis has identified that the project is forecast to have a minimal impact on the St Peters interchange and surrounds road network in 2026. By 2036, while the surface road network is not significantly impacted by the project, significant queuing is forecast on the exit ramp from the F6/New M5 and the M4-M5 Link to the Campbell Road / Euston Road intersection in the AM peak hour, which may queue back to the New M5 mainline motorway.

Intersections are generally forecast to experience similar levels of service compared with the 'do minimum' scenario in the 2026 and 2036 PM peak hours. In the 2036 AM peak hour, queuing on the exit ramp approach to the Campbell Road / Euston Road intersection from the F6/New M5 Motorway causes increased forecast delay at this intersection. As a result, vehicles are likely to divert to the Gardeners Road exit ramp, which impacts the intersections on Gardeners Road.

Daily traffic on the roads around the President Avenue intersection and surrounds is forecast to remain similar in the 'do something' scenario compared to the 'do minimum' scenario. Small increases on certain roads and decreases on others, 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.

There is minimal difference in bus travel times forecast between the 'do minimum' and 'do something' scenarios in either the AM or PM peak hours for the St Peters interchange modelled road network.

Management of impacts – operational

President Avenue intersection and surrounds

The analysis has identified that the wider road network is forecast to perform slighter better with the project than without the project in 2026 and 2036, as traffic reassigns to use the new motorway. Some intersections are forecast to deteriorate compared to the 'do minimum' scenarios, mainly focused on the President Avenue corridor, though these intersection levels of service are forecast to be LoS D or better.

While the President Avenue / O'Connell Street intersection performance is forecast to be acceptable, more traffic is forecast to use O'Connell Street, which is an unclassified regional road. Roads and Maritime would develop a strategy in consultation with Council to minimise the impacts of the project on O'Connell Street, which may involve Local Area Traffic Management measures.

Roads and Maritime will undertake a review of network performance, in consultation with Transport for NSW and Council, to confirm the operational traffic impacts of the project on the President Avenue corridor and the surrounding arterial roads and major intersections at both 12 months and at five years after the commencement of operation of the project. The assessment will be based on updated traffic surveys at the time and the methodology used will be comparable with that used in this assessment. These reviews would examine potential management measures, following the collection of data that would facilitate a clearer understanding of actual project impacts.

St Peters interchange and surrounds

The analysis has identified that the project is forecast to have a minimal impact on the St Peters interchange and surrounds road network in 2026. By 2036, significant queuing is forecast on the exit ramp from the F6/New M5 and the M4-M5 Link to the Campbell Road / Euston Road intersection in the AM peak hour, which may queue back to the New M5 mainline motorway.

Any mitigation measures would be developed in consultation with WestConnex and it is expected that 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 data of the operational traffic impacts of these projects on the surrounding arterial roads and major intersections. 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 and would confirm if the forecast traffic conditions are eventuating or not.

Construction traffic assessment

The majority of the project footprint is located underground within the mainline tunnels. However, surface areas would be required to support tunnelling activities, construction of the tunnel portal, the President Avenue intersection, other surface roadworks, ventilation facilities, tunnel support facilities and other ancillary operations buildings and facilities.

Construction of the project is expected to occur over a period of around four years. Based on the indicative construction program, 2021 was used as the assessment year for construction impacts, as this is when peak construction traffic volumes are expected. Heavy vehicles would be required to deliver and remove construction plant, equipment and materials as well as remove spoil and waste from the construction sites. Wherever possible, access to construction ancillary facilities is proposed to be gained directly from major arterial roads. Some use of local roads by heavy vehicles delivering materials and/or equipment may also be required, however this would be minimised as far as practicable. Additionally, construction would result in increased use of light vehicles on the surrounding road network associated with the construction workforce, including shift workers for tunnelling activities.

While construction traffic would impact on the operation of the road network surrounding the construction facilities, the analysis indicates that the intersection levels of service are forecast to generally not be significantly impacted, with the exception of the Marsh Street / M5 East ramps. This is due to the access to and from the M5 East Motorway being the key routes for construction traffic. The Marsh Street / M5 East ramps intersection is still forecast to operate at a LoS D in the 'with construction' scenario. Impacts due to temporary lane closures and speed reductions, particularly during traffic staging, would also occur. A Construction Traffic and Access Management Plan (CTAMP) will be prepared and implemented, which will detail construction traffic management and mitigation measures that will assist in minimising disruption to road users.

As the volume of traffic generated by construction is expected to be relatively low compared to existing traffic, the effects of this relatively short-term increase on the existing road network is not expected to significantly impact road safety in the study area, though there is a risk with construction traffic interacting with general traffic.

Management of impacts – construction

Prior to the commencement of construction of the project, a CTAMP would be prepared as part of the Construction Environmental Management Plan. The CTAMP would include the guidelines, general requirements and principles of traffic management to be implemented during construction. It would be prepared in accordance with Austroads *Guide to Road Design* (with appropriate Roads and Maritime supplements), the RTA *Traffic Control at Work Sites* manual and AS1742.3: *Manual of uniform traffic control devices – Part 3:Traffic control for works on roads*, and any other relevant standard, guide or manual. It would seek to minimise delays and disruptions, and identify and respond to any changes in road safety as a result of construction works.

Specifically, the CTAMP would include a detailed travel management strategy for construction staff at the various worksites, in consultation with local councils and stakeholders associated with any facilities adjacent to the project site. This strategy would include the promotion of public transport and carpooling to reduce worksite-related vehicle movements, and also investigate feasible options for the provision of vehicle parking strategies to reduce parking on local roads. In addition to development of CTAMP, mitigation strategies would be implemented to manage and control construction traffic, where reasonably practical.

1 Introduction

1.1 Overview of the project

Key components of the project would include:

- An underground connection to the existing stub tunnels at the New M5 Motorway at Arncliffe
- Twin motorway tunnels (around four kilometres in length) between the New M5 Motorway at Arncliffe and President Avenue, Kogarah
- A tunnel portal and entry and exit ramps connecting the tunnels to a surface intersection with President Avenue
- Intersection improvements at the President Avenue / Princes Highway intersection
- Mainline tunnel stubs to allow for connections to future stages of the F6 Extension
- Shared pedestrian and cycle pathways connecting Bestic Street, Rockdale to Civic Avenue, Kogarah via Rockdale Bicentennial Park (including an on-road cycleway)
- An Operational Motorway Control Centre to be located off West Botany Street, Rockdale
- Ancillary infrastructure and operational facilities for signage (including electronic signage), ventilation structures and systems at Rockdale, fire and safety systems, and emergency evacuation and smoke extraction infrastructure
- A proposed permanent power supply connection from the Ausgrid Canterbury subtransmission substation
- Temporary construction ancillary facilities and temporary works to facilitate the construction of the project.

Once complete, the F6 Extension Stage 1 would improve connections and travel times between Sydney and the Princes Highway and enhance connections for residents and businesses within the broader regional area as well as promote and support economic development in areas to the south, such as Sutherland and the Illawarra.

Approval for the project is being sought under Part 5, Division 5.2 of the EP&A Act. Future stages of the F6 Extension would be subject to separate planning applications and assessments would be undertaken accordingly. The configuration and design of the project will be further developed to take into consideration the outcomes of community and stakeholder engagement.

1.2 Project location

This project would be generally located within the Bayside local government area. The project commences about eight kilometres south west of the Sydney central business district (CBD). The proposed President Avenue intersection would be located about 11 kilometres south east of the Sydney CBD.

1.3 Study area

The study area for the traffic and transport assessment broadly encompasses an area extending from St Peters in the north to Kogarah in the south, as shown in **Figure 1-2**. It is predominantly focused on the corridor between St Peters and Kogarah, as well as the surface road networks around the President Avenue and St Peters interchanges. The extent of the study area, and the areas requiring operational modelling assessment, was 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 encompassed roads where the change in traffic volumes would likely cause a significant operational impact in the AM and PM peak periods. 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**.

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 assessed through a screenline analysis, which is presented in **Chapter 9**.

1.4 Purpose of this report

The purpose of this traffic and transport assessment is to provide pertinent technical information and analysis to support the EIS for the project by assessing and reporting existing and forecast future traffic and transport conditions. Specifically, this assessment includes:

- Review of existing traffic conditions, including a description of transport infrastructure in the study area, daily and peak hour traffic patterns, details of public transport frequency and mode share, and a review of active transport (pedestrian and cycle) networks
- Analysis of existing and future year intersection and roadway traffic volumes using outputs from the SMPM, with a particular focus on the project area between St Peters and Kogarah; including the forecast transfer of fixed and induced travel demand to the project from alternative transport corridors
- A construction traffic assessment of construction-related vehicles travelling on strategic and local roads that would provide access to the construction ancillary facilities
- Reporting on the operational performance of the existing and future road network around the St Peters interchange and the President Avenue intersection, as well as the F6 Extension Stage 1 (New M5 Motorway at Arncliffe to President Avenue at Kogarah) in-tunnel traffic performance, during the AM and PM peak hours
- Analysis of crash data, consideration of the project's effect on forecast travel speeds and travel times and a review of opportunities to enhance public transport networks within the project area
- Recommendations to mitigate and manage any identified traffic and transport impacts of the project with the potential to occur during construction and operation.

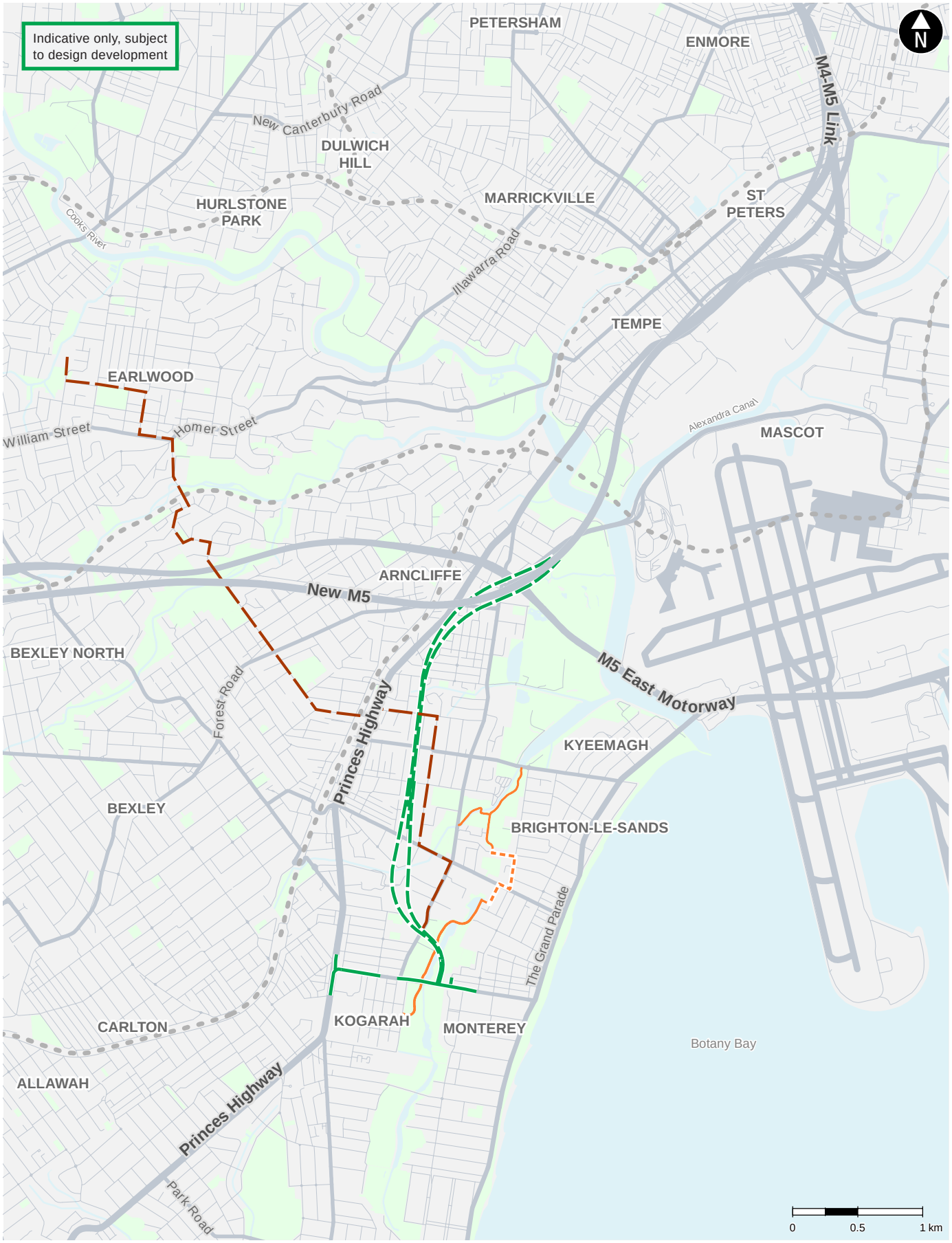


Figure 1-1 F6 Extension Stage 1 overview and project location

LEGEND

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

Figure 1-2 Study area for the traffic and transport assessment

1.5 Assessment requirements

In preparing this technical report, the Secretary's Environmental Assessment Requirements (SEARs), issued for the F6 Extension Stage 1 (New M5 Motorway at Arncliffe to President Avenue at Kogarah) project (SSI 8931) on 23 January 2018, have been addressed. The key matters raised by the SEARs for consideration in the traffic and transport assessment and where this technical report addresses these matters are outlined in **Table 1-1**.

Table 1-1 SEARs – Traffic and Transport

Assessment requirements	Where addressed in this report
1) The Proponent must assess construction transport and traffic (network, vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	Chapter 7
(a) a considered approach to route identification, including for spoil haulage, and scheduling of transport movements, particularly outside standard construction hours	Construction access and spoil haulage routes are described in section 7.3
(b) the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements);	Potential impacts from construction vehicle movements are assessed in section 7.3
(c) construction worker parking;	Potential impacts from construction worker parking are assessed in section 7.3
(d) 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);	Background traffic volumes are outlined in section 7.4 and section 7.5
(e) access constraints and impacts on public transport, pedestrians and cyclists;	Potential construction impacts to access, public transport, pedestrians and cyclists are assessed in section 7.4 and section 7.5
(f) 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;	Temporary closures and diversion during construction are described in section 7.4
(g) details on construction scheduling and management to maintain traffic capacity along President Avenue and sports field parking during construction.	Details regarding construction traffic management are provided in section 7.3
(h) 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;	Potential cumulative construction traffic impacts are assessed in section 7.5
(i) 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	Spoil haulage is discussed in section 7.3
(j) 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, Rockdale Bicentennial Park East, Ilinden Sports Centre, Scarborough Park north, Barton Park and the Kogarah Golf Course.	Potential risks to public safety are assessed in section 7.4
2) The Proponent must assess and model the operational transport impacts of the project including, but not necessarily limited to:	

Assessment requirements	Where addressed in this report
(a) forecast travel demand and traffic volumes (expressed in terms of total numbers and heavy and light vehicle numbers) for the project and the surrounding road, cycle and public transport networks; including potential shifts of traffic movements on alternate routes inside and outside the proposal area and impact of any permanent road closures directly attributable to the SSI;	Forecast travel demand volumes for the project are provided in Chapter 9, Chapter 10 and Annexure D.
(b) impacts on access to and parking for commercial centres and health and education facilities within the vicinity of the project;	Potential operational parking and access impacts are assessed in section 10.3 and section 10.4
(c) travel time analysis;	Travel time analysis is provided in section 10.1, section 10.3, section 10.4, section 12.2, section 12.4 and section 12.5
(d) performance of key interchanges and intersections by undertaking a level of service analysis at key locations;	Levels of service for key interchanges and intersections are provided in section 10.3, section 10.4, section 12.4 and section 12.5
(e) wider transport interactions (local and regional roads, cycling, public and freight transport);	Wider transport interactions are assessed in section 3.4, section 10.1, section 10.4, section 12.2 and section 12.5.
(f) induced traffic and operational implications for existing and proposed public transport (particularly with respect to strategic bus corridors and bus routes and permanent closure/relocation of bus stops) and consideration of opportunities to improve public transport;	Induced traffic and operational implications for existing and proposed public transport is considered in section 10.3, section 10.4, section 12.4 and section 12.5.
(g) impacts on cyclists and pedestrian access and safety;	Potential impacts on cyclist and pedestrian access and safety are assessed in section 10.3, section 10.4, section 12.4 and section 12.5
(h) opportunities for active transport, including new and integrated cycling and pedestrian elements connecting to surrounding networks;	Opportunities for active transport are outlined in section 10.4 and section 12.5
(i) property and business access and on street parking; and	Potential impacts to property and business impacts are assessed in section 10.3 and section 10.4
(j) an explanation for the scope of the modelled area, including justification of the nominated boundaries.	The scope of the modelled area is explained in section1.3, section 1.5 and Annexure B
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, and other relevant motorway projects.	An operational transport impact assessment is provided in Chapter 10 and Chapter 12 and considers potential impacts in isolation and as part of cumulative impacts with other relevant motorway projects.

1.6 Structure of this report

This report has been structured as follows:

- **Chapter 2** presents an overview of the project
- **Chapter 3** provides an appreciation of the strategic transport context of the project
- **Chapter 4** documents the traffic modelling approach adopted to assess construction and operational impacts
- **Chapter 5** provides an overview of the existing traffic and transport conditions, including details of public transport frequency and patronage and a summary of daily and peak hour traffic patterns
- **Chapter 6** outlines the operational performance of the existing road network in terms of network performance and intersection levels of service, travel times and crashes
- **Chapter 7** documents the impact assessment undertaken for the construction scenarios
- **Chapter 8** provides details of future traffic and transport operational conditions without the project
- **Chapter 9** presents a strategic assessment of future daily and peak hour traffic volumes and patterns with the project
- **Chapter 10** documents the impact assessment undertaken for peak hour operational scenarios with the project
- **Chapter 11** documents management measures that are proposed to mitigate the traffic and transport impacts of the project
- **Chapter 12** documents the impact assessment undertaken for the cumulative peak hour operational scenarios
- **Chapter 13** provides a conclusion to the traffic and transport assessment.

2 The Project

2.1 Project features

The project would comprise a new multi-lane road between the New M5 Motorway at Arncliffe and President Avenue at Kogarah.

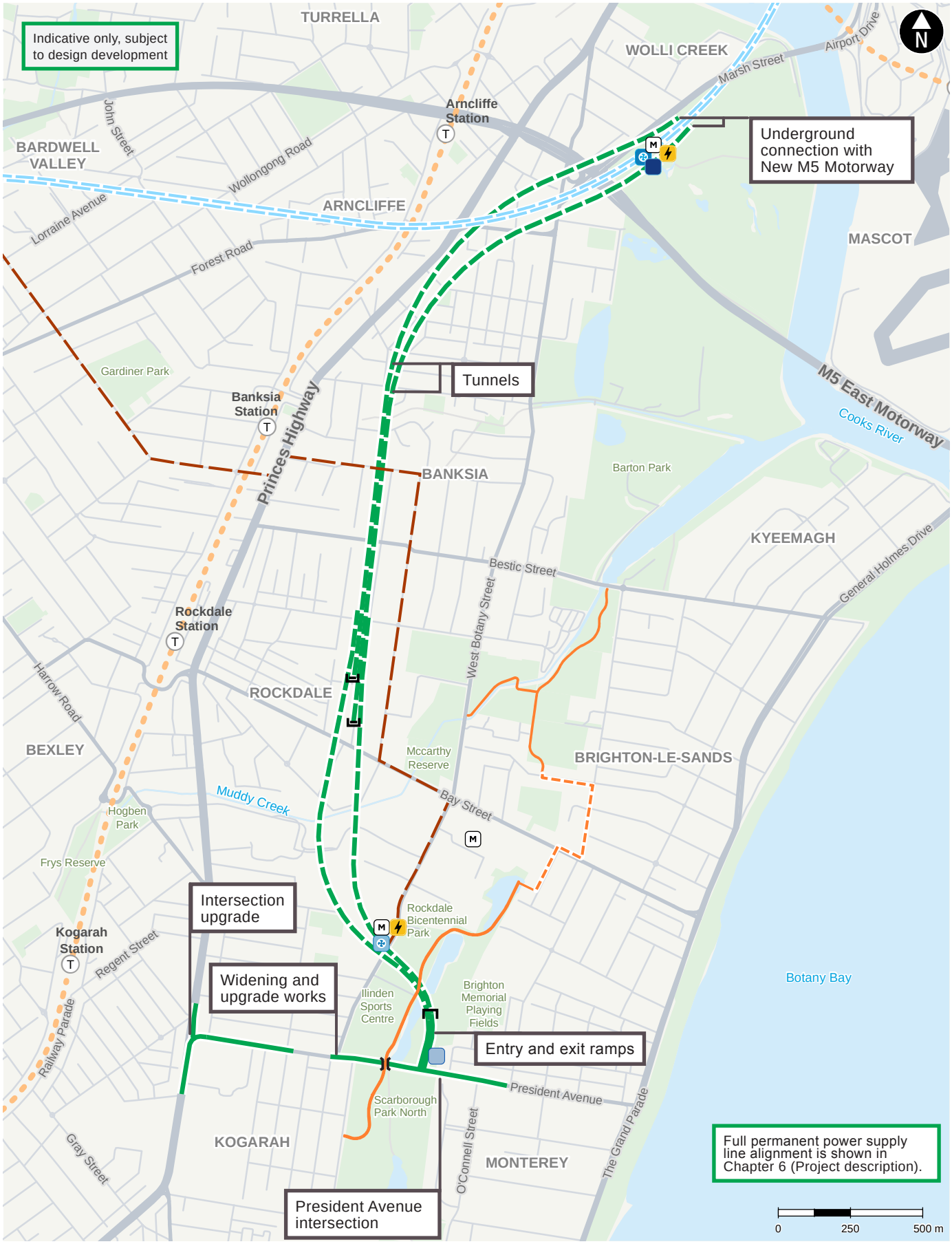
Key components of the project would include:

- Twin mainline tunnels. Each mainline tunnel would be around 2.5 kilometres in length, sized for three lanes of traffic, and line marked for two lanes as part of the project
- A tunnel-to-tunnel connection to the New M5 Motorway southern extension stub tunnels, including line marking of the New M5 Motorway tunnels from the stub tunnels to St Peters interchange
- Entry and exit ramp tunnels about 1.5 kilometres long (making the tunnel four kilometres in length overall) and a tunnel portal connecting the mainline tunnels to the President Avenue intersection
- An intersection with President Avenue including entry and exit ramps and the widening and raising of President Avenue
- Upgrade of the President Avenue / Princes Highway intersection to improve intersection capacity
- Shared cycle and pedestrian pathways connecting Bestic Street, Brighton-Le-Sands to Civic Avenue, Kogarah (including an on-road cycleways)
- Three motorway operation complexes:
    - Arncliffe, including a water treatment plant, substation and fitout (mechanical and electrical) of a ventilation facility currently being constructed as part of the New M5 Motorway project
    - Rockdale (north), including a motorway control centre, deluge tanks, a workshop and an office
    - Rockdale (south), including a ventilation facility, substation and power supply.
- Reinstatement of Bicentennial Park and recreational facilities
- In-tunnel ventilation systems including jet fans and ventilation ducts connecting to the ventilation facilities
- Drainage infrastructure to collect surface water and groundwater inflows for treatment
- Ancillary infrastructure for electronic tolling, traffic control and signage (both static and electronic signage)
- Emergency access and evacuation facilities (including pedestrian and vehicular cross and long passages); and fire and life safety systems
- New service utilities, and modifications and connections to existing service utilities
- A proposed permanent power supply connection from the Ausgrid Canterbury subtransmission substation, to Rockdale Motorway Operations Complex south. 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.

The project will include a toll for use of the F6 Extension Stage 1 between Arncliffe and Kogarah and for use of WestConnex and the Sydney Gateway.

The project does not include ongoing motorway maintenance activities during operation or future upgrades to other intersections in the vicinity during operation. These works are permitted under separate existing approvals and / or are subject to separate assessment and approval.

The key features of the project are shown on **Figure 2-1**.



LEGEND

- The project in tunnel
- The project on surface
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Tunnel stub
- Tunnel portal
- Water quality basin
- Water treatment facility
- Rockdale ventilation facility
- Motorway operations complex
- Substation
- Permanent power supply line
- New M5 Tunnel
- Arncliffe ventilation facility*
- * Under construction as part of the New M5 Motorway project
- Road
- Waterway
- Railway line
- Railway station
- Parks and recreation

Figure 2-1 Project features

2.2 Construction

2.2.1 Construction activities

The proposed construction activities for the project would include:

- Preparatory investigations
- Site establishment and enabling work
- Tunnelling
- Surface earthworks and structures
- Construction of motorway operations complexes
- Drainage and construction of operational water management infrastructure
- Construction of the permanent power supply connection
- Road pavement works
- Finishing works.

These activities would generally be undertaken within the following construction ancillary facilities:

- Arncliffe construction ancillary facility (C1) at Arncliffe, within the Kogarah Golf Course currently being used for the construction of the New M5 Motorway
- Rockdale construction ancillary facility (C2) at Rockdale, within a Roads and Maritime depot at West Botany Street
- President Avenue construction ancillary facility (C3) at Rockdale, north and south of President Avenue within Rockdale Bicentennial Park and part of Scarborough Park North, and a site west of West Botany Street
- Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) at Brighton-le-Sands, within the recreation area between West Botany Street and Francis Avenue, near Muddy Creek
- Princes Highway construction ancillary facility (C6), on the north-east corner of the President Avenue and Princes Highway intersection.

2.2.2 Construction boundary

The area required for project construction is referred to as the 'construction boundary'. This comprises the surface construction works area, and construction ancillary facilities (refer to **Figure 2-2**). Utility works to support the project would occur within and outside the construction boundary (refer to **Chapter 7** (Construction) of the EIS).

In addition to these works, the underground construction boundary (including mainline tunnel construction and temporary access tunnels) is also shown on **Figure 2-2**.

C1

- Tunnelling and spoil handling
- Construction of MOC1 (Water treatment plant, substation)
- Fitout, testing and commissioning of tunnels and MOC 1

C2

- Construction of the decline tunnel
- Tunnelling and spoil handling
- Pavement works for internal access road
- Construction of MOC2
- Reconfiguration of the site to enable ongoing/future use for maintenance activities

C3

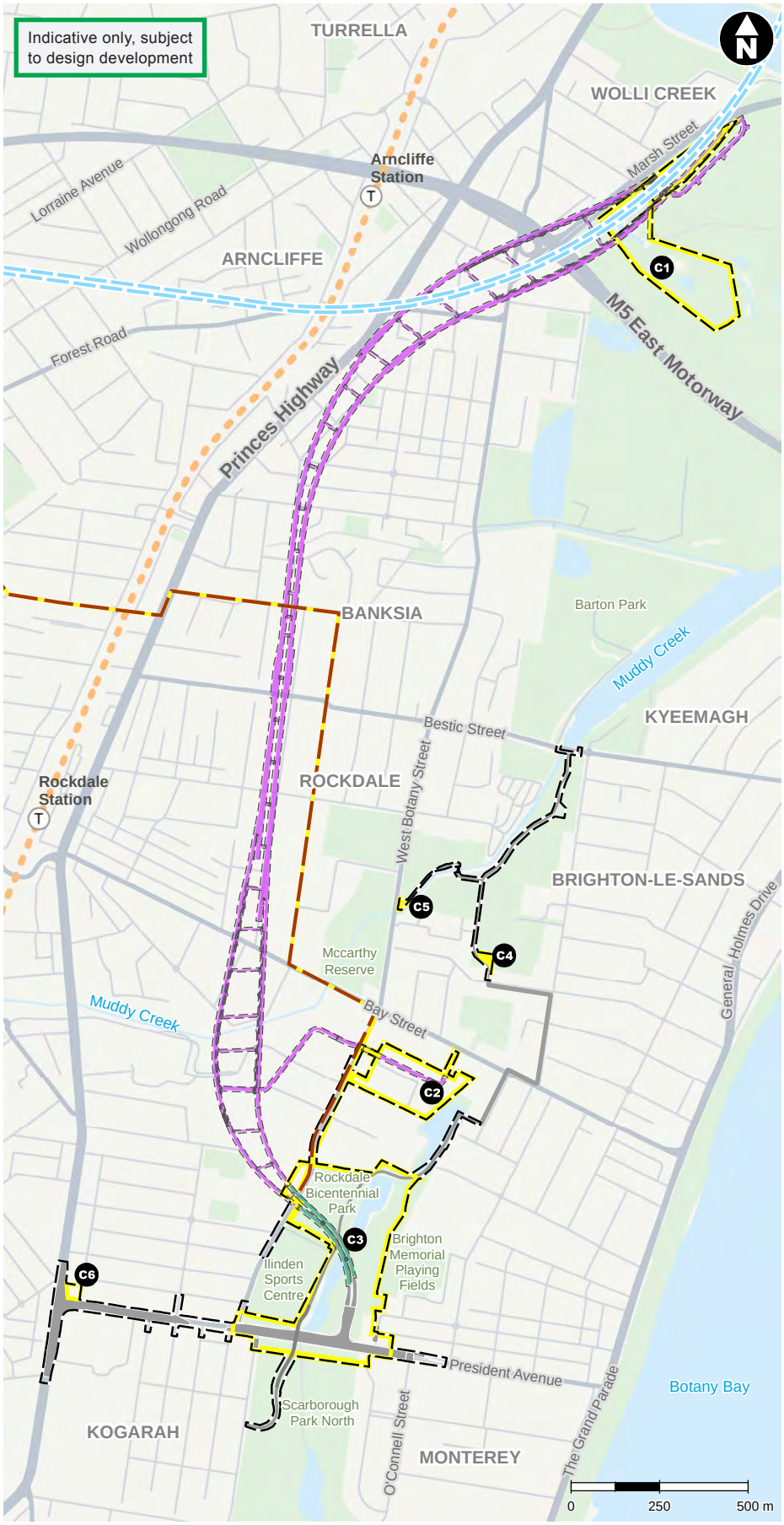
- Demolition of buildings and vegetation clearing and removal
- Relocation of utilities
- Temporary stockpiling of spoil and fill materials
- Management of any contaminated land, including acid sulphate soils
- Construction of cut-and-cover structures
- Construction of MOC3 (Rockdale ventilation facility and substation)
- President Avenue intersection upgrade works
- Construction of shared pedestrian and cyclist path and overpass

C4/C5

- Site establishment
- Vegetation clearing and removal, topsoil stripping areas and land-form shaping
- Temporary stockpiling of materials
- Construction of the shared pedestrian and cyclist path
- Finishing works including lighting, line marking and signage installation

C6

- Property adjustment and demolition
- Relocation of utilities, stormwater infrastructure, underground storage tanks and substation
- Laydown and parking of construction vehicles and equipment
- Reinstatement of site



LEGEND

- Surface works
- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- Permanent power supply line
- Permanent power supply construction route
- New M5 Tunnel
- Road
- Waterway
- Railway line
- Railway station
- Parks and recreation

Figure 2-2 Overview of construction boundary and construction ancillary facilities

2.2.3 Construction program

The project would be constructed over a period expected to be around four years, including commissioning, which would occur concurrently with the final stages of construction (refer to **Figure 2-3**). The project is expected to be completed towards the end of 2024.

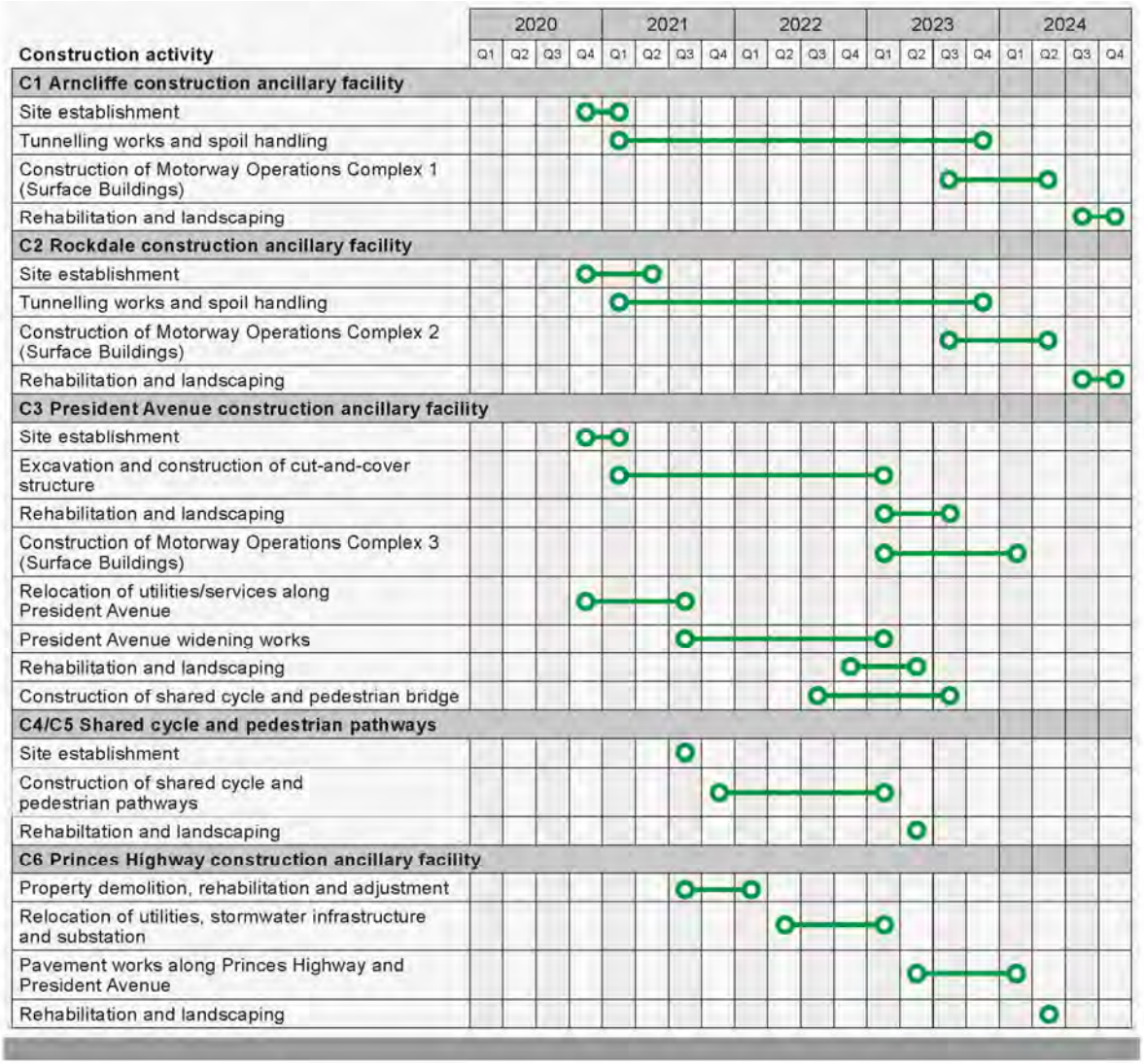


Figure 2-3 Indicative construction program

3 Strategic transport context

3.1 Appreciation of the strategic context

The traffic and transport assessment methodology was developed with consideration of relevant strategic planning and transport policies to provide a firm understanding of the overarching issues and objectives of the project.

Investment in transport infrastructure that improves road travel reliability is a NSW Government State Priority and essential to sustaining economic growth and prosperity by reducing travel times, boosting productivity and reducing business costs. The Greater Sydney Region Plan (Greater Sydney Commission 2017a) indicates that by 2036, Greater Sydney's population is forecast to increase from 4.7 to 6.4 million, which equates to an average of about 90,000 additional residents per year. Moreover, by 2036, the number of trips made across Greater Sydney each day is forecast to increase to 22 million trips, up 40 per cent compared to 2016.

This growth will put increasing pressure on the NSW transport network and particularly the strategic transport corridors, which support the movement of people and goods connecting major centres or trip generators across the greater Sydney metropolitan area, shown in **Figure 3-1**.

Figure 3-1 Greater Sydney strategic transport corridors

Source: *Greater Sydney Services and Infrastructure Plan* (Transport for NSW 2017)

A large number of the strategic transport corridors are serviced by the Greater Sydney strategic road network, which supports key road movements made by public transport, private vehicles and freight. The Greater Sydney strategic road network is shown in **Figure 3-2.**

Each of the strategic road corridors accommodates high levels of daily demand and the majority of trips using the corridors experience congestion, delay and occasional traffic incidents, with these corridors put under strain during the busy weekday and weekend peak periods. Transport improvements including new capacity, improved services and a future-ready transport network will support movements on this strategic road network and alleviate pressure on local roads, providing an improved user experience for local road users. The project area forms part of the strategic road corridor between the Sydney CBD and the south (to Kogarah and beyond to Wollongong). There is currently no motorway grade link in this corridor, which means that vehicles travelling between the Sydney motorway network and the existing M1 Princes Motorway south of Waterfall are required to use the arterial road network, resulting in traffic congestion and delayed travel times.

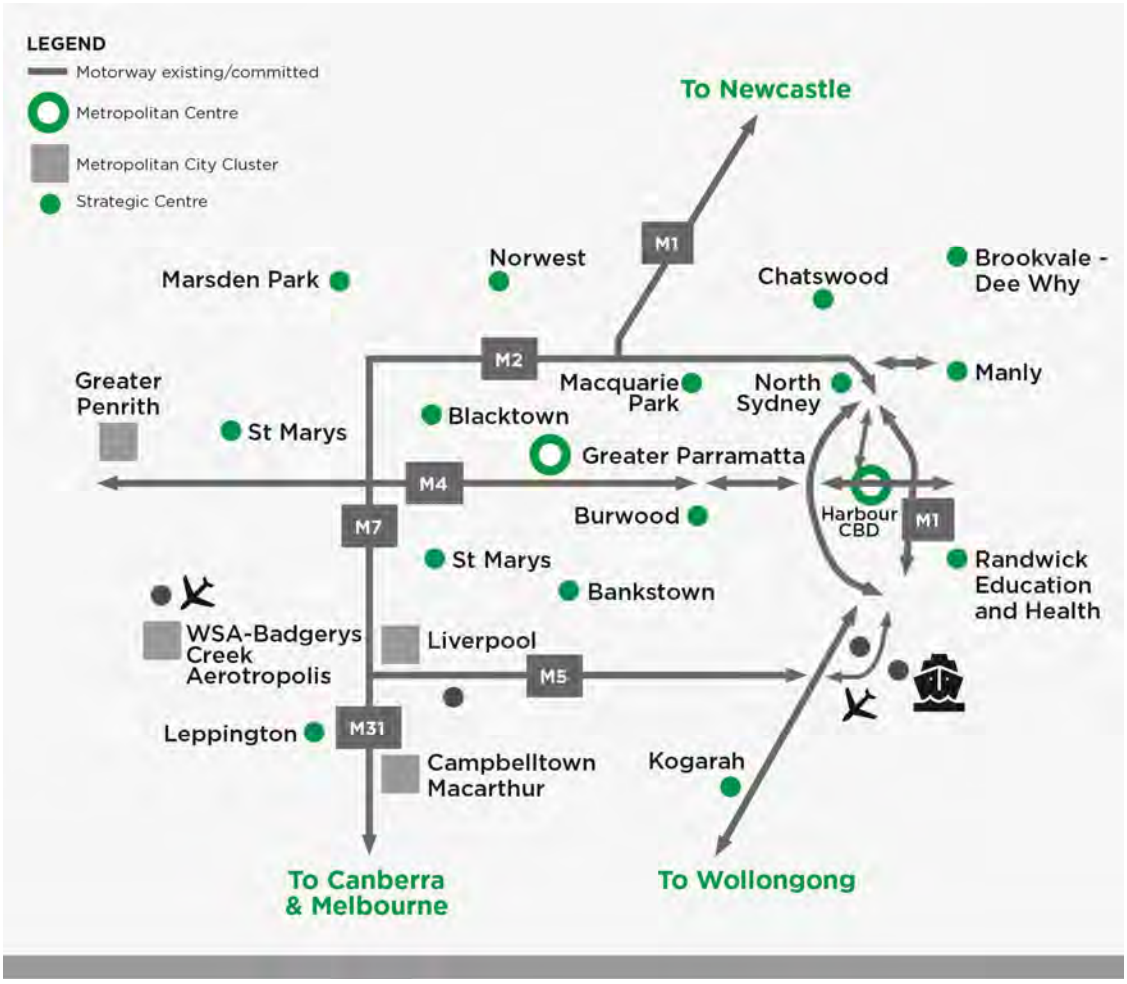


Figure 3-2 Greater Sydney strategic road network 2017 (existing and committed)

Source: *Greater Sydney Region Plan* (Greater Sydney Commission 2017)

The traffic and transport study area contains several major transport corridors and infrastructure, including the Princes Highway, General Holmes Drive and The Grand Parade, the M5 Motorway, the Sydney Trains suburban railway network, freight rail and road access to Port Botany, and Sydney Airport. The Princes Highway between President Avenue and the M5 East is identified as a secondary road freight route. General Holmes Drive and The Grand Parade between the M5 East and President Avenue, form part of a tertiary road freight route. Both these routes connect Sydney to the Sutherland Shire to the south, and beyond to the Illawarra.

3.2 Sydney metropolitan transport movement – general traffic and transport

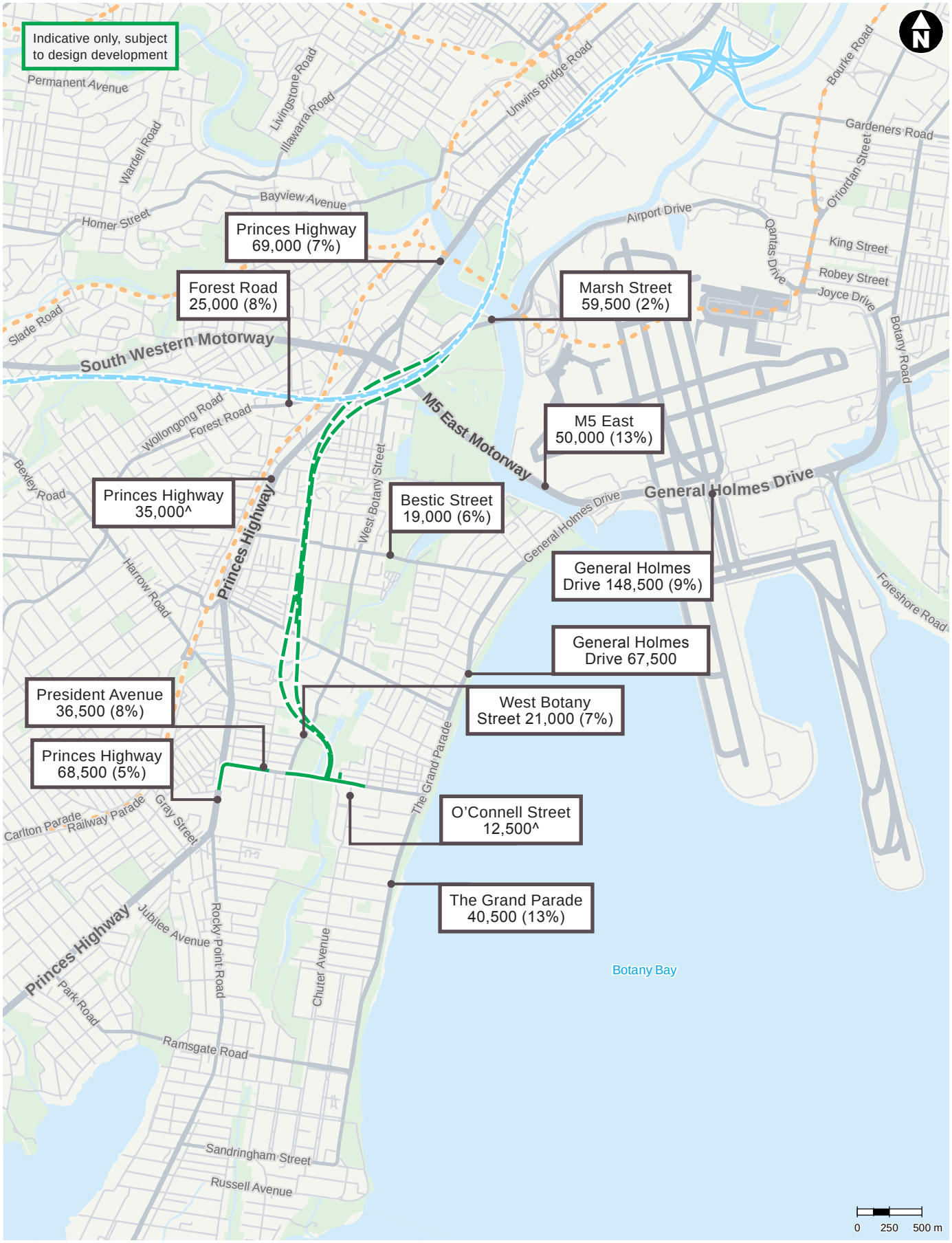
In 2016, just over one million trips (car, bus, rail and walk/cycle) were made to, from and within the study area. Moreover, by 2036, this is forecast to increase to about 1.5 million trips, up 47 per cent compared to 2016[1].

The project would provide a motorway grade connection that is currently performed by arterial roads (namely Princes Highway, General Holmes Drive and The Grand Parade, and West Botany Street) and lower-order roads, which are nearing capacity as ongoing development and population growth places additional pressure on the road network. The project would also provide for network redundancy by providing for an alternative route and improved network management in the event of an incident on the surface road network.

Average weekday traffic (AWT) volumes on strategic roads in the vicinity of the project in the base case are shown in **Figure 3-3**. Observations on the traffic movements along these strategic roads are:

- South of President Avenue, north-south traffic movements are focused on the Princes Highway and The Grand Parade
- Between President Avenue and M5 East Motorway, the key north-south road links include the Princes Highway, West Botany Street, and General Holmes Drive. General Holmes Drive is the most heavily used, carrying more than double the amount of traffic that the corresponding location on Princes Highway carries, due to the access provided to Southern Cross Drive and the Sydney Airport / Port Botany precinct
- This pattern is replicated north of the M5 East Motorway, with General Holmes Drive carrying more than twice the volume of traffic carried by the Princes Highway at a similar location.

[1] Transport Performance and Analytics (TPA) STM, 2018



LEGEND

- The project in tunnel
- The project on surface
- New M5 surface road
- New M5 tunnel
- Road
- Waterway
- Railway line
- Parks and recreation
- Average Weekday Daily Traffic (HV%)

Figure 3-3 Average weekday traffic (AWT) volumes on strategic roads

3.3 Sydney metropolitan transport movement – freight traffic

The NSW freight network consists of a system of rail lines, roads, ports, Sydney Airport and regional airports, and intermodal terminals. The Greater Sydney strategic freight network, including infrastructure that exists or has been identified as a committed initiative for the next ten years, is shown in **Figure 3-4**.

Figure 3-4 Greater Sydney strategic freight network – committed (0-10 years)

Source: *Greater Sydney Services and Infrastructure Plan* (Transport for NSW 2012)

The *NSW Draft Freight and Ports Plan* (Transport for NSW 2017) states that the volume of freight in Greater Sydney is expected to almost double over the next 40 years. This forecast growth has implications for the capacity of the existing road network, with increased heavy vehicle volumes. As identified in **section 3.1**, there is currently no motorway link connecting the Sydney motorway network and the M1 Princes Motorway, south of Waterfall, and vehicles, including freight vehicles, are currently required to use the arterial road network.

To deliver a freight network that supports the projected growth of the NSW economy, one of the Priority Action Areas in the *Draft Freight and Ports Plan* is Action 4.2*: Increase access for freight across the road and rail network*, with a task to meet the growth in freight demand via '*increased safe access to both the road and rail network between key freight facilities, gateways and corridors*'[2].

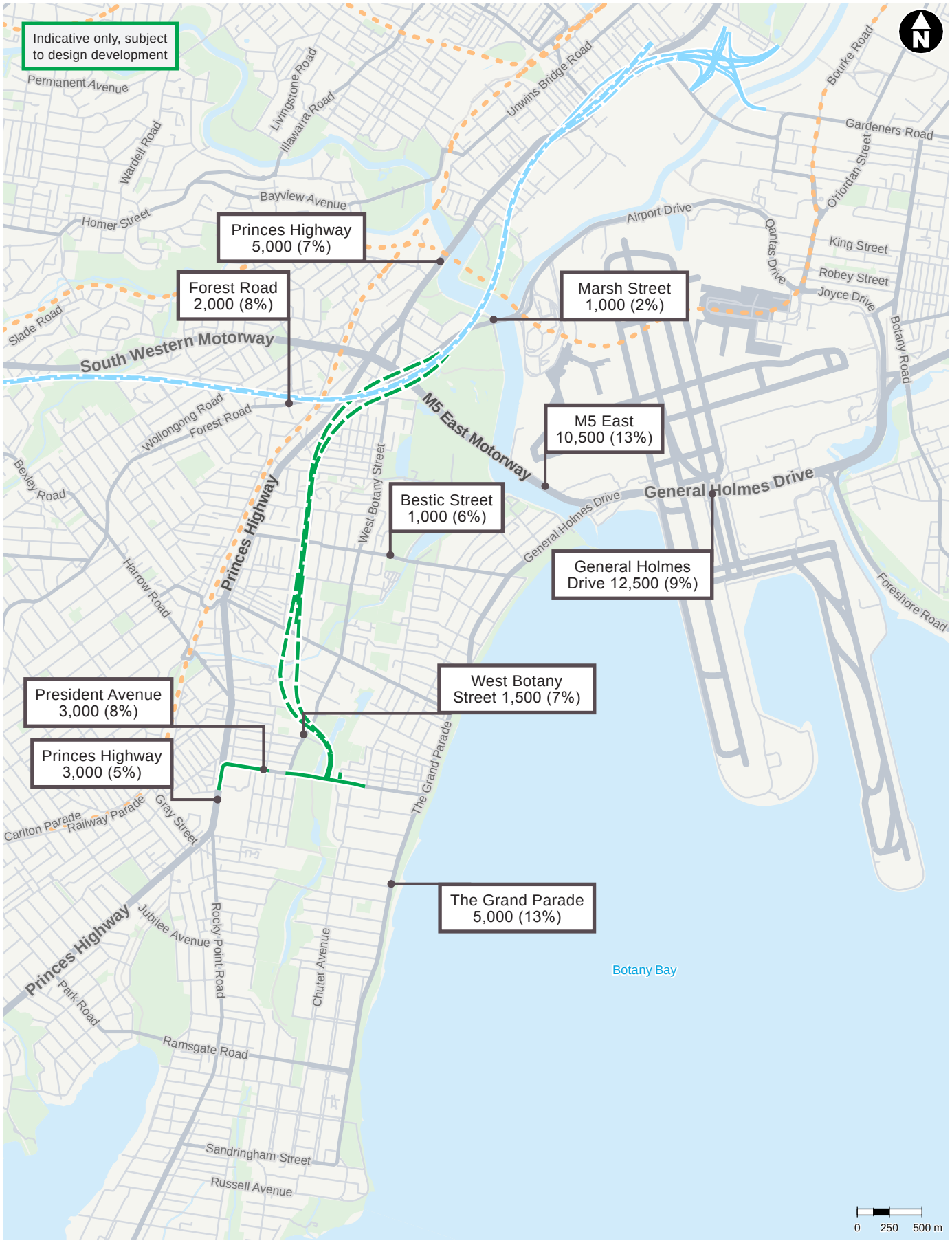
[2] Transport for NSW, *Draft Freight and Ports Plan*, 2017

The F6 Extension Stage 1 is included in a list of committed Greater Sydney initiatives for the next ten years in the *Draft Greater Sydney Services and Infrastructure Plan*. The NSW Ports' 30 Year Master Plan (NSW Ports, 2015), identifies the full F6 Extension as a required action to support efficient connections to Port Kembla, which contributes $760 million annually to NSW's Gross State Product and generates 5,200 jobs. Port Kembla is planned to act as a progressive overflow facility for Port Botany once Port Botany's operational capacity has been reached. This is expected to occur after 2040.

Average weekday heavy vehicle volumes on strategic roads in the vicinity of the project are shown on **Figure 3-5**.

South of President Avenue, north-south heavy traffic movements are more focused on The Grand Parade than the Princes Highway. The Grand Parade carries less total vehicle traffic than the Princes Highway at this location, connects to Captain Cook Bridge (via Sandringham Street and Rocky Point Road) and the industrial areas of Sutherland to the south and provides access to General Holmes Drive and the Sydney Airport / Port Botany precinct to the north.

This is also reflected in General Holmes Drive, at the Airport Tunnel, carrying more than twice the number of vehicles as the Princes Highway, north of the M5 East Motorway. It has a slightly higher proportion of heavy vehicle traffic (nine per cent) compared with seven per cent on the Princes Highway.



LEGEND

- The project in tunnel
- The project on surface
- New M5 surface road
- New M5 tunnel
- Road
- Waterway
- Railway line
- Parks and recreation
- Average Weekday Heavy Vehicle Volumes (HV as a % of total traffic)

Figure 3-5 Average weekday heavy vehicle volumes on strategic roads in the traffic and transport study area

3.4 Transport policy and plans

The following sections describe the consistency of the project with relevant Australian Government and NSW Government policies and plans. The project would meet the NSW Government's commitment to deliver the first stage of the F6 Extension, which is identified in the *Future Transport Strategy 2056* (NSW Government 2017) as a committed initiative – subject to final business case and funding – within the next 0-10 years. The strategy notes that the share of trips by public transport, and the share of freight moved by train, will need to increase to enable efficient and reliable journeys. However, the strategy also confirms roads will continue to have an important role in Greater Sydney, supporting freight, on-road public transport and trips best served by car (i.e. trips to dispersed locations and commercial services such as trades and deliveries).

The project is consistent with recommendations and strategies identified in the *Greater Sydney Region Plan* (Greater Sydney Commission 2017a), draft *NSW Freight and Ports Strategy* (Transport for NSW 2013b), the *South District Plan (*Greater Sydney Commission 2017c) and the *Eastern City District Plan* (Greater Sydney Commission 2017d). The project would contribute to the NSW Government's State Priority of improving road travel reliability by building infrastructure.

The *Greater Sydney Region Plan* (Greater Sydney Commission 2017a) presents a vision for Greater Sydney as a global city; an economic powerhouse; where people live within 30 minutes of their jobs, education and health facilities, services and recreational opportunities as illustrated in **Figure 3-6**. The *Greater Sydney Region Plan* has been prepared in conjunction with the *Future Transport Strategy 2056* (NSW Government, 2017) and provides directions to how the city can grow to be well connected and supported by efficient infrastructure.

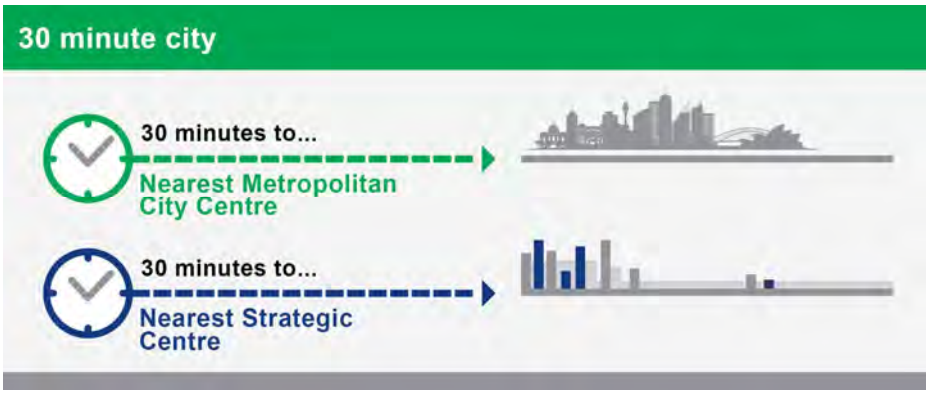


Figure 3-6 The 30-minute city by public transport

The project would support the delivery of these strategic transport and land use objectives as it would:

- Provide a new motorway link from the New M5 Motorway at Arncliffe to President Avenue at Kogarah as the first stage of the F6 Extension, providing a motorway grade connection for a function that is currently performed by arterial roads
- Assist in reducing travel times and improving reliability for bus services, business, personal and freight journeys across the Sydney road network, supporting freight and on-road public transport
- Facilitate a future extension of the F6 to the south thus improving connectivity between the Sydney CBD, Sydney Airport and Port Botany and southern Sydney and the Illawarra region, providing the necessary connectivity and making transport more efficient
- Improve road safety by reducing traffic volumes on Sydney's arterial roads and improving travel time reliability
- Reduce future traffic volumes on the north-south road corridors through Rockdale, Kogarah and Brighton-Le-Sands, including Princes Highway and The Grand Parade
- Improve the journey experience for active transport users in southern Sydney by improving cycling infrastructure near the new motorway corridor
- Attract commercial activity to southern Sydney by improving access between local commercial areas and strategic centres in Greater Sydney
- Facilitate place making at key locations, such as along sections of the Princes Highway, by improving accessibility, reducing traffic volumes and improving amenity.

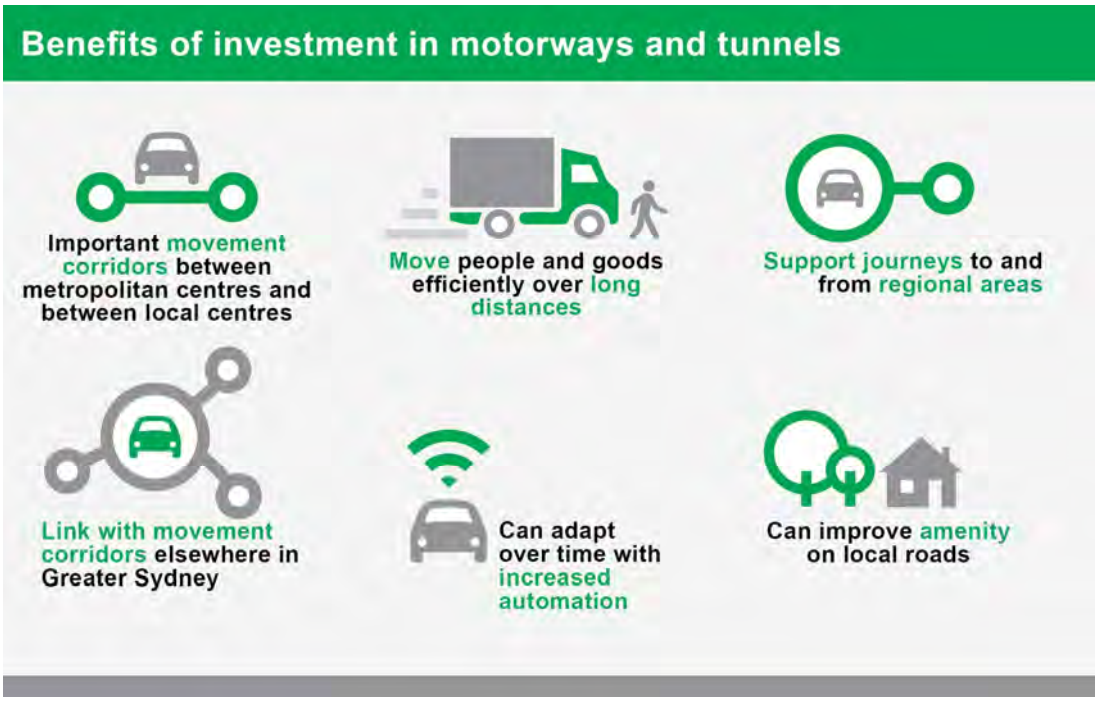


Figure 3-7 Benefits of investment in motorways and tunnels

Investment in the project would also assist in facilitating the delivery of city-shaping improvements, such as those identified in the *Bayside West Precincts (Arncliffe, Banksia and Cooks Cove) Draft Land Use and Infrastructure Strategy*, which would contribute to delivering economic growth. The project would support some of NSW's major sources of economic activity and provide a strategic response to the future transport demand on the already congested road network.

4 Assessment methodology

4.1 Relevant guidelines and policies

The following guidelines were followed in carrying out this assessment:

- *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).

4.2 Methodology – traffic forecasting and modelling process

This section provides an overview of the three stage traffic forecasting and modelling approach that was undertaken for the assessment, as outlined in **Figure 4-1**. The objective was to make best use of available traffic count data and modelling software to determine base and future traffic conditions for the project and surrounding road network in terms of estimating travel demand and traffic volumes. These traffic conditions were then used to assess the operational performance of the network, in scenarios with and without the project. Subsequent sections provide further details of the process and assumptions for each stage of the forecasting and modelling.

4.2.1 Stage 1 – Traffic demand forecasting

The Sydney Strategic Motorway Planning Model (SMPM) version 1, which is developed and operated by Roads and Maritime, provides a platform to understand changes in future weekday travel patterns under different land use, transport infrastructure and pricing scenarios.

Modelling approach

The SMPM was developed in the following stages:

- A review of the available transport planning models and data was undertaken to determine the optimal models and data to provide an appropriate foundation for the SMPM
- Base and future population and employment data, generation rates and mode choice for metropolitan Sydney was sourced from Transport for NSW Transport Performance and Analytics (TPA), which are available at five-year intervals
- Available toll choice modelling techniques were assessed in the current Sydney context where multiple competing toll roads cover a substantial portion of the developed Greater Sydney metropolitan area
- Value of Travel Time Savings (VTTS) surveys of drivers' willingness to pay tolls were undertaken to inform the toll choice modelling
- Existing road infrastructure was reviewed for the base year. A set of future road infrastructure projects anticipated for future years for the modelled Sydney metropolitan area was developed and these projects formed the basis for the future 'do minimum' networks modelled in SMPM.

Traffic forecasting approach

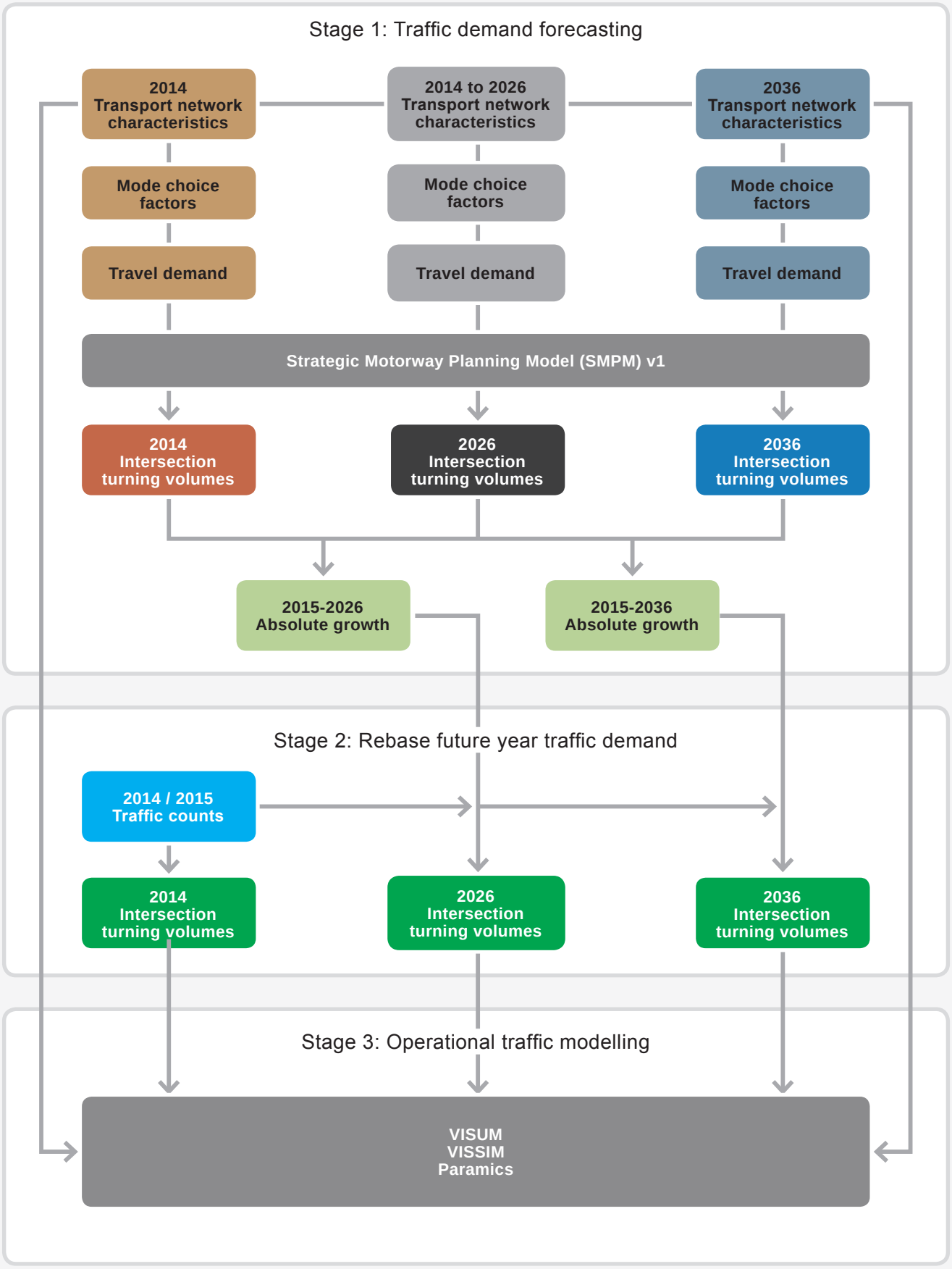


Figure 4-1 Overview of traffic forecasting and modelling approach

- The SMPM project model was developed and calibrated to current observed travel behaviour, then validated against 2014 Sydney-wide travel behaviour from a series of traffic count and travel time surveys. It was then adjusted to reflect driver behaviour on Sydney's toll roads as indicated by the VTTS surveys. The SMPM comprises separate weekday time period sub-models, with average one-hour peak multi-class traffic assignments run for[3]:
    - AM period: (7.00 am – 9.00 am)
    - Daytime inter-peak: (9.00 am – 3.00 pm)
    - PM period: (3.00 pm – 6.00 pm)
    - Evening off-peak: (6.00 pm – 7.00 am)
- The project was coded into the SMPM future year models
- Future demands were estimated by applying future year traffic growth forecast by the Strategic Travel Model (STM) to the SMPM to produce the most likely future base case scenario. Traffic estimates were produced by the SMPM for the years 2021, 2026 and 2036. These traffic estimates were produced by time period for an average school day at each year and vehicle class for toll assessment.

Traffic demand data contained within this traffic and transport assessment was taken from the SMPM, following assessment of the model calibration and validation by independent peer reviewers and agreement that the model is suitable for the purposes of this EIS.

Data inputs into the SMPM

The primary inputs for the development of the SMPM included:

- Traffic volume counts for screenlines and project specific counts
- Road travel time surveys
- Google travel time data
- Base 2011 and future year vehicle demand matrices by travel purpose from the STM sourced from TPA in January 2017
- Population and employment by small zone area provided by TPA consistent with demographics released by NSW Department of Planning and Environment (DP&E) in September 2016 (version Land Use (LU)16)
- Household travel survey data collected by TPA
- Private car driver stated and revealed preference value of travel time survey data collected in 2013
- Commercial vehicle stated preference value of travel time survey (VTTS) data collected in 2012
- Aerial photography collected for detailed auditing of road networks
- Recently completed and future infrastructure project lists, including information from Transport for NSW
- Existing strategic models and data within the Sydney region.

[3] A comparison of weekday and weekend traffic volumes in the study area was undertaken. This revealed that the peak weekday hourly volumes are similar or higher than the peak weekend hourly volumes. Therefore, the weekday scenario is the worst traffic situation and is appropriate to be tested as such. This is standard assessment methodology and consistent with previous motorway assessments.

Structure of the SMPM

The regional SMPM traffic forecasting model process comprises two separate elements: Base Demand Model (based on STM with updates to incorporate more recent data) and SMPM toll choice assignment model (an assignment module to incorporate toll choice behaviour). The role of each element of SMPM, and interaction between each element, is outlined in the following subsections:

Base demand model

The base demand model was developed using the STM with updated information used to produce improved travel demand matrices for detailed toll choice route assignment and project appraisal testing. The base demand model provides the forecast capability to address changes in land use, trip distribution and mode choice and produces vehicle traffic demands for peak and off-peak periods for subsequent allocation to routes in the detailed SMPM toll choice assignment model.

Toll choice assignment model

The SMPM toll choice assignment model was developed to test impacts of toll and infrastructure strategies and provide infrastructure project traffic forecasts. The model is designed to forecast the traffic choosing to use tolled and non-tolled routes for the representative peak and inter-peak periods of the day. The development of the Toll choice assignment model included:

- VTTS survey analysis to investigate people's willingness to pay tolls to use toll roads based on project specific market research surveys
- Development of improved road traffic demand matrices for the following vehicle classifications:
  - Private vehicles: cars not registered for business use
  - Light commercial vehicles (LCV): vehicles up to 4.5 tonnes gross vehicle mass (GVM) (or under 2.8 metre height/12.5 metre length), including cars registered for business use
  - Heavy commercial vehicles (HCV): all vehicles with a GVM of more than 4.5 tonnes that have been registered for business use[4].

To support the development of the SMPM, an investigation was undertaken into the various toll choice assignment methods in the Sydney and Australian context. Based on the assessment, it was determined that the SMPM toll choice assignment model should adopt a distributed Value of Time (VOT) multi-class equilibrium assignment methodology.

The key reasons were:

- The methodology was considered a valid approach for the SMPM toll choice assignment model for assessing the F6 Extension. It would address the functional requirements of the project model with capabilities to consider a range of tolling strategies and scenario tests
- The approach appears to be emerging as an industry standard and has recently been used as the preferred modelling approach for a number of Australian toll roads, such as the stages of the WestConnex project.

The SMPM toll choice assignment model was constructed to model the range of driver behaviours and was adjusted to match the observed patronage on the existing toll facilities. A series of validation checks was undertaken by Roads and Maritime to verify the performance of the SMPM.

[4] Within the SMPM, trucks are all vehicles of Austroads class 3 and higher. While trucks carrying hazardous materials would not be able use the tunnels, most of these restrictions apply to a subset of articulated vehicles and are not relevant to rigid vehicles, which are the majority of the truck class.

Land use projections

The SMPM is linked to the STM, which includes the trip generation, trip distribution and mode choice modules and incorporates demographic data related to land uses including population, employment and education enrolment projections. For SMPM, this data has been supplied by TPA as data extracts from the STM and is based on the latest population and employment projections.

These population and employment projections are based on the latest land use data (version LU16) provided by TPA. This data has been projected from 2016 Census data and incorporates known major urban renewal projects and developments, including those around Green Square and Mascot town centres. The base vehicle demands from STM are consistent with these demographic assumptions and therefore provide a consistent base for the future demands used in the SMPM. Projects and developments included in the SMPM also include the strategic directives contained in *A Plan for Growing Sydney* (NSW Government 2014) in 14 transport and land use corridors:

- Arncliffe to Banksia
- The Bays Precinct
- Broader Western Sydney Employment Area
- Central to Eveleigh
- Glenfield to Macarthur
- Greater Macarthur Investigation Area
- North-western Growth Area
- Parramatta
- Second (Western) Sydney Airport
- South-western Growth Area
- Sydney Metro – Bankstown to Sydenham
- Sydney Metro – Chatswood to Sydenham
- Sydney Metro – Northwest
- Sydney to Parramatta (including the Parramatta Road Urban Transformation Strategy).

The SMPM has also included planned future port activities and uses, for instance at Port Botany, Sydney Airport Freight terminal and intermodal terminals.

Induced demand

Induced demand results from improved travel times between homes and destinations, such as workplaces, shopping centres and education facilities, which cause changes to region-wide trip patterns.

Even with no growth in regional population and economic activity, a new or substantially upgraded road can induce changes in trip patterns which then results in induced traffic demand. The SMPM includes the changes in traffic associated with this induced demand. Induced demand equates to about 0.3 per cent additional daily trips in the Sydney metropolitan area in 2036.

Modelled scenarios

In considering the future, several scenarios need to be considered, reflecting the timeframe under which the project would be delivered and the extent of other infrastructure developments. These scenarios were explored through development of specific modelled scenarios, reflecting various future travel demands.

Examined demand cases were represented by specific forecast years:

- 2014/15 was adopted as the base case
- 2026 was adopted as the project opening case for the project. The project is forecast to be open to motorists in 2024. However, using 2026 as the year of opening for the traffic assessment allows for full ramp-up of traffic demand as motorists respond to the provision of the project.
- 2036 was adopted as the case for 10 years after opening as required in the Roads and Maritime assessment guidelines.

The scenarios were modelled in the SMPM by combining future year demands with future networks. As SMPM has a base year of 2014 and models the future years in five-year intervals (starting at 2021), the 2014/15 base year was calculated by interpolating between 2014 and 2021 outputs. Traffic was assigned using the calibrated road assignment model, taking account of changes in toll choice behaviour over time. The SMPM provided growth in AM peak and PM peak roadway and intersection turning volumes for input to the following operational traffic modelling scenarios:

- **Base case (2014/15)**: current road network with no new projects or upgrades. For the operational modelling, 2014/15 was adopted as the base case to match the year of traffic survey data collection.
- **Operation 'do minimum' (2026)**: a future network including NorthConnex, the WestConnex program of works, Sydney Gateway, and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth. It is called 'do minimum' rather than 'do nothing' as it assumes that ongoing improvements would be made to the broader road and public transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.
- **Operation 'do something' (2026)**: With the 2026 'do minimum' projects completed and the F6 Extension Stage 1 (New M5 Motorway at Arncliffe to President Avenue at Kogarah) complete and open to traffic
- **Operation 'do minimum' (2036)**: a future network including NorthConnex, the WestConnex program of works, Sydney Gateway, and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth. It is called 'do minimum' rather than 'do nothing' as it assumes that ongoing improvements would be made to the broader road and public transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.
- **Operation 'do something' (2036)**: With the 2036 'do minimum' projects completed and the F6 Extension Stage 1 (New M5 Motorway at Arncliffe to President Avenue at Kogarah) complete and open to traffic
- **Operation 'cumulative' (2036)**: With the 2036 'do something' projects completed and Western Harbour Tunnel and Beaches Link, and future stages of the F6 Extension between Kogarah and Loftus complete and open to traffic.

Table 4-1 Traffic modelling scenarios

Scenario	Year	Existing road network	F6 Extension		Future network				
			Stage 1	from Kogarah to Loftus	NorthConnex	WestConnex program of works	Sydney Gateway	Western Harbour Tunnel	Beaches Link
Base Case	2014/15	✓							
Operation 'do minimum'	2026	✓			✓	✓	✓		
Operation 'do something'		✓	✓		✓	✓	✓		
Operation 'do minimum'	2036	✓			✓	✓	✓		
Operation 'do something'		✓	✓		✓	✓	✓		
Operation 'cumulative'		✓	✓	✓	✓	✓	✓	✓	✓

No Operation 'cumulative' scenario is required for 2026 as no additional projects not already considered in the Operation 'do minimum' are expected to have a significant impact on traffic volumes in the study area. Western Harbour Tunnel and Beaches Link are proposed to be operational in 2027.

Bandwidth plots used in this assessment are produced directly from SMPM for 2014, 2026 and 2036. The bandwidth plots in this report use 2014 as a proxy for 2014/15.

4.2.2 Stage 2 – Future year traffic demand for operational assessment

The SMPM was used to generate base and future year traffic demand matrices for the weekday AM and PM peak hours. As mentioned above, the key objective of the SMPM demand modelling was to forecast traffic demand and growth in traffic volumes on key roads in the project area, based on expected population and employment changes, and proposed road network improvements for the future modelling scenarios. From this, the forecast growth in travel demand and traffic volumes on the road network could be derived for each scenario for application in the more detailed operational modelling.

This growth in traffic volumes was then applied to the balanced turning counts, derived from traffic surveys undertaken on the road network, and used to create the traffic flows used in the future year operational modelling, based on practices described in Roads and Maritime modelling guidelines. Where a future reduction in traffic demand is anticipated, the absolute growth is expressed as a negative.

This approach is consistent with the modelling adopted for the EIS assessment of other strategic road projects, such as the previous M4 Widening, M4 East, New M5 Motorway and M4-M5 Link EISs, and makes the best use of observed traffic count data as the basis for future year travel demand and traffic volumes and patterns. More specifically, this approach provides the most accurate representation of how the modelled increase in future traffic would affect existing observed network travel demands and the resultant network operation.

4.2.3 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 models were required to fully evaluate operational impacts on the surrounding road network in the study area. The boundary for the operational modelling area was informed by the forecast SMPM traffic volume differences around the interchanges as a result of the project. The extents of the operational model areas covered roads where the change in traffic volumes would likely cause a significant operational impact in the AM and PM peak periods. Further detail is contained in **Annexure B**.

The operational modelling area is divided into three component locations:

- President Avenue intersection and surrounding network
- Motorway mainline
- St Peters Interchange and surrounding network.

Traditional analytical intersection assessment tools, e.g. SIDRA, do not provide a whole of network assessment and tend to work best at evaluating individual, isolated intersections or small networks of intersections. Microsimulation modelling software, which models individual vehicle behaviour, such as weaves and merges and interactions with the network and other road users, are better tools for evaluating network operation particularly in small congested networks with motorway entry and exit ramps that would have weaving and merging movements. Mesoscopic modelling provides an additional option for larger networks not suited to microsimulation and can model intersection delay and dynamic route choice at a lane-based level.

A suite of operational traffic models has been selected to assess the project impacts based on the size and key requirements of each component area:

- The study area surrounding the President Avenue intersection is large in scale, extending 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 and is not well suited to assessment using microsimulation. Accordingly, two separate models were developed:
    - 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. Unlike basic volume delay functions, ICA considers a range of intersection characteristics (e.g. number of lanes / lane usage, signal timings, hierarchy of priorities, traffic turning volumes and composition, gap acceptance and follow up times, and flare lengths) and incorporates a blocking back component to model queuing. The VISUM ICA model provides a detailed and consistent approach in evaluating intersections within a modelled network and is a suitable tool for the assessment of the wider study area.
    - 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 motorway mainline between St Peters Interchange and President Avenue intersection was assessed using a Vissim microsimulation model
- Paramics microsimulation was used to assess impacts at St Peters Interchange. The study area is relatively limited in scale (based on analysis of forecast SMPM traffic volume differences). The Paramics model used in the assessment of M4-M5 Link impacts (*M4-M5 Link: Technical working paper: Traffic and Transport*, August 2017) formed the basis for the assessment, but was adapted for this project.

Base year model development – operational

It is standard modelling practice to create base year models that replicate existing traffic conditions before developing any future year scenarios. Base models of the road network around the proposed President Avenue intersection and the St Peters interchange for the AM and PM peak periods 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 indicated in **Figure 4-2** and **Figure 4-3**. To ensure an accurate representation of existing traffic conditions, the base simulation models were calibrated and validated as per Roads and Maritime modelling guidelines to align with existing traffic conditions. The following data sources were used in the calibration and validation process:

- Aerial photography: The modelled network layout was primarily based on aerial photography and Traffic Control Signal (TCS) plans. Additionally, intersection geometry was verified during site inspections
- Intersection turning counts: a series of AM and PM peak hour turning count surveys were undertaken at the majority of the modelled intersections. In addition, Sydney Coordinated Adaptive Traffic System (SCATS) traffic count data was used to derive turning volumes for intersections where no survey data was available
- Intersection Diagnostic Monitor data (IDM): IDM data provides a comprehensive record of traffic signal operation statistics (cycle and phase timings etc.) at signalised intersections
- Saturation flows: SCATS LX data was used to identify the saturation flow characteristics for individual approach lanes
- Site inspections: AM peak and PM peak site visits were completed at key intersections by the traffic modellers to observe and document:
    - Intersection geometry
    - Lane usage
    - Sample traffic signal timings
    - 'Dead green' time (green traffic light phase, but vehicles unable to advance due to queuing ahead or downstream blocking effects)
    - Pedestrian delays
    - Posted speed limits
    - Location of parking and bus stop (if applicable)
    - Bottlenecks and pinch points in the study area
    - Strategic model cordon matrices i.e. volume of traffic going in and out of the boundary of the modelled road network from specified origins to specified destinations.

The operational model demand matrices were developed in the following stages:

- Cordon applied to SMPM to obtain initial origin/destination matrices for the model areas
- Initial matrices were expanded to match the simulation model zoning system (there are fewer zones in the SMPM cordon area due to the nature of this model and these zones needed to be disaggregated for the simulation models)
- 'Target' zone origin and destination totals were determined based on observed count data where available. At locations where count data was not available, the SMPM totals were retained
- Matrices were furnessed to match 'target' volumes. Furnessing is a common process used in transport modelling to factor the rows and columns of a demand matrix in an iterative manner to obtain totals that match the 'target' volumes.

The resulting matrices were then used as inputs to the simulation models with refinements carried out as part of the calibration process.

Figure 4-2 President Avenue intersection operational model boundaries (VISUM and vissim)

Figure 4-3 St Peters interchange operational model boundary (Paramics)

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 study area. These 2026 and 2036 models catered for the assessment of the following scenarios:

- 'Do minimum' scenario
- 'Do something' scenario
- 'Cumulative' scenario (2036 only).

The growth in SMPM forecasts was used to grow the demands from the base year to the relevant St Peters interchange Paramics and President Avenue corridor Vissim future year models. While the simulation models are over three to four-hour peak periods, SMPM forecasts typical one-hour peak (AM and PM) volumes. The forecast one-hour volumes were extrapolated across the full simulation periods to reflect typical demand profiles on either side of the peak hours. This profile was based on observed count data across the relevant networks, e.g. the road networks surrounding the St Peters interchange and the President Avenue intersection.

In some cases, the forecast one-hour future demand derived from SMPM would exceed the physical road capacity. This calculated future excess demand was then distributed into the hours before and after the peak hour to correspond with anticipated peak spreading, effectively predicting longer peak periods in future.

The future year model demand for the President Avenue corridor Vissim model was cordoned from the corresponding VISUM models to ensure consistency of modelled demand and take account of the forecast route choice assignment.

The modelling reflects the design of proposed local road upgrades and interchanges proposed as part of the project. The operational modelling also includes currently planned and funded transport infrastructure improvements on the existing road network, such as routine road network and intersection upgrades that would be provided over time to incrementally improve capacity and traffic throughput to address specific congestion issues.

This was developed by considering the following planned programs to improve road based transport infrastructure in southern Sydney:

- Roads and Maritime's Easing Sydney's Congestion Program, which includes:
  - the Pinch Point Program
  - the Sydney Clearways Program
- Transport for NSW's proposed Bus Priority Infrastructure Program
- Arterial road upgrades.

Pinch Point Program

The Pinch Point Program aims to reduce traffic delays, manage congestion and improve travel times on Sydney's major roads, particularly during weekday peak periods. Pinch points are traffic congestion points, intersections or short lengths of road where a traffic bottleneck slows down the broader network. In February 2015, the NSW Government committed to the Gateway to the South Pinch Point Program to address critical pinch points along the A1, A3 and A6 routes south of the M5 Motorway. More than 20 locations have been identified as part of this program for further investigations and potential improvements.

Pinch Point Program work is currently proposed in the vicinity of the project at the following locations:

- Princes Highway, Forest Road and Wickham Road, Arncliffe
- Princes Highway and Rockdale Plaza Drive, Rockdale
- The Grand Parade and President Avenue, Monterey (completed 2017)
- Princes Highway, Gray Street and Rocky Point Road, Kogarah (underway in 2018).

Sydney's Clearways Program

In December 2013, the NSW Government published the Sydney Clearways Strategy, which identified routes on Sydney's road network that could benefit from new clearways. Clearways are installed on key arterial roads where traffic is often heavy and congested. When vehicles are parked in the kerbside lane, fewer lanes are available to traffic and road users are also forced to merge from the kerbside lane which can create significant delays and queues. Clearways help keep vehicles moving by making all lanes available to road users. The only exceptions are the stopping of buses and taxis dropping off or picking up passengers as well as emergency vehicles.

The Sydney Clearways Strategy identifies over 1000km of state roads on key corridors across Sydney, which may benefit from the introduction of new and extended weekday and new weekend clearways, to improve the movement of goods and people. Corridors identified in the strategy are currently under further investigation.

Clearway hours are determined based on an analysis of traffic volumes and times along the corridor, taking into consideration a need for consistency in the clearway hours of operation both along a corridor and across the network. Since 2013, new and extended clearways have been installed on some of Sydney's busiest corridors including the Princes Highway from President Avenue, Kirrawee to King Georges Road, Blakehurst. Community engagement has also commenced for new weekend and extended weekday clearways on Taren Point Road between Captain Cook Bridge, Taren Point and Kingsway, Caringbah.

Other corridors for investigation in southern Sydney are identified in the 2013 Sydney Clearways Strategy, including:

- Princes Highway through Blakehurst, Kogarah , Rockdale and Wolli Creek
- Rocky Point Road from Kogarah to Sans Souci
- General Holmes Drive, The Grand Parade and Sandringham Street from Kyeemagh to Sans Souci.

The identification of possible new and extended clearways in the Sydney Clearways Strategy was based on assessment of traffic volumes and speeds in 2013 and is separate to and is not prompted by the project.

Clearways have an immediate positive impact on traffic flow as they use existing road space for the movement of vehicles and are an operational traffic management solution, intended to be implemented in the short to medium term to address current congestion.

Irrespective of the future changes to the traffic flows and patterns should the project proceed, the anticipated longer term traffic volumes on these key arterial road corridors would likely require clearways to be retained for certain periods. The implementation of new and extended clearways, with alternate business parking solutions, within the project area provides a response to managing current road congestion, using existing road assets.

4.2.4 Stage 3 – Construction traffic modelling assessment

Base year model development

Similar to the operational assessment, the construction modelling methodology included deriving base year traffic patterns and developing base and future year traffic models. Base year construction models were developed in LinSig as, unlike the locations adjacent to motorway ramps assessed in the operational scenarios, detailed interactions such as weaving and merging are not prevalent. Furthermore, the impact of relatively small volume changes associated with the addition of construction-related vehicles is more easily identified in detailed intersection models. This is a similar approach to that used in the previous motorway project construction impact assessments (e.g. M4 East, New M5 Motorway and M4-M5 Link EISs). The construction models were calibrated in a similar manner to that described for the operational models.

Future year model development

Based on the planned construction activities, a worst case construction traffic scenario was assumed to be the period of spoil removal from tunnel construction during 2021. The current road network with the addition of the M4 East and New M5 Motorway projects was assumed for the road network in the construction scenario.

AM and PM peak hour models for 2021 were developed 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. Construction traffic was based on the proposed construction methodology, covering vehicle types, volumes and construction traffic routes to and from the various construction ancillary facilities. The performances of the intersections in the vicinity of the construction ancillary facilities were then calculated.

4.3 Methodology – assessment criteria

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

- At a network level, in terms of total distance travelled and total time travelled within the modelled network
- For single-point assessment at a mid-block level, showing changed travel routes and impacts
- At an intersection level, showing changed performance of these typically constraining elements of urban road networks.

Traditionally, less total time travelled through a network imply increased network efficiency. However, as demands and networks may be different, higher values may be indicative of a better performing network because more vehicles are able to travel through the network to reach their destinations.

Given the existing congested traffic in the study area, single-point assessment criteria do not present a complete picture of road network traffic operations. Traditional mid-block and intersection levels of service do not recognise that traffic is often constrained upstream, meaning that vehicles cannot get to the evaluation point giving an unrealistically low level of demand. Similarly, they do not recognise that traffic is constrained downstream; meaning vehicles are queued through the evaluation point. The measurements therefore reveal only throughput at that point, not realistic performance.

The operation of the modelled road network as a whole is regarded as being of prime importance, recognising that there may be single locations where there may be improvement, while at others, some deterioration. These should therefore not be considered in isolation. The critical evaluation is that the project does not overburden the network and provides more efficient network operations as a whole.

4.3.1 Motorway intersection network performance

As discussed above, the SMPM was used to assign traffic demand on the strategic road network using the land use and demographic assumptions based on input provided by the STM. The SMPM is intended for use as a Sydney-wide traffic assignment model and is not intended to be used for detailed traffic operational analysis of the road network, which requires more specialised software, such as microsimulation software, which has been used in this assessment. Of particular importance is merge behaviour at tunnel portals and potential blocking of entry and exit ramps. Such behaviour is best represented by microsimulation modelling.

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. The visual representation and interaction of individual vehicles is of particular importance where merge and weave behaviour, as well as differential lane utilisation, are expected to have an impact on traffic capacity. Mesoscopic simulation was used for the wider President Avenue intersection network as the extent of the study area was not suited to microsimulation.

Modelling parameters collected and reported for the AM and PM peak hours in each scenario modelled were:

- 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.

4.3.2 Level of service

Level of service (LoS) is a measure to describe the operational conditions and efficiency of a roadway or intersection. The definition of LoS generally outlines the operating conditions in terms of speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and road safety. It is a qualitative measure describing operational conditions within a roadway or intersection, as perceived by motorists and/or passengers.

Motorway levels of service

The level of service for freeway or motorway sections where the design speed is greater than 70 km/h 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[5]) 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 km/h 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. **Table 4-2** shows the six levels of service for motorways, ranging from LoS A–F, with LoS A representing optimum operating conditions (free flow) and LoS F the poorest (forced or breakdown in flow). When a roadway performance falls below LoS D, investigations are generally initiated to determine if suitable remediation can be provided.

Intersection levels of service

Average delay is commonly used to assess the operational performance of intersections, with level of service used as an index. A summary of the intersection level of service criteria is shown in **Table 4-3**.

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 mean that LoS E and LoS F are regularly experienced by motorists at pinch points on the existing strategic road network in Sydney, generally during peak periods. Roads and Maritime has an established program office (*Easing Sydney's Congestion*) aimed at delivering improvements to relieve congestion at pinch points and improving performance on strategic roads. It should also be noted that capacity constraint can be used as a demand management technique, which discourages car travel and that conversely, over-provision of capacity can encourage more car use.

[5] 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.

Table 4-2 Mid-block level of service definitions and criteria

LoS	Definition	Multi-lane roads[1]	Freeways[2]
		V/C ratio	Density (PCU/km/ln)
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high.	≤ 0.26	≤ 7.0
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort is a little less than with level of service A.	0.27 to 0.41	7.1 to 11.0
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	0.42 to 0.59	11.1 to 16.0
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow would generally cause operational problems.	0.60 to 0.81	16.1 to 22.0
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream would cause breakdown.	0.82 to 1.00	22.1 to 28.0
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.	> 1.00	> 28.0

Notes: [1] Where free flow speed is taken as 70 kilometres per hour
[2] Where free flow speed is taken as 90 kilometres per hour
Source: A*ustroads, Guide to Traffic Management – Part 3 Traffic Studies and Analysis*, Second Edition 2013

Table 4-3 Level of service criteria for intersections

LoS	Average delay/vehicles (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

5 Existing traffic and transport environment

5.1 Introduction

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

5.2 Existing road network constraints within the study area

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

- 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.

- Local road congestion where different trip types converge

  The current road hierarchy does not efficiently separate competing traffic movements, with through traffic conflicting with 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 Eastern City District.

  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 other north-south road links, with those roads subsequently performing the role of the arterial road network, a task for which they were not designed. Use of these roads, in particular West Botany Street and The Grand Parade (south of President Avenue), is not limited to private vehicles. As seen in **Figure 3-3**, the volume of heavy vehicles on The Grand Parade (south of President Avenue), and the proportion of heavy vehicles on West Botany Street and The Grand Parade (south of President Avenue), exceeds the Princes Highway.

5.3 President Avenue intersection and surrounds

The southern connection between the project and 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 adjacent Ilinden Sports Centre, Scarborough Park North, located on the south side of President Avenue, low to medium-density residential streets in the suburbs of Rockdale, Brighton-Le-Sands, Kogarah, and Monterey.

Local and regional centres including Rockdale, Brighton-Le-Sands, Kogarah and St George Hospital are in the wider surrounding area, the Illawarra and South Coast Line rail is located west of the proposed interchange, and there is residential land uses 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 proposed President Avenue intersection and surrounds are shown in **Figure 5-1** and include:

- Princes Highway – is a state road and classified highway, extending from Sydney, NSW to Port Augusta, South Australia. It runs from Sydney CBD at Broadway, through Newtown and St Peters, and beyond Kogarah. In this location, the Princes Highway has many signal-controlled intersections and is frequently congested
- The Grand Parade – is a state road and classified main road that connects to General Holmes Drive near Bruce Street, Brighton-Le-Sands and to Sandringham Street, Sans Souci. The section of The Grand Parade between President Avenue and General Holmes Drive is part of the A1 road corridor between Waterfall and Mascot. The Grand Parade generally has three lanes of traffic in each direction between General Holmes Drive and President Avenue, and two lanes of traffic in each direction between President Avenue and Sandringham Street
- President Avenue – is a state road and classified main road that links The Grand Parade at Brighton-Le-Sands and the Princes Highway at Kogarah. It forms part of the A1 road corridor between Waterfall and Mascot and generally has two traffic lanes and one parking lane in each direction. The posted speed limit is 60 kilometres per hour
- West Botany Street – is a regional road and classified secondary road that extends between the Princes Highway at Arncliffe and President Avenue at Kogarah. West Botany Street generally has two lanes in each direction and a posted speed limit of 60 kilometres per hour. West Botany Street performs a sub-arterial function and is a key link from President Avenue, north to Marsh Street and the Princes Highway at Arncliffe
- Bay Street – is a state road and classified main road that extends between the Princes Highway at Rockdale and The Grand Parade at Brighton-Le-Sands. It generally has one traffic lane and one parking lane in each direction, though there are parking restrictions in certain locations. It has a posted speed limit of 60 kilometres per hour along most of the road, however at Brighton-Le-Sands a posted speed limit of 40 kilometres per hour applies.
- Chuter Avenue / O'Connell Street – is an unclassified regional road between Sandringham Street and President Avenue. It generally has one traffic lane and one parking lane in each direction, though there are parking restrictions in certain locations. It has a posted speed limit of 60 kilometres per hour along most of the road, with a 40 kilometres per hour school zone at Ramsgate Public School. It provides a parallel route to The Grand Parade and the Princes Highway, south of President Avenue and performs a sub-arterial function; however, there is a 4.5t load limit on the road. Anecdotal evidence suggests sections of Chuter Avenue and O'Connell Street are used as a short-cut for longer distance trips through this area.

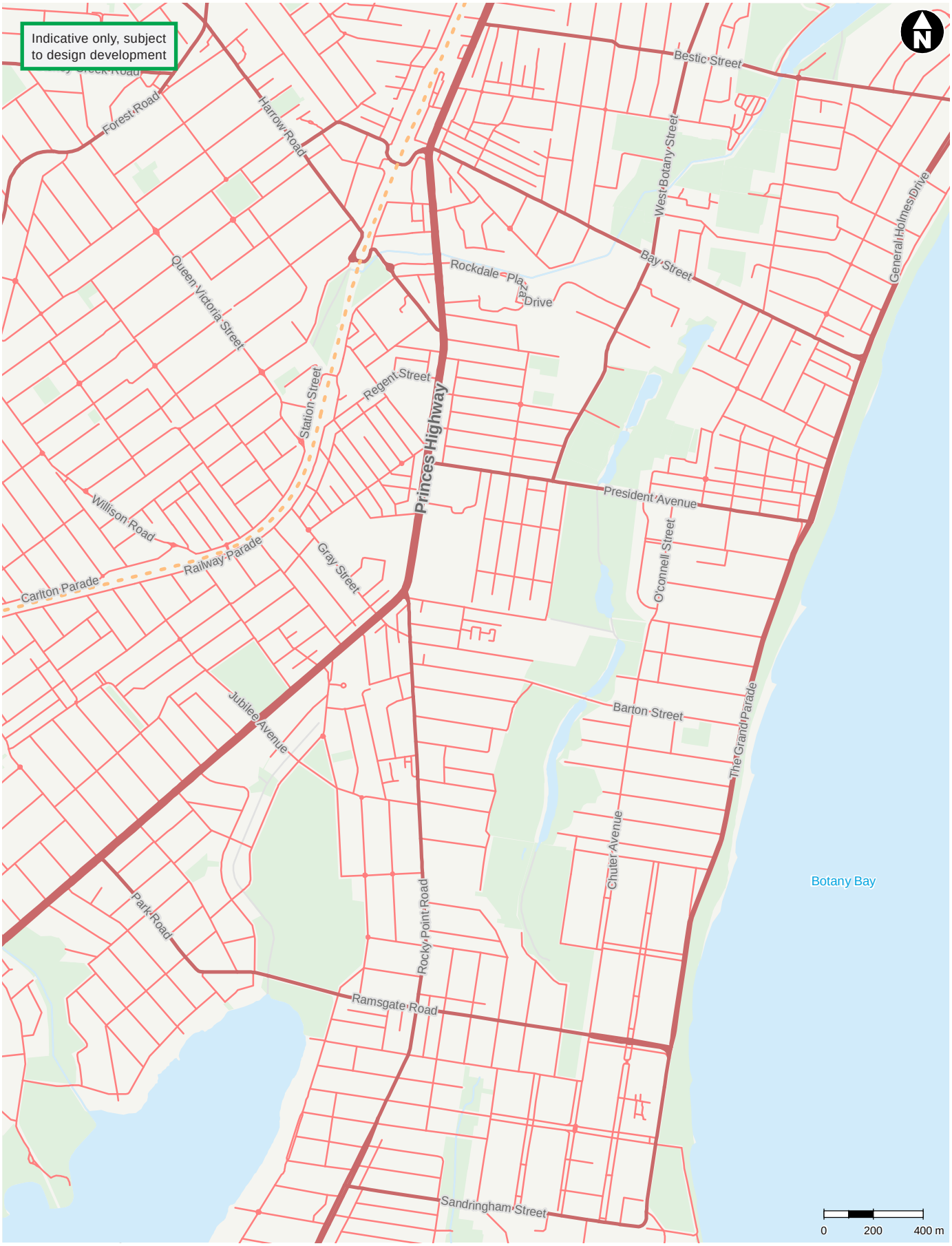


Figure 5-1 Road network around the President Avenue intersection

5.3.1 Modes of travel

Travel mode share for Statistical Areas Level 3 (SA3s) in 2015/16 are available. 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 (GMA) is shown in **Table 5-1**.

The Kogarah Rockdale SA3 has a similar travel mode share 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 rail connections provided by the Sydney Trains T4 Eastern Suburbs and Illawarra Line, which serves the Kogarah – Rockdale SA3.

Table 5-1 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: TfNSW, Household Travel Survey: Sydney 2015/16 data, accessed via Statistical Area Level 3 (SA3) Viz & Sydney SMA Regions Viz

5.3.2 Public transport services

Rail services

The area around the proposed President Avenue intersection is served by the Sydney Trains T4 Eastern Suburbs and Illawarra Line. The closest station to the interchange site is Kogarah Station, which is located just over one kilometre to the west of the future interchange. Kogarah Station in the context of the Sydney Trains network is shown in **Figure 5-2**.

Table 5-2 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 5-2 Weekday rail service frequency

Station	Line	AM Peak[1]		PM Peak[2]	
		No. services	Average Frequency (mins)	No. services	Average Frequency (mins)
Kogarah	T4 Eastern Suburbs & Illawarra	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

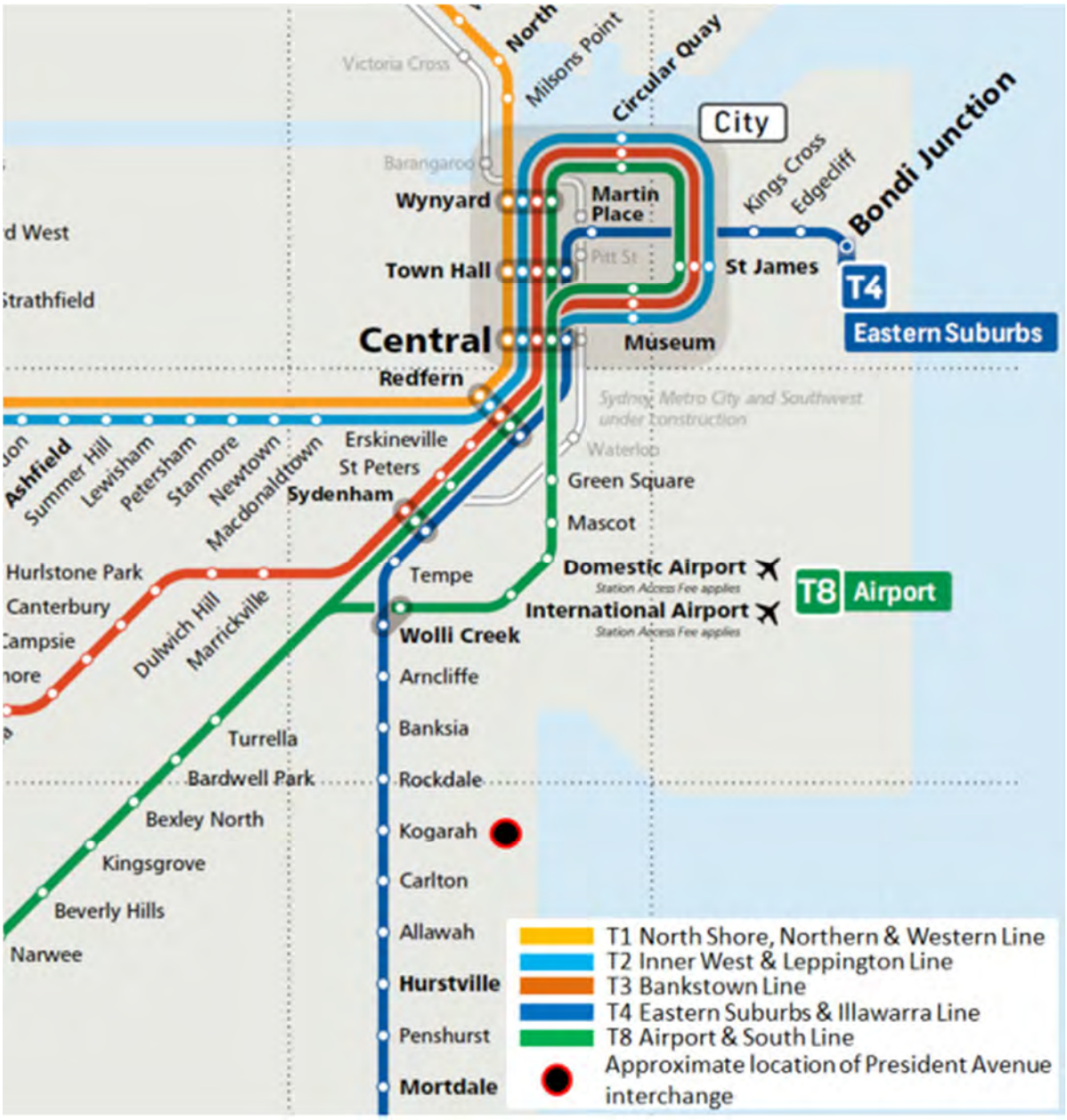


Figure 5-2 Extract of Sydney train network map around the President Avenue intersection and surrounds

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 5-3**, which shows routes operated by State Transit, and **Figure 5-4**, which shows routes operated by Transdev NSW. The bus routes provide a mixture of regional connections between activity centres, and local connections that complement the rail service provision.

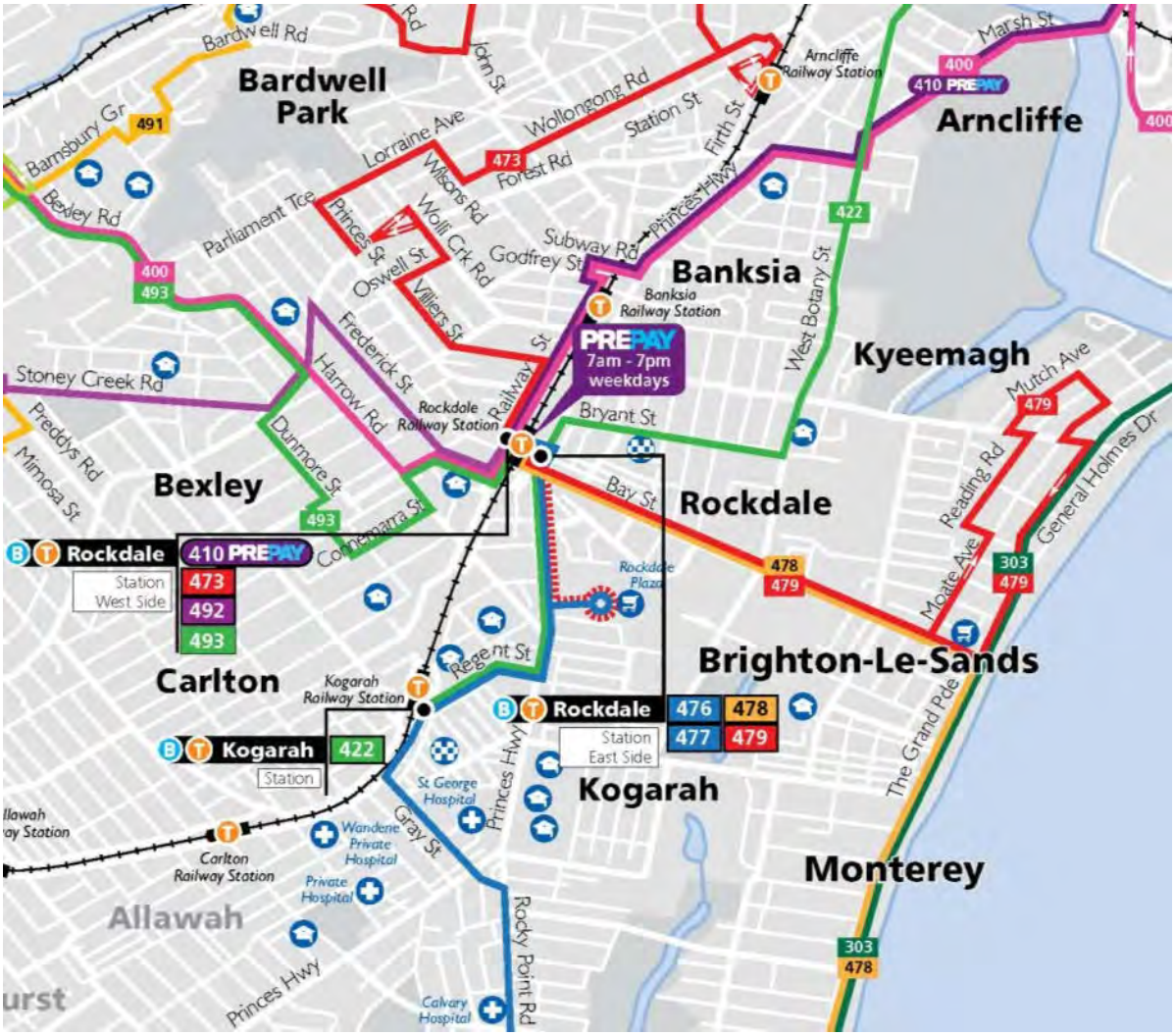


Figure 5-3 Bus routes around the President Avenue intersection site operated by State Transit

Source: State Transit, April 2018

Figure 5-4 Bus routes around the President Avenue intersection site operated by Transdev

Source: Transdev, November 2016

The bus routes operated in the vicinity of the President Avenue intersection are summarised in **Table 5-3**. 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.

Table 5-3 Bus services around the President Avenue intersection and surrounds

Route	Operator	AM peak[1]		PM peak[2]	
		No. services	Average frequency (mins)	No. services	Average frequency (mins)
400 Burwood to Bondi Junction via Eastgardens	State Transit	6	20	7	17
410 Bondi Junction to Rockdale	State Transit	4	30	6	20
422 Kogarah to City Martin Place	State Transit	4	30	4	30
476 Rockdale to Dolls Point (Loop Service)	State Transit	4	30	8	15
477 Rockdale to Miranda	State Transit	7	17	5	24
478 Miranda to Rockdale via Ramsgate	State Transit	13	9	11	11
479 Rockdale to Kyeemagh (Loop Service)	State Transit	4	30	8	15
493 Roselands to Rockdale	State Transit	-	-	-	-
303 Sans Souci to City Circular Quay via Mascot	State Transit	4	30	2	60
452 Rockdale to Beverly Hills	Transdev NSW	6	20	6	20
453 Percival St, Rockdale to Rockdale Station	Transdev NSW	5	24	6	20
455 Kingsgrove to St George Hospital, Kogarah	Transdev NSW	4	30	4	30
947 Kogarah to Hurstville via Dolls Pt	Transdev NSW	5	24	5	24
958 Hurstville to Kogarah via Carss Park	Transdev NSW	6	20	5	24

Notes: [1]7.00 am–9.00 am (higher frequency direction), [2]4.00 pm–6.00 pm (higher frequency direction)
Source: State Transit & Transdev NSW, December 2017

To provide an indication of the on-time performance of bus services in the President Avenue intersection study 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, on average, run about 5 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. The AM and PM peak period travel time performance for bus route 410 is shown in **Table 5-4**.

Table 5-4 Bus route 410 (Bondi Junction to Rockdale) on time running performance for March and October 2017

Arrival or departure timeband[1]	Average deviation from timetabled running time (mins)	
	Inbound (Bondi Junction to Rockdale / Kogarah)	Outbound (Rockdale / Kogarah to Bondi Junction)
06:00 to 07:00	n/a	0
07:00 to 08:00	n/a	9
08:00 to 09:00	0	3
09:00 to 10:00	11	n/a
14:00 to 15:00	n/a	4
15:00 to 16:00	2	5
16:00 to 17:00	12	16
17:00 to 18:00	8	4
18:00 to 19:00	6	n/a

[1] For inbound services, the timeband is determined by the time the service is scheduled to reach its final destination, for outbound services, the timeband is determined by the time the service is scheduled to depart from its initial destination

Source: Transport Performance and Analytics (TPA) Bus Opal Assignment Model (BOAM), 2018

5.3.3 Walking and cycling facilities

Land use around the proposed President Avenue intersection area includes recreational, commercial, and residential uses. The walking and cycling facilities within the study area vary with the different land use types and trip generators.

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. Carlton, Kogarah and Rockdale stations fall within an approximate two kilometre radius of the proposed President Avenue intersection area. Residential and retail areas surrounding these stations are of low to medium density and generally have a fine grid size, conducive to walking.

The cycle network within a five kilometre radius of the President Avenue intersection area is shown in **Figure 5-5**. This indicates that, aside from the Cook Park Trail and trails through Rockdale Bicentennial Park or Rockdale Bicentennial Park East, the cycle links parallel to the project are listed as medium to high difficulty on-road cycle routes.

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. Similar to the St Peters interchange area, 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.

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 active transport corridors 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.

Sydney Green Grid

The NSW Office of the Government Architect has released a plan to seek out opportunities for a network of high-quality green space that connects town centres, public transport hubs, and major residential areas. This network is known as the Sydney Green Grid[6].

The vision for the Sydney Green Grid is identified in the revised draft *Eastern City District Plan,* and includes the Rockdale Wetlands Open Space Corridor. The plan states that parts of this corridor, which are currently zoned for a future motorway, should be designed to retain and protect recreational open spaces and the ecological values of the corridor. The project has been designed to align with this vision, minimising impacts on recreational open space and ecological values within the project corridor by placing the motorway underground.

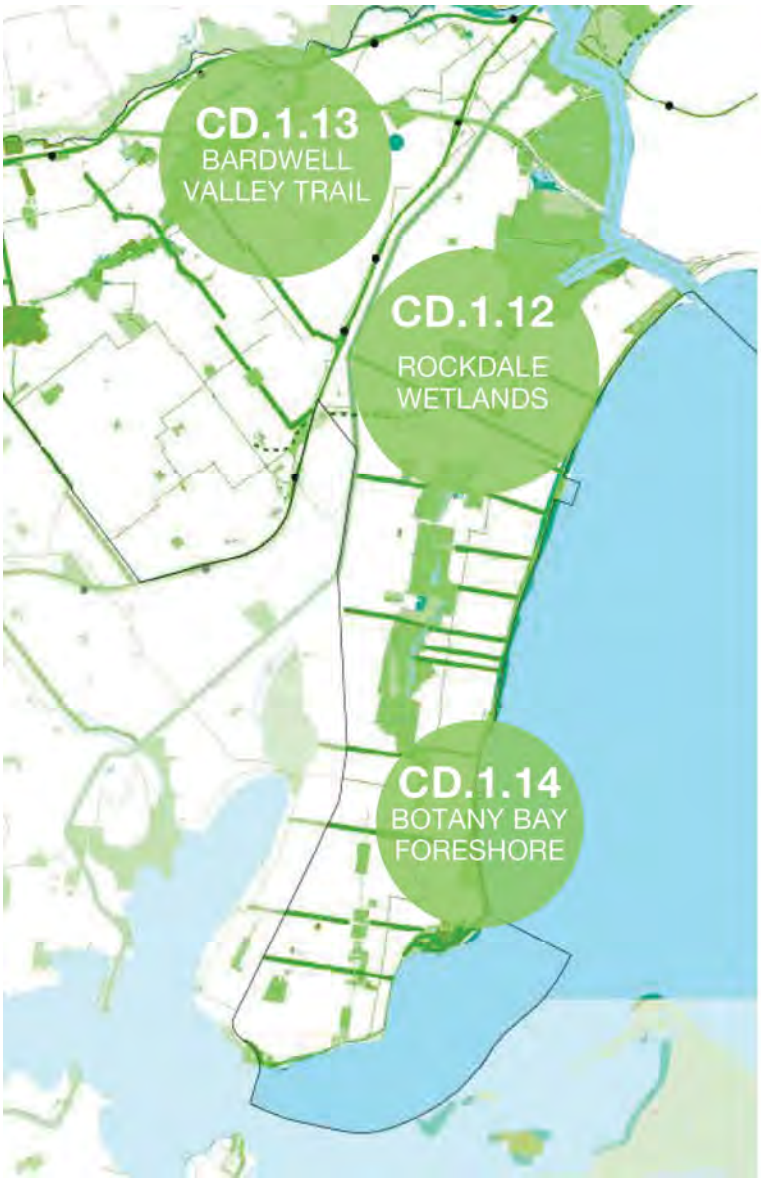
The reinstatement of Rockdale Bicentennial Park would be undertaken in consultation with Bayside Council and the NSW Office of the Government Architect to ensure the vision and objectives of the Sydney Green Grid are taken into consideration. The Green Grid within the vicinity of the project is shown on **Figure 5-6**.

[6] www.governmentarchitect.nsw.gov.au/articles/2017/06/sydney-green-grid

LEGEND

- Low difficulty
- Medium difficulty
- High difficulty
- New M5 surface road
- New M5 tunnel
- Road
- Waterway
- Railway line
- Parks and recreation

Figure 5-5 Extract from RMS Active Transport Catchment and Cycling map - 5km radius of President Avenue intersection area



SD.1.12 ROCKDALE WETLANDS – GEORGES RIVER TO COOKS RIVER

This group of projects have a very high conservation value extending from the Cooks to the Georges River along Muddy Creek, through Eve Street Wetlands, Spring Creek Wetlands, Landing Light Wetland, Patmore Swamp, Scarborough Park Ponds and through to Sans Souci. Opportunities include wetland restoration, establishment of bird hides education, interpretation and an improved pedestrian and cyclist environment.

CD.1.13 BARDWELL VALLEY TRAIL

This project cluster contains projects from Hurstville to Turella connecting pockets of natural bushland and remnant Turpentine forest and Eucalypt woodland which create a swathe of green in the middle of the densely populated area of the district. Projects include conservation management, green skills and interpretation, connectivity and biodiversity.

- Consider open space acquisition of Bardwell Valley Golf Course to provide additional open space in the rapidly growing area.
- Enhance the Two Valley Trail.

CD.1.14 BOTANY BAY FORESHORE AND COOKS PARK TRAIL

The Botany Bay Foreshore project is important in its context of linking the Great Coastal Walk to Botany Bay and the coastal projects of the South District. This cluster of projects provides an opportunity to improve connectivity to the foreshore and provide enhancements to the length of Cook Park from Brighton le Sands to Sans Souci.

Figure 5-6 Rockdale Wetlands' place in Sydney's Green Grid

Source: www.governmentarchitect.nsw.gov.au/articles/2017/06/sydney-green-grid

5.3.4 Existing traffic volumes and patterns

Table 5-5 provides the existing AM peak hour, PM peak hour and AWT flows for the key road corridors in the vicinity of the proposed 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. 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 are heavy vehicles.

Table 5-5 Average 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	
		veh/hr	HCV%	veh/hr	HCV%	veh/day	HCV%
President Avenue, west of Oakdale Avenue	Eastbound	1,530	9%	940	7%	17,500	8%
	Westbound	970	8%	1,390	6%	18,500	8%
President Avenue, east of Civic Avenue	Eastbound	1,010	10%	1,090	6%	16,500	7%
	Westbound	1,050	7%	1,090	7%	16,500	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%	35,500	5%
	Southbound	1,180	6%	3,230	2%	33,000	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%	18,000	12%
	Southbound	570	15%	2,330	13%	22,500	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%	10,500	7%
	Southbound	530	8%	950	6%	10,500	7%

Source: Traffic surveys (2015-2017)

Notes: Vehicles per hour rounded to the nearest 10 and vehicles per day rounded to the nearest 500.
AWT count data not available at all locations
HCV% refers to the percentage of heavy vehicles that make up the total number of vehicles

5.4 President Avenue intersection to St Peters interchange 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. There is a secondary freight route connecting the M5 East eastbound at the Princes Highway to the A1 at the intersection of the Princes Highway and President Avenue, as indicated in green in **Figure 5-7**. However, as there are only eastbound off ramps at the intersection of the M5 East and the Princes Highway, movements from the Princes Highway onto the M5 East, and from the M5 East westbound onto the Princes Highway need to use the M5 East ramps at Marsh Street, accessible via the identified tertiary freight roads of Wickham Street and Marsh Street, as indicated in blue in **Figure 5-7**.

Figure 5-7 Excerpt from Metropolitan Road Freight Hierarchy

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

5.4.1 Existing traffic volumes and patterns

Table 5-6 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. In the AM peak hour, there are more than twice as many vehicles travelling northbound than southbound.

Table 5-6 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%
Princes Highway, north of Banksia Avenue	Northbound	2,550	3%	1,220	2%	15,500	-
	Southbound	570	10%	1,870	2%	19,000	-
West Botany Street, south of Spring Street	Northbound	970	7%	550	5%	12,000	7%
	Southbound	370	10%	1,240	6%	13,000	8%
General Holmes Drive, south of Bestic Street	Northbound	3,900	3%	1,630	1%	32,500	-
	Southbound	1,530	6%	2,470	4%	35,000	-

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

Notes: Vehicles per hour rounded to the nearest 10 and vehicles per day rounded to the nearest 500.
AWT HCV% not available at all locations

5.5 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:

- Princes Highway – The Princes Highway is a major state highway, extending from Sydney, NSW to Port Augusta, South Australia, passing through NSW, Victoria and South Australia. It runs from Sydney CBD at Broadway, through Newtown and St Peters, and on beyond Kogarah and is a key bus route. In this location, the Princes Highway has many signal controlled intersections and is frequently congested
- King Street – King Street is a major state road running through the retail precinct of Newtown. It serves as one of the key connections between the Sydney CBD and areas in the south of Sydney and is a key bus route. It is a four-lane, two-way road with two lanes in each direction. King Street has a posted speed limit of 50 kilometres per hour and on-street parking in non-clearway periods
- Canal Road / Ricketty Street / Kent Road – Canal Road / Ricketty Street / Kent Road provide a link in the state road network, connecting Princes Highway to Gardeners Road. It is a two-way roadway with two to three lanes in each direction, operating at a posted speed limit of 60 kilometres per hour and is a key bus route. The Ricketty Street Bridge provides the only crossing of the Alexandra Canal in the area
- Gardeners Road – Gardeners Road is a four- to six-lane state road which runs east-west, connecting Kent Road in the west to Anzac Parade and Bunnerong Road in the east. It has a posted speed limit of 60 kilometres per hour and is a key bus route

- Burrows Road – Burrows Road is a wide, two-way local road with on-street parking on both sides of the road. The road begins at Huntley Street and end south of Canal Road. It has a posted speed limit of 50 kilometres per hour from Huntley Street to Campbell Road and the speed limit increases to 60 kilometres per hour after Campbell Road
- Campbell Road – Campbell Road is a wide, two-way regional road with a posted speed limit of 60 kilometres per hour. It runs between Burrows Road and Barwon Park Road. It has on-street parking from Burrows Road to Barwon Park Road
- Campbell Street – Campbell Street is a two-lane, two-way local road with a posted speed limit of 60 kilometres per hour. It runs between Barwon Park Road and Unwins Bridge Road. It operates with vehicle restrictions from 10 pm to 6 am prohibiting goods vehicles weighing more than three tonnes.
- Euston Road – Euston Road is a wide, two-way collector road with on-street parking on both sides of the road, although parking in the kerbside lanes would only be permitted during off-peak periods once the New M5 Motorway is operational. It connects McEvoy Street in the north and Campbell Road in the south and is a key bus route. It has a posted speed limit of 60 kilometres per hour from McEvoy Street to Sydney Park Road. In this section, it is marked as four lanes and forms a part of the regional road network to the Eastern Suburbs. From Sydney Park Road to Campbell Road, it is posted at 50 kilometres per hour and serves a light industrial precinct
- Bourke Road / Bourke Street – Bourke Road is a two-way local road. It runs between Botany Road, Waterloo and Gardeners Road, Alexandria. North of Botany Road, it becomes Bourke Street and continues until Campbell Street, Darlinghurst. To the south of Gardeners Road, it becomes Bourke Street through Mascot Town Centre to Coward Street, Mascot, when it then returns to being Bourke Road until O'Riordan Street, Mascot. It is posted as 50 kilometres per hour, except through Mascot Town Centre where it is 40 kilometres per hour. It contains a major cross-regional, separated two-way cycleway and is a key bus route.

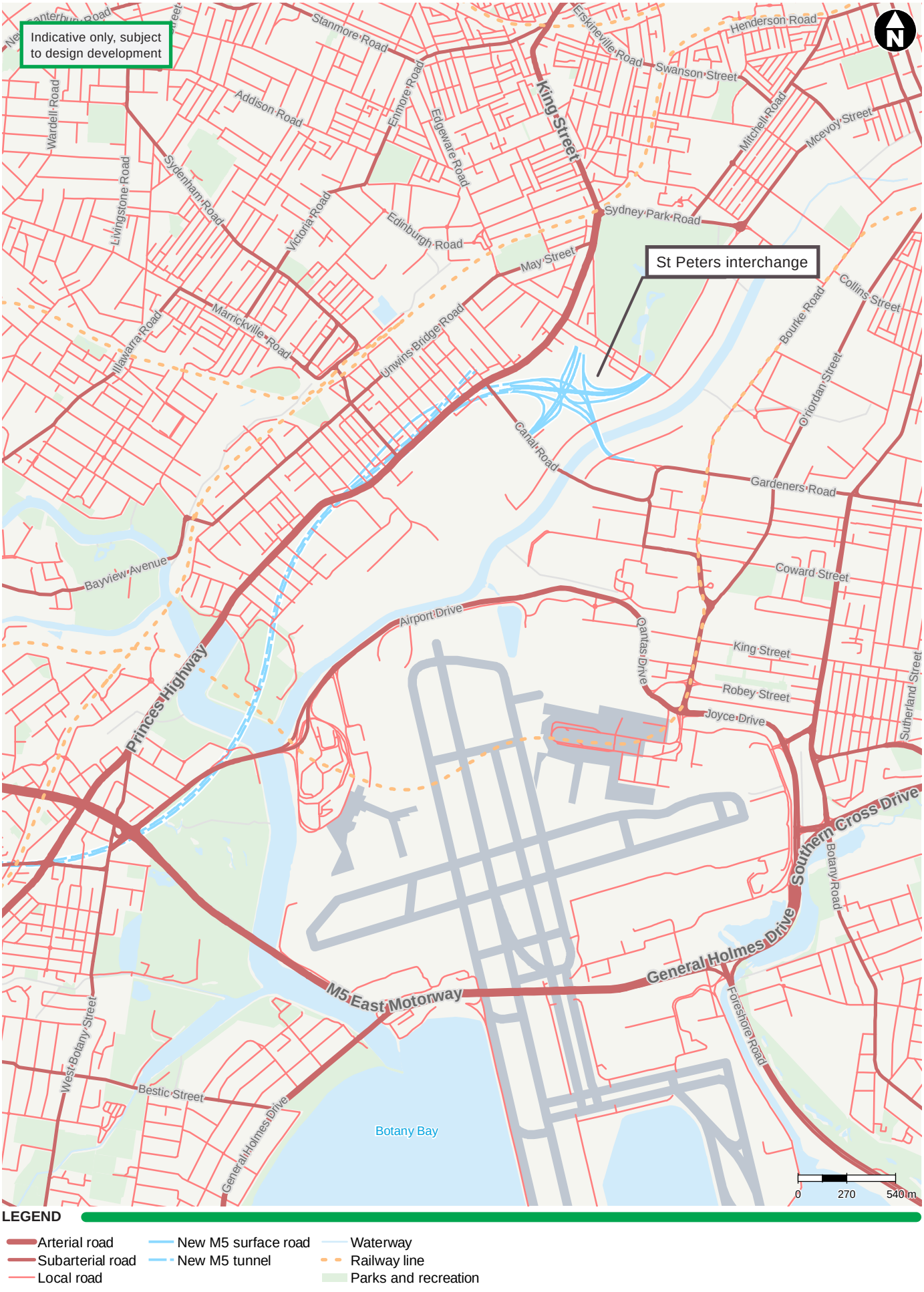


Figure 5-8 Road network around the St Peters interchange

5.5.1 Modes of travel

The area around the St Peters interchange is located in parts of the Sydney Inner City SA3, Marrickville – Sydenham – Petersham SA3 and the Botany SA3. Travel mode shares for these SA3s in comparison with the Sydney GMA are shown in **Table 5-7**.

The mode split varies quite widely between each of the SA3s and reflects the land use mix of each of the SA3s, in terms of the location of employment relative to residential land uses, and also reflect the public transport infrastructure in each of the SA3s. The Sydney Inner City SA3 has the lowest private vehicle mode share as well as the highest walk only mode share, as a larger proportion of persons in this SA3 would live within walking distance of their place of work since this SA3 is characterised by dense residential and commercial land uses. The density of housing and commercial activity in the Marrickville – Sydenham – Petersham SA3 is much lower than that in the Sydney Inner City SA3, and as a result far fewer persons are able to walk to work and there is a greater reliance on private vehicles and public transport. While the Botany SA3 has a car mode share that is similar to that of the Sydney GMA, it has a much higher walk more share (24 per cent), which likely reflects a land use mix where a greater proportion of persons live close to their place of work, residential or commercial land use which is more 'walkable'.

Table 5-7 Average weekday travel mode share for Marrickville – Sydenham – Petersham and Botany SA3s and Sydney GMA

Area	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Sydney Inner City SA3	23%	9%	32%	8%	7%	46%	7%
Marrickville – Sydenham – Petersham SA3	37%	12%	49%	14%	5%	25%	6%
Botany SA3	46%	17%	63%	2%	9%	24%	3%
Sydney GMA	48%	21%	69%	6%	6%	17%	2%

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

5.5.2 Public transport services

Rail services

The closest stations to the St Peters interchange are Sydenham and St Peters stations, which are serviced by the T4 Eastern Suburbs and Illawarra, the T3 Bankstown Line, the T8 Airport and South Line, and the South Coast Line (at Sydenham Station only), and Mascot Station, which is serviced by the T8 Airport and South Line.

Mascot and St Peters stations are located one kilometre to the south and 750 metres to the north of the St Peters interchange respectively. St Peters Station is about 10 minutes walking distance from the St Peters interchange, while Sydenham Station is about 20 minutes walking distance, and Mascot Station is about 25 minutes walking distance. These stations in the context of the Sydney Trains network are shown in **Figure 5-9**.

Figure 5-9 Extract of Sydney train network map around St Peters interchange and surrounds

Source: Sydney Trains, 2017

Table 5-8 shows that St Peters, Sydenham and Mascot stations have frequent services in the AM and PM peak periods. In the AM and PM peaks, Sydenham station has an average frequency of less than five minutes, St Peters station has an average frequency of less than six minutes and at Mascot station, average frequency is less than seven minutes.

Table 5-8 Weekday rail service frequency

Station	Line	AM Peak[1]		PM Peak[2]	
		No. services	Average Frequency (mins)	No. services	Average Frequency (mins)
St Peters	T3 Bankstown	14	8.5	14	8.5
	T8 Airport & South	7	19	7	19
St Peters Total		21	5.5	21	5.5
Sydenham	T3 Bankstown	24	5	20	6
	T4 Eastern Suburbs & Illawarra	23	5	14	8.5
	T8 Airport & South	7	19	7	19
Sydenham Total		54	2	41	3
Mascot	T8 Airport & South	18	6.5	18	6.5

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

Figure 5-10 presents the bus services map around the St Peters interchange site and surrounds. The bus routes provide a mixture of regional connections between activity centres, and local connections to complement the rail service provision.

The bus routes operating around the St Peters interchange are summarised in **Table 5-9**. All bus routes are operated by State Transit. 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 15 minutes in the AM and PM peaks. The bus routes also provide connection to Bondi Junction to the east, Kogarah and Rockdale to the south, and Dulwich Hill, Campsie and Burwood to the north-west.

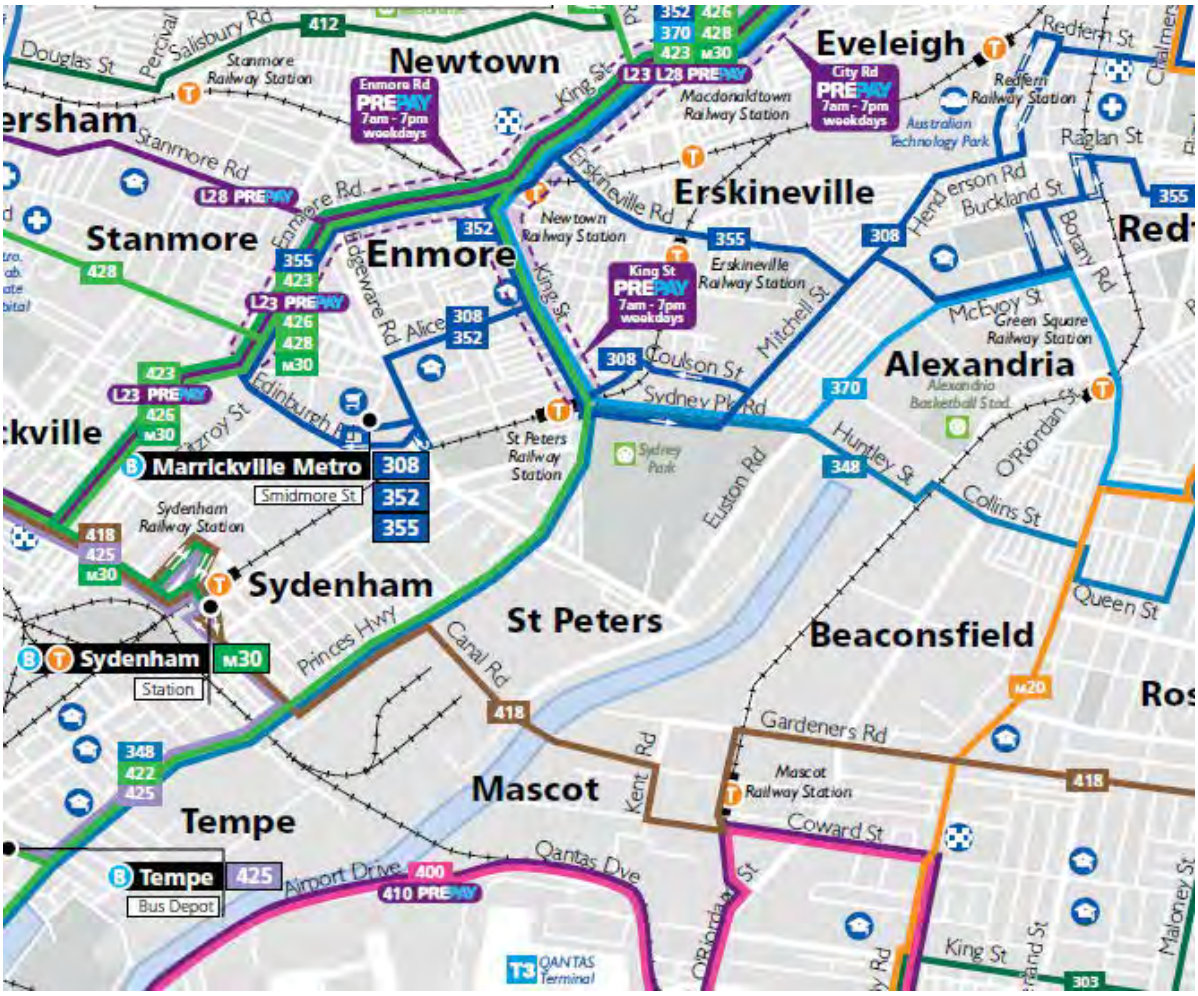


Figure 5-10 Bus routes around the St Peters interchange site

Source: Transport for NSW, April 2018

Table 5-9 Bus services around St Peters interchange and surrounds

Route	Operator	AM peak[1]		PM peak[2]	
		No. services	Average frequency (mins)	No. services	Average frequency (mins)
308 City to Marrickville	State Transit	8	15	8	15
348 Wolli Creek to Bondi Junction	State Transit	5	24	5	24
352 Marrickville to Bondi Junction (via Oxford, Crown & King Streets)	State Transit	5	24	6	20
355 Bondi Junction to Marrickville (via Moore Park and Erskineville)	State Transit	4	30	4	30
370 Coogee to Leichhardt	State Transit	9	13	12	10
348 Wolli Creek to Bondi Junction	State Transit	7	17	6	20

Route	Operator	AM peak[1]		PM peak[2]	
		No. services	Average frequency (mins)	No. services	Average frequency (mins)
400 Burwood to Bondi Junction (via Eastgardens)	State Transit	7	17	7	17
410 Bondi Junction to Rockdale	State Transit	4	30	7	17
418 Bondi Junction to Burwood	State Transit	7	17	8	15
422 Kogarah to City Martin Place	State Transit	8	15	8	15
425 Dulwich Hill to Tempe	State Transit	4	30	4	30
M20 Botany to Gore Hill	State Transit	16	7.5	12	10
X03 Sans Souci to City Circular Quay	State Transit	-	-	1	-
M30 Taronga Zoo to Sydenham	State Transit	7	17	11	11

Notes: [1]7.00 am–9.00 am (higher frequency direction), [2]4.00 pm–6.00 pm (higher frequency direction)
Source: State Transit, Dec 2017

5.5.3 Walking and cycling facilities

Cycle connectivity

The St Peters interchange area is located close to a range of land uses including recreational, commercial, and residential, and is also close to Sydney Airport and several train stations. There are a range of different walking and cycling facilities within the study area that aim to cater for the different land use types and trip generators.

Due to the proximity to the Cooks River and the Sydney CBD, the St Peters interchange area has good access to a number of off-road recreational cycle links, including along the Cooks River Cycleway, and the Bourke Street cycleway, which is part of a north-south corridor running from Mascot to Sydney Harbour. Further cycle connections and facilities are being provided as part of the New M5 Motorway project – these are discussed in **Chapter 8.0**.

The St Peters interchange falls within a five kilometre cycle radius of train stations on the Airport and East Hills Line, the Bankstown Line and the Eastern Suburbs and Illawarra 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 which are of moderate or high difficulty. Of the stations closest to the St Peters interchange, St Peters station, which is served by the Airport and East Hills Line, and the Bankstown Line, is the most well connected to the cycle network. The cycle network within a five kilometre radius of the St Peters interchange area is shown in **Figure 5-11**.

Figure 5-11 Extract from RMS Active Transport Catchment and Cycling map - 5km radius of St Peters interchange area

Pedestrian connectivity

The proposed St Peters interchange is within one kilometre of St Peters Station, and within two kilometres of Sydenham and Mascot stations. Residential areas surrounding these stations are of low to medium density residential or commercial use and generally have a fine to medium grid size. The grid size is finer around St Peters Station and most conducive to walking.

Looking more broadly at connectivity across the St Peters interchange area, the key roads in the vicinity of the St Peters interchange include multi-lane roads that carry high volumes of vehicles daily. These road corridors provide a lower level of pedestrian amenity due to the high volume of traffic that they carry. High traffic volumes create an environment that discourages pedestrian activity along the corridor, and also creates a barrier for pedestrian movement as pedestrians need to cross at either overhead pedestrian bridges or at formal pedestrian crossings across many traffic lanes. There are also several commercial and recreational areas that have a larger grid size and create barriers to pedestrian access between public rail transport and trip attractors.

5.5.4 Existing traffic volumes and patterns

Table 5-10 provides the 2014 AM peak hour, PM peak hour and average weekday traffic (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 5-10 Average mid-block traffic volumes at key locations around St Peters and surrounds (2014 count data)

Location	Direction	AM Peak		PM Peak		AWT Flow	
		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%	19,000	6%
	Southbound	560	9%	1,600	4%	17,500	7%
Princes Highway, south of Campbell Street	Northbound	1,720	11%	1,040	6%	19,500	9%
	Southbound	610	10%	1,550	9%	18,000	10%
Euston Road, north of Campbell Road	Northbound	410	13%	190	7%	3,000	13%
	Southbound	200	23%	190	7%	2,500	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%	7,500	11%
	Westbound	160	21%	320	13%	3,500	14%
Campbell Street, east of May Street	Eastbound	360	8%	320	8%	5,000	8%
	Westbound	140	16%	280	11%	3,000	12%
Ricketty Street	Eastbound	2,290	7%	1,160	9%	22,000	11%
	Westbound	960	17%	1,830	7%	20,500	12%
Gardeners Road, west of O'Riordan Street	Eastbound	1,090	13%	920	15%	14,000	14%
	Westbound	1,000	11%	1,120	12%	15,000	11%

Source: Traffic surveys (2014)

Notes: Vehicles per hour rounded to the nearest 10 and vehicles per day rounded to the nearest 500.
AWT count data not available at all locations
HCV% refers to the percentage of heavy vehicles that make up the total number of vehicles

6 Existing road network performance

6.1 Introduction

This section outlines existing road network performance in the President Avenue intersection, St Peters interchange to President Avenue intersection corridor and St Peters interchange and surrounds study areas.

The assessment of the existing operational performance of the road network around the proposed President Avenue intersection and the St Peters interchange considered the following aspects of performance:

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

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.

6.2 President Avenue intersection and surrounds

6.2.1 Network performance

Table 6-1 presents the 2014/15 base case performance of the VISUM modelled road network for the President Avenue intersection and surrounds, as presented in **Figure 4-2**, 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 congested conditions on the road network in the modelled area.

Table 6-1 President Avenue intersection and surrounds: VISUM 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)	0	0
% of total traffic demand	0%	0%

6.2.2 Intersection performance

Table 6-2 presents Vissim modelled intersection performance in the AM and PM peak hour for key intersections in the President Avenue corridor study area, while **Table 6-3** presents VISUM modelled intersection performance in the AM and PM peak hour for key intersections in the wider modelled road network.

As noted in section 4.3.2, for the purpose of analysing intersection performance, 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.

Table 6-2 indicates that the key intersections in the President Avenue corridor perform at LoS D or better.

Table 6-3 indicates that, in the wider modelled road network, the key intersections perform at LoS D or better, except for:

- 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 – that performed poorly in the AM and PM peak hours
- The West Botany Street / Bay Street intersection, which experienced poor levels of service during the PM peak hour.

Table 6-2 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

Table 6-3 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
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

6.2.3 Traffic crashes

Table 6-4 summarises the crash history for five years (1 January 2012 to 31 December 2016) on the key roads around the President Avenue intersection that were identified as warranting additional attention based on crash density mapping.

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 6-4 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

Crash severity indices, presented in **Table 6-5**, provide a means of assessing road safety based on the type and number of crashes occurring on a route, where a larger proportion of crashes with fatalities, or injuries, will result in a higher crash severity index. The average crash severity index on three of the eight roads assessed was more than 1.30, exceeding the Sydney Metropolitan average of 1.29, and the NSW average of 1.30.

Table 6-5 President Avenue intersection and surrounds: crash severity indices (Jan 2012 to Dec 2016)

Road section	Crash Severity Index
Princes Hwy (Gannon St to Jubilee Ave)	1.27
Rocky Point Rd (Princes Hwy to Jubilee Ave)	1.31
West Botany St (Princes Hwy to President Ave)	1.24
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	1.28
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	1.26
President Ave (Princes Hwy to The Grand Pde)	1.35
O'Connell St / Chuter Ave (President Ave to Barton St)	1.24
Bay St (Princes Hwy to The Grand Pde)	1.32
Sydney Metropolitan average / NSW average - all roads	
Sydney Metropolitan Area	1.29
NSW	1.30

Source: Summarised from crash reports, 2018

Table 6-6 indicates that the majority of roads assessed for crash patterns around the President Avenue intersection and surrounds have a higher crash rate per million vehicle kilometres travelled (MVKT) than the average for NSW and the Sydney Metropolitan area. Of the roads assessed, about 60% had a crash rate more than double the NSW average, and more than 30% had a crash rate more than double the Sydney Metropolitan average.

Table 6-6 President Avenue intersection and surrounds: crash rates per 100MVKT (Jan 2012 to Dec 2016)

Road	Section length (km)	ADT (veh)	Crash rates per 100MVKT			
			Total	Fatal	Injury	Tow-away
Princes Hwy (Gannon St to Jubilee Ave)	6.4	48,800	101.7	0.2	54.0	47.5
Rocky Point Rd (Princes Hwy to Jubilee Ave)	0.9	24,100	136.5	2.5	75.8	58.1
West Botany St (Princes Hwy to President Ave)	3.6	19,200	195.2	0.0	94.4	100.8
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	6	79,100	46.0	0.1	25.2	20.7
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	2.4	55,900	58.8	0.0	30.2	28.6
President Ave (Princes Hwy to The Grand Pde)	1.5	31,900	107.7	2.3	65.3	40.1
O'Connell St / Chuter Ave (President Ave to Barton St)	0.9	12,300	84.4	0.0	39.7	44.7
Bay St (Princes Hwy to The Grand Pde)	2	15,600	214.3	1.8	128.3	84.3
Sydney Metropolitan average / NSW average - all roads						
Sydney Metropolitan Area (Jan 2012 to Dec 2013)			68.8	0.2	29.4	39.2
NSW			49.1	0.5	27.2	21.4

Source: Summarised from crash reports, 2018

Table 6-7 provides details of the crash costs for the key roads surrounding the President Avenue intersection. Average crash costs based on crash severity have been calculated using Roads and Maritime's Economic Analysis Manual (Economic Parameters for 2009).

Crash costs per MVKT consider the number of vehicles on a section of road, the length of the section of road, and the severity of the accident (whether there is a fatality, injury or if it is a tow-away accident), and hence provide a means of comparing road safety on different roads. The crash cost per MVKT on each of the road sections assessed around the President Avenue intersection are generally in line with the corresponding crash rates per MVKT presented in **Table 6-6**. However, the impact of accident severity on crash costs is also evident, especially on President Avenue, which has a lower crash rate per MVKT than West Botany Street, but a higher crash cost per MVKT, reflecting the higher severity index on this road.

Table 6-7 President Avenue intersection and surrounds: crash costs (Jan 2012 to Dec 2016)

Road	Section length (km)	ADT (veh)	Crash cost		
			Total cost	Average annual cost	Cost per 100MVKT
Princes Hwy (Gannon St to Jubilee Ave)	6.4	48,800	$63,406,000	$12,681,000	$11,120,000
Rocky Point Rd (Princes Hwy to Jubilee Ave)	0.9	24,100	$11,737,000	$2,347,000	$29,674,000
West Botany St (Princes Hwy to President Ave)	3.6	19,200	$21,335,000	$4,267,000	$16,928,000
The Grand Pde/General Holmes Dr (Southern Cross Dr to Barton St)	6	79,100	$41,866,000	$8,373,000	$4,836,000
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	2.4	55,900	$13,615,000	$2,723,000	$5,562,000
President Ave (Princes Hwy to The Grand Pde)	1.5	31,900	$24,716,000	$4,943,000	$28,315,000
O'Connell St / Chuter Ave (President Ave to Barton St)	0.9	12,300	$717,000	$143,000	$3,558,000
Bay St (Princes Hwy to The Grand Pde)	2	15,600	$23,703,000	$4,741,000	$41,644,000

Source: Summarised from crash reports, 2018

6.3 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 6-8**. 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 6-8 Average AM and PM peak period speeds along key roads within 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

6.4 St Peters interchange and surrounds

Network performance and intersection performance analysis around the St Peters interchange is presented in **section 6.4.1** and **section 6.4.2**. It is noted that currently traffic conditions around the St Peters interchange are temporarily altered due to the construction of the New M5 Motorway project with road network layouts and traffic conditions changing frequently during the construction periods. To allow an assessment that reflects the unaltered road network performance for comparison, the network performance reported is for the situation prior to construction of the New M5 Motorway project commencing.

6.4.1 Network performance

Table 6-9 presents the 2014/15 base scenario performance of the modelled road network for the St Peters interchange and surrounds, as presented in **Figure 4-3**, 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 6-9 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%

6.4.2 Intersection performance

Table 6-10 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. Analysis of forecast SMPM traffic flow differences as a result of the project identified these intersections as those that would be impacted by the project.

As noted in **section 4.3.2**, for the purpose of analysing intersection performance, 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.

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 6-10 St Peters interchange and surrounds: 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
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

6.4.3 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 6-11**.

Table 6-11 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

Source: Summarised from crash reports, 2018

Crash severity indices provide an assessment of road safety based on the type and number of crashes occurring on a route. Fatal, injury and tow-away crashes carry different weightings; they are determined independently of absolute traffic volumes and calculated to establish the average level of severity of crashes that occur. The following equation is applied to calculate the crash severity indices with results presented in **Table 6-12**.

$$Crash\ Severity\ Index = \frac{[(No.of\ fatal\ crashes * 3.0) + (No.of\ indury\ crashes * 1.5) + (No.of\ non - inury\ crashes)\}}{Total\ no.of\ crashes}$$

Source: Roads and Maritime Crash Data. 2013

It was found that key roads around the St Peters interchange have an average crash severity index equal to the Sydney Metropolitan average, of 1.29, and slightly lower than the NSW average of 1.30.

Table 6-12 St Peters interchange and surrounds: crash severity indices (Jan 2012 to Dec 2016)

Road section	Crash Severity Index
Princes Highway (Enmore Road to Gannon Street)	1.29
Canal Road / Ricketty Street / Gardeners Road (Princes Highway to Botany Road)	1.28
Euston Road (Sydney Park Road to Campbell Road)	1.26
Bourke Road (Wyndham Street to Gardeners Road)	1.32
Sydney Metropolitan average / NSW average - all roads	
Sydney Metropolitan Area	1.29
NSW	1.30

Source: Summarised from crash reports, 2018

Crash rates per 100 million vehicle kilometres travelled (MVKT), have been calculated and are shown in **Table 6-13**. These rates allow for comparison between the safety performance of different roads as they take into account both the number of vehicles on the road as well as the length of the road section. This measure can be used to help compare the safety performance on longer roads with high traffic volumes with that on shorter roads with lower traffic volumes.

Analysis indicates that many of the roads assessed for crash patterns around the St Peters interchange have a crash rate per million vehicle kilometres travelled that is significantly higher than the average for the Sydney Metropolitan area, as well as the average across NSW. This is likely due to the congested traffic conditions and mix of light and heavy vehicles in the St Peters network.

Table 6-13 St Peters interchange and surrounds: crash rates per 100MVKT (Jan 2012 to Dec 2016)

Road	Section length (km)	ADT (veh)	Crash rates per 100MVKT			
			Total	Fatal	Injury	Tow-away
Princes Highway (Enmore Rd to Gannon St)	4.1	39,400	128.6	0.7	72.6	55.3
Canal Rd / Ricketty St / Gardeners Rd (Princes Highway to Botany Rd)	4.7	34,300	57.1	0.0	32.0	25.2
Euston Rd (Sydney Park Rd to Campbell Rd)	0.9	4,800	556.9	0.0	291.1	265.8
Bourke Rd (Wyndham St to Gardeners Rd)	2.2	11,400	124.2	0.0	80.6	43.6
Sydney Metropolitan average / NSW average - all roads						
Sydney Metropolitan Area (Jan 2012 to Dec 2013)			68.8	0.2	29.4	39.2
NSW			49.1	0.5	27.2	21.4

Source: Summarised from crash reports, 2018

Table 6-14 provides details of the crash costs for the key roads surrounding the St Peters interchange. Average crash costs based on crash severity have been calculated using Roads and Maritime's Economic Analysis Manual (Economic Parameters for 2009).

Crash costs per MVKT act similarly to crash rates per MVKT, in being a measure of road safety that allows comparison between different roads since they also take into account the number of vehicles on a section of road, as well as the length of the section of road. However, the crash costs per 100MVKT also reflect the severity of injuries, where a higher crash cost per MVKT could indicate a higher proportion of injury and or fatal crashes. Around the St Peters interchange, the crash costs per MVKT are reflective of relevant crash rates for each of the road sections; with Euston Road displaying the highest crash cost rate, and Canal Road / Ricketty Street / Gardeners Road, displaying the lowest.

Table 6-14 St Peters interchange and surrounds: crash costs (Jan 2012 to Dec 2016)

Road	Section length (km)	ADT (veh)	Crash cost		
			Total cost	Average annual cost	Cost per 100MVKT
Princes Highway (Enmore Road to Gannon St)	4.1	39,400	$57,777,000	$11,555,000	$19,599,000
Canal Rd / Ricketty St / Gardeners Rd (Princes Highway to Botany Rd)	4.7	34,300	$15,213,000	$3,043,000	$5,174,000
Euston Rd (Sydney Park Rd to Campbell Rd)	0.9	4,800	$3,591,000	$718,000	$45,447,000
Bourke Rd (Wyndham St to Gardeners Rd)	2.2	11,400	$6,669,000	$1,334,000	$14,532,000

Source: Summarised from crash reports, 2018

7 Assessment of construction impacts

7.1 Construction overview

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.

Construction of the project is expected to take around four years, which includes commissioning that would occur concurrently with the final stages of construction. Construction activities are described in detail in section 7.4 of Chapter 7 (Construction work) of the EIS. The anticipated hours of operation for key construction activities are also outlined in section 7.6 of Chapter 7 of the EIS.

Civil works would be required including earthworks in Rockdale 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. Following exhibition of the EIS, the Response to Submissions and Preferred Infrastructure Report would likely describe some changes to the indicative construction plans reported in this section and the resultant traffic, safety and construction management plans would then form part of the road occupancy licences for the construction works.

Heavy vehicles would deliver and remove construction plant, equipment and materials as well as remove waste 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.

The anticipated hours of operation for key construction activities are also outlined in section 7.6 of Chapter 7 of the EIS. The construction period would also result in increased use of light vehicles on the surrounding road network to cater for the construction workforce, including shift workers for tunnelling activities.

Six construction ancillary facilities, as well as three other construction sites, required to construct components of the project that lie outside the boundaries of the construction ancillary facilities, are identified in Chapter 7 (Construction work) of the EIS. The 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 ancillary facilities required to support construction of the project include:

- Arncliffe construction ancillary facility (C1)
- Rockdale construction ancillary facility (C2)
- President Avenue construction ancillary facility (C3)
- Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5)
- Princes Highway construction ancillary facility (C6).

The three additional construction sites that lie outside the boundaries of the construction ancillary facilities would be located at the following locations:

- Between Bestic Street and the President Avenue construction ancillary facility for the construction of the shared cycle and pedestrian pathways
- 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 upgrade works.

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 proposed permanent power supply connection would be constructed within and outside the project footprint to service the construction and operation of the project. The power line would be constructed underground either by trenching or, where required, under-boring. Where the power line crosses waterways or railways, it would be installed in a conduit attached to an existing bridge. 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.

Temporary road closures associated with the works are detailed in **section 7.4.3**, while temporary impacts on bus stop locations are detailed in **section 7.4.5**. Temporary changes to pedestrian and cyclist access and movements are summarised in **section 7.4.6**.

7.2 Construction ancillary facilities

The construction boundaries and construction ancillary facilities are shown in overview in **Figure 7-1**. 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 section 7.3 of Chapter 7 (Construction work) of the EIS.

C1

- Tunnelling and spoil handling
- Construction of MOC1 (Water treatment plant, substation)
- Fitout, testing and commissioning of tunnels and MOC 1

C2

- Construction of the decline tunnel
- Tunnelling and spoil handling
- Pavement works for internal access road
- Construction of MOC2
- Reconfiguration of the site to enable ongoing/future use for maintenance activities

C3

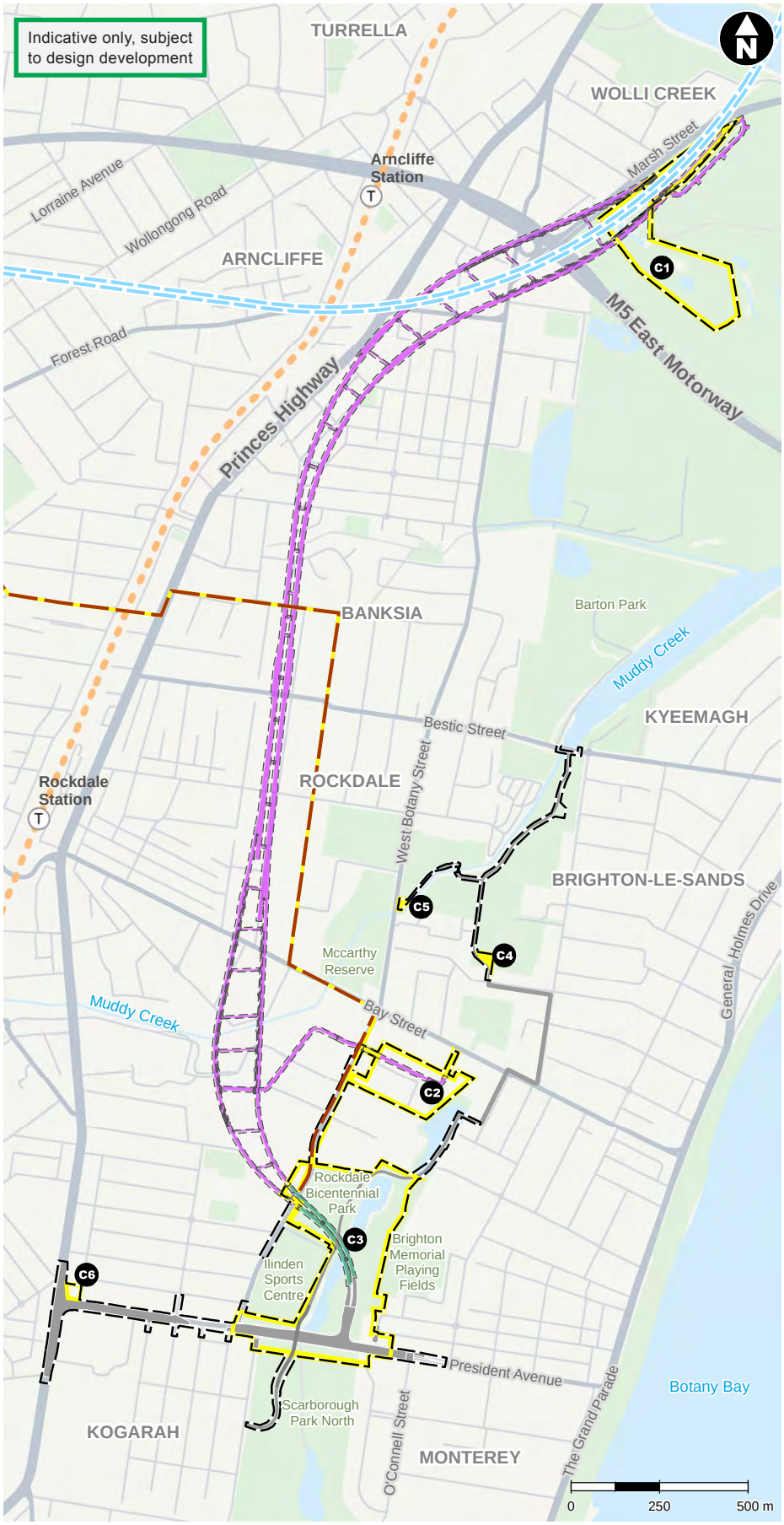
- Demolition of buildings and vegetation clearing and removal
- Relocation of utilities
- Temporary stockpiling of spoil and fill materials
- Management of any contaminated land, including acid sulphate soils
- Construction of cut-and-cover structures
- Construction of MOC3 (Rockdale ventilation facility and substation)
- President Avenue intersection upgrade works
- Construction of shared pedestrian and cyclist path and overpass

C4/C5

- Site establishment
- Vegetation clearing and removal, topsoil stripping areas and land-form shaping
- Temporary stockpiling of materials
- Construction of the shared pedestrian and cyclist path
- Finishing works including lighting, line marking and signage installation

C6

- Property adjustment and demolition
- Relocation of utilities, stormwater infrastructure, underground storage tanks and substation
- Laydown and parking of construction vehicles and equipment
- Reinstatement of site



LEGEND

- Surface works
- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- Permanent power supply line
- Permanent power supply construction route
- New M5 Tunnel
- Road
- Waterway
- Railway line
- Railway station
- Parks and recreation

Figure 7-1 Overview of construction boundary and construction ancillary facilities

7.2.1 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.

An indicative site layout for the Arncliffe construction ancillary facility is shown in **Figure 7-2**.

Tunnelling and spoil management within the Arncliffe construction ancillary facility (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 Motorway 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.

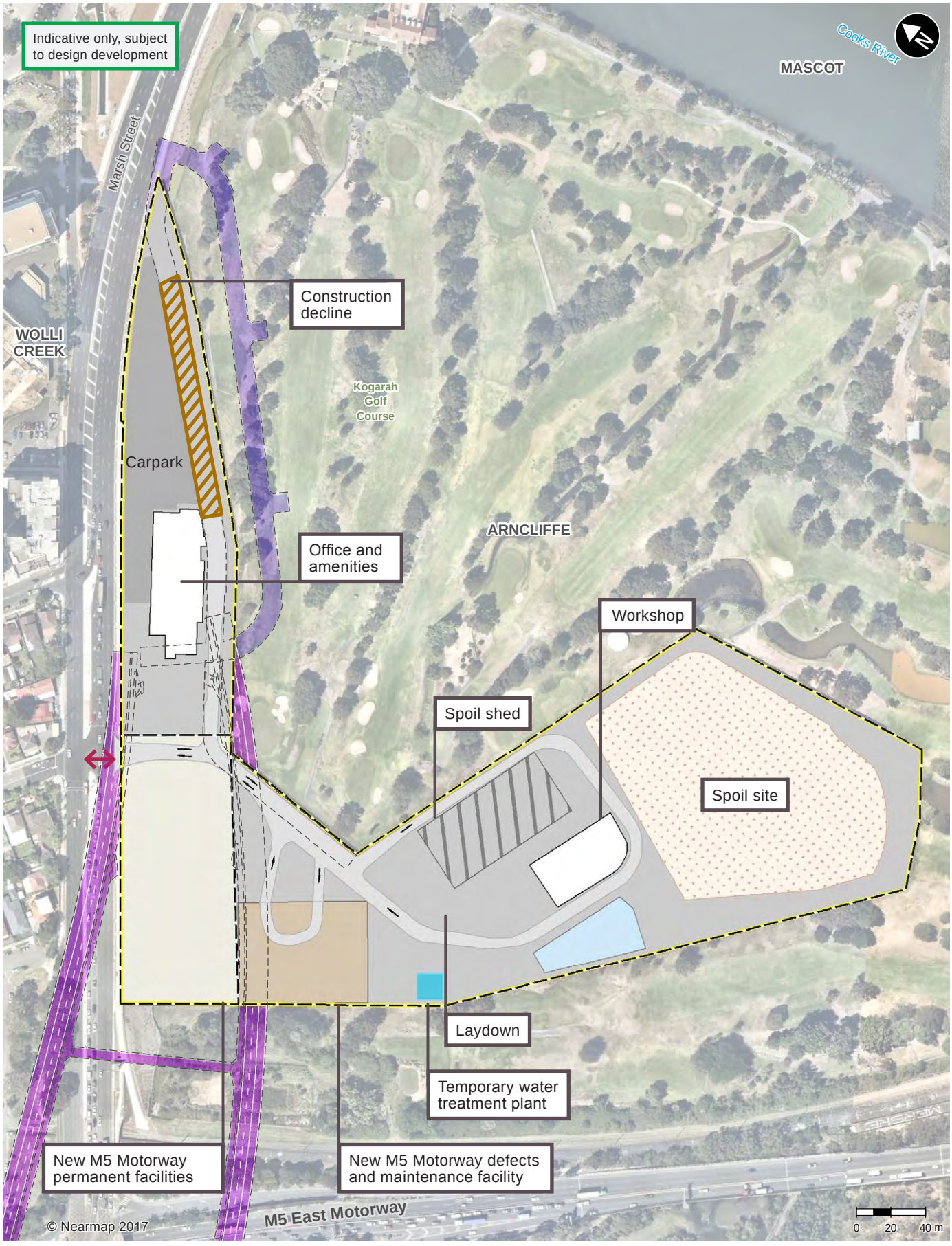


Figure 7-2 Arncliffe construction ancillary facility (C1) layout

7.2.2 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. The Rockdale construction ancillary facility (C2) would be used to support tunnelling, including loading of spoil and spoil removal.

An indicative site layout for the Rockdale construction ancillary facility is shown in **Figure 7-3**.

Spoil handling at the Rockdale construction ancillary facility (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.

Figure 7-3 Rockdale construction ancillary facility (C2) layout

7.2.3 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 intersection, the construction of the Rockdale Motorway Operations Complex (south) (MOC3), including the Rockdale ventilation facility, and surface works.

An indicative site layout for the President Avenue construction ancillary facility is shown in **Figure 7-4**.

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

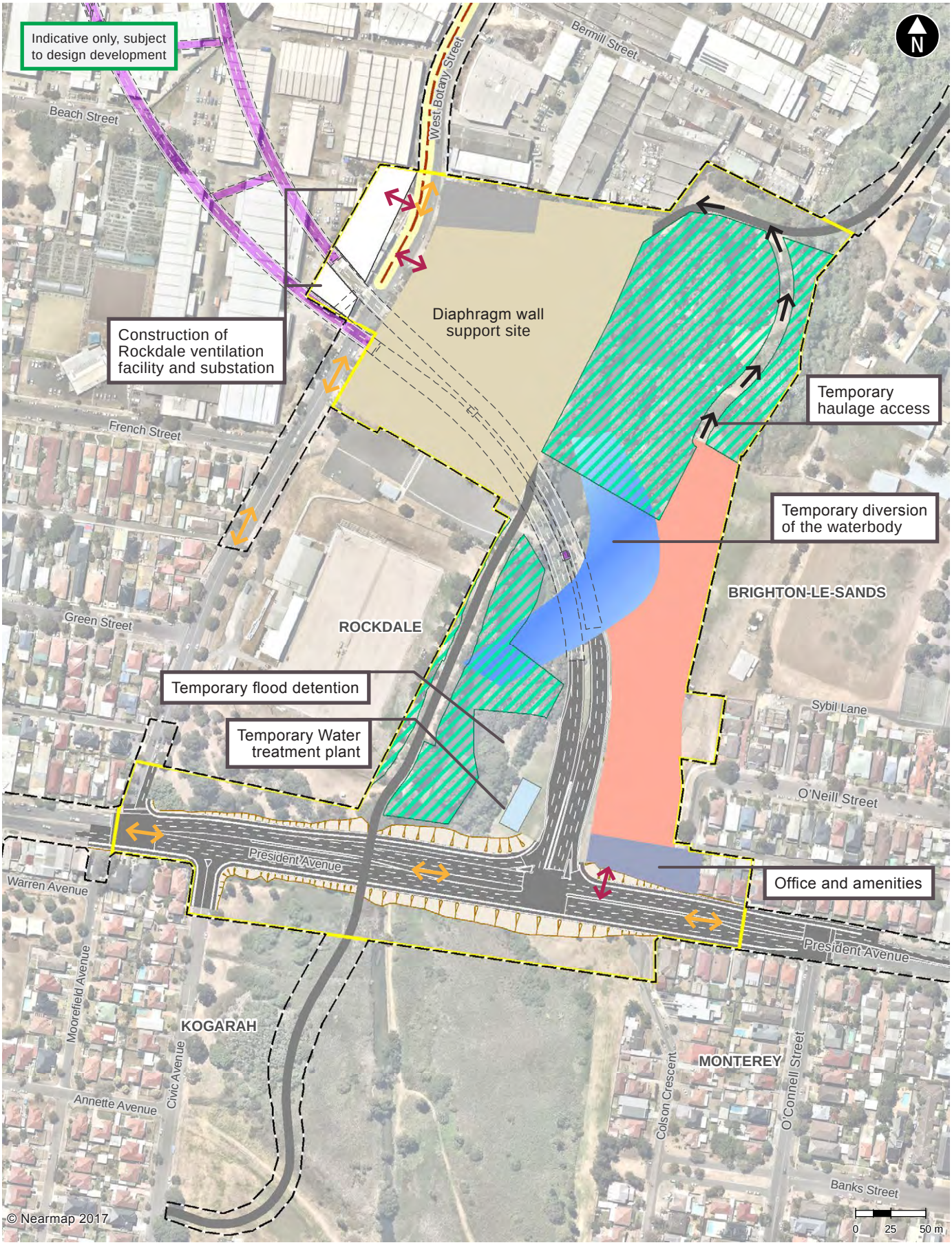
The following entry and exit points are anticipated for use at the President Avenue construction ancillary facility (C3) site:

- 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 President Avenue construction ancillary facility (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.



LEGEND

- Surface works
- Embankment
- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- Underground construction - Temporary access tunnel
- Building
- Carpark
- Sediment basin
- Soil treatment area
- Carpark and facilities
- Waterbody diversion
- Diaphragm wall support site
- Vehicle access
- Vegetation exclusion zone
- Permanent power supply line
- Permanent power supply construction boundary
- Through traffic maintained during construction

Figure 7-4 President Avenue construction ancillary facility (C3) layout

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

The construction of the shared cycle and pedestrian pathways between Bestic Street and Bruce Street would be supported by the shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5). The construction ancillary facilities are shown in **Figure 7-5**.

Entry and exit

Access and egress to shared cycle and pedestrian pathways construction ancillary facility east (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 Shared cycle and pedestrian pathways construction ancillary facility west (C5).

Local road impacts

A small volume of heavy and light vehicles would use Bruce Street, a local road, to access shared cycle and pedestrian pathways construction ancillary facility west (C5). The daily and peak hour traffic forecasts are provided in **section 7.3.1**.

Figure 7-5 Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) layout

7.2.5 Princes Highway construction ancillary facility (C6)

The Princes Highway 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)
- 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.

An indicative site layout for the construction ancillary facility is shown in **Figure 7-6**.

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.

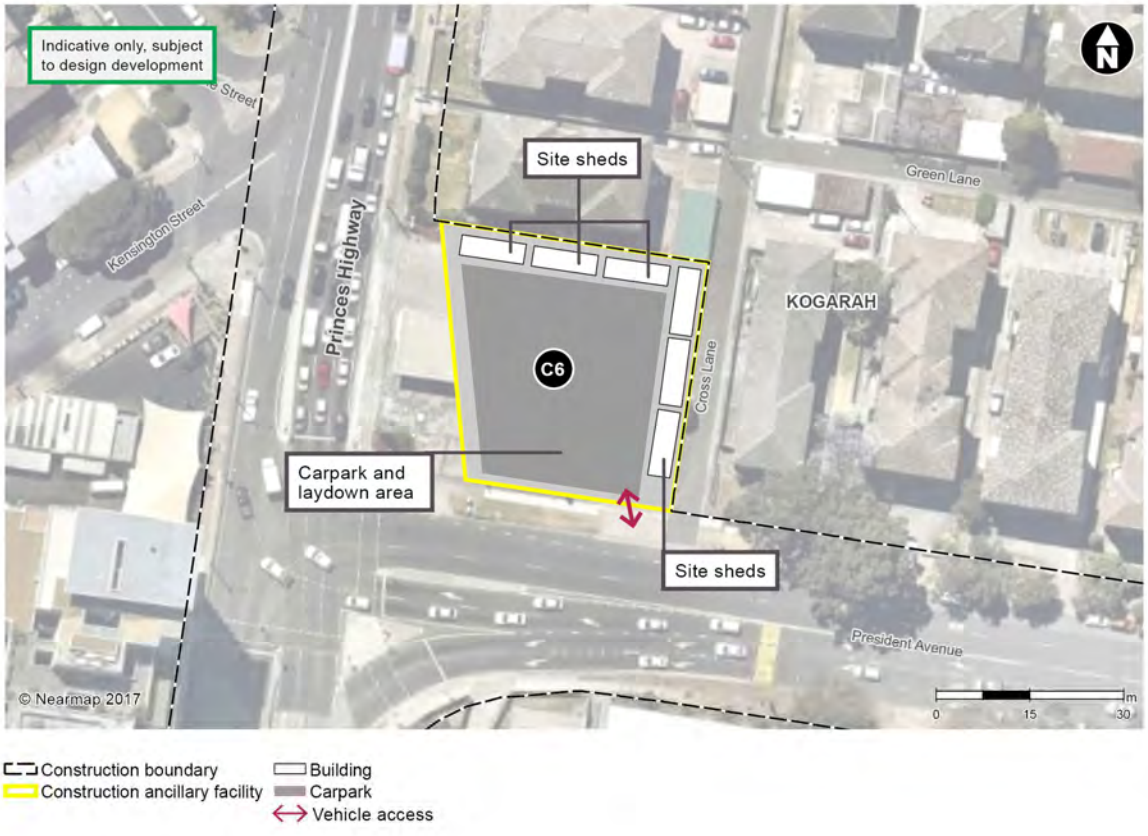


Figure 7-6 Princes Highway construction ancillary facility (C6) layout

7.2.6 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 located:

- 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. Refer to **Table 7-1** for indicative construction vehicle numbers for access from Bestic Street
- South of President Avenue, east of Civic Avenue for the construction of the shared cycle and pedestrian pathways and President Avenue shared cycle and pedestrian bridge
- President Avenue / Princes Highway intersection (within the construction boundary), to facilitate upgrade works
- Along the route of the proposed 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.

7.3 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 and construction worker parking.

7.3.1 Construction traffic generation and distribution

Construction vehicles expected to access the works include:

- Light vehicles (e.g. workforce parking)
- 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 7-1 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 the construction volume peak period has been modelled at each location for consistency. Much lower light vehicle volumes would be generated outside of these peak arrival and departure hours, so this 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 7-7** to **Figure 7-9**. 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 within the Arncliffe construction ancillary facility (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.

Table 7-1 shows that the highest volumes of heavy construction vehicles are forecast at the Arncliffe construction ancillary facility (C1) and the Rockdale construction ancillary facility (C2). Construction vehicles would use the M5 East tunnel rather than the surface road network, wherever possible.

Table 7-1 Indicative daily and peak period construction traffic volumes

Location		Daily vehicles (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[7]	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 7-2 provides details of indicative heavy vehicle construction volumes on key roads during the AM peak and PM peak hours. The table shows that up to 82 construction heavy vehicles are predicted to travel on the M5 East Motorway (two-way) during the AM and PM peak hours. Additionally, it is anticipated that volumes on West Botany Street, south of Bay Street (two-way) would increase by up to 52 construction heavy vehicles during the PM peak hour (with a smaller increase during the AM peak hour). Increases of around two construction heavy vehicles are expected on other roads such as Princes Highway, north of Bay Street and President Avenue, east of West Botany Street.

Table 7-2 Indicative peak period distribution of heavy vehicles

Road location	AM peak hour	PM peak hour
M5 East Motorway, west of Marsh Street	66	82
Princes Highway, north of Bay Street	2	2
West Botany Street, south of Bay Street	36	52
President Avenue east of West Botany Street	2	2

[7] The PM volumes from 4-5pm have been used for this site to provide a more conservative assessment as volumes drop substantially after 5pm

Figure 7-7 Indicative spoil haulage routes – Arncillfe construction ancillary faciliy (C1)

LEGEND

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

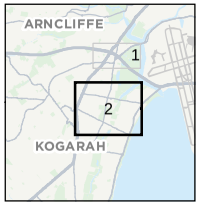
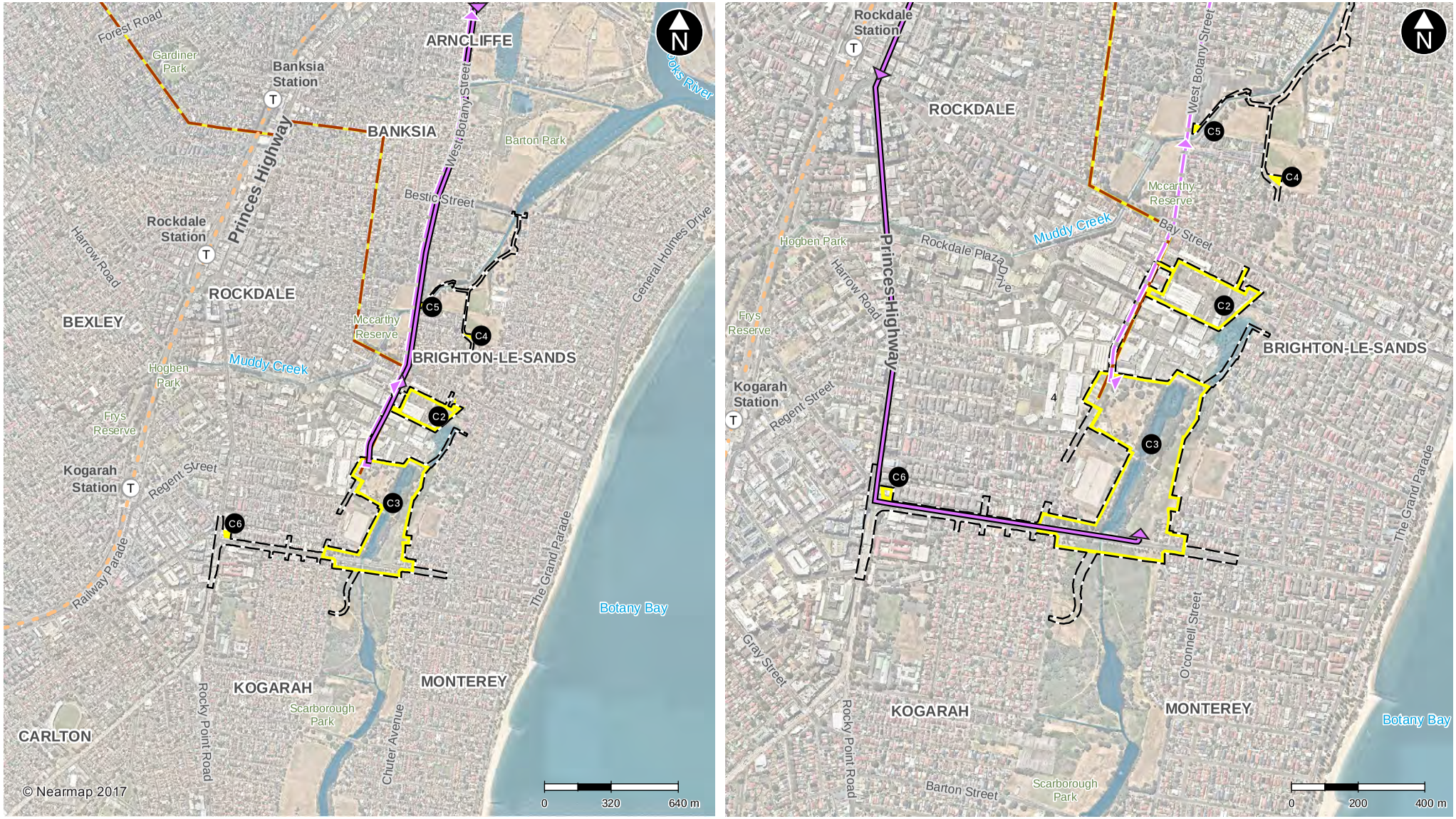


Figure 7-8 Indicative spoil haulage routes – Rockdale construction ancillary facility (C2)



LEGEND

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

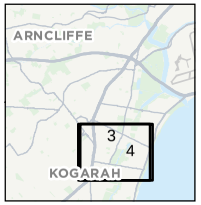


Figure 7-9 Indicative spoil haulage routes – President Avenue construction anciliary facility (C3)

7.3.2 Construction workforce parking

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

It is anticipated that construction workforce parking would be provided at the following sites:

- Arncliffe construction ancillary facility (C1) – around 140 car parking spaces
- Rockdale construction ancillary facility (C2) – around 50 car parking spaces
- President Avenue construction ancillary facility (C3) – around 150 car parking spaces
- Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) – around 10 parking spaces at each construction ancillary facility
- Princes Highway construction ancillary facility (C6) – around 25 car parking spaces.

The President Avenue construction ancillary facility (C3) would provide a substantial amount of on-site car parking, as shown in **Table 7-3**. Some parking of construction-related vehicles in adjacent local roads would occur during site establishment while site entrances and car parking areas are constructed.

To assist in minimising impacts on on-street parking around construction ancillary facilities, the construction workforce would be encouraged to use public transport (where feasible). All construction ancillary facilities are located about a 15-minute walk from a train station. Rockdale construction ancillary facility (C2) and President Avenue construction ancillary facility (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.

A preliminary assessment of parking provision, based on approximate peak workforce estimates anticipate that the total parking provision at the construction ancillary facility sites would be able to meet forecast parking demand, as shown in **Table 7-3**. While Rockdale construction ancillary facility (C2) has a forecast deficit, the surplus at other sites could be used to accommodate the overflow from this site.

Table 7-3 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
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

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 impacts on on-street parking on local roads around the construction ancillary facilities. The strategy would be developed in consultation with local councils and stakeholders associated with public facilities adjacent to project sites, as well as with the New M5 Motorway contractors (where relevant).

The car parking strategy would include items such as forecasting of construction parking demand, review of existing parking supply and use on local streets in the area, predicted impacts on existing parking, consultation activities and proposed mitigation measures, such as management of workforce parking and transport, alternative parking arrangements and communication and engagement. This would include the identification of areas where there are high levels of existing parking demand around the construction ancillary facilities and works sites and identifying alternative car parking sites for use by the construction workforce. Processes for monitoring, reporting and corrective actions would also be part of the strategy.

7.3.3 Indicative access routes

The proposed access to the construction sites is summarised in **Table 7-4** and shown in **Figure 7-7**, **Figure 7-8** and **Figure 7-9**. Wherever possible, access is proposed to be gained directly from arterial roads. Use of local roads by heavy vehicles delivering materials and/or equipment would be required to access the shared cycle and pedestrian pathways construction ancillary facility (C5). **Table 7-1** sets out estimated daily construction vehicle numbers during construction. Details about construction hours, including hours during which spoil haulage would occur, are provided in **Chapter 7** (Construction) of the EIS.

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

Table 7-4 Indicative access routes to and from construction ancillary facilities

Location	Access and egress routes (heavy vehicles)	Access and egress routes (light vehicles)
Arncliffe construction ancillary facility (C1)	The existing arrangement, for construction of the New M5 Motorway, would be maintained: the signalised intersection on Marsh Street is left and right-in, left-out	The existing arrangement, for construction of the New M5 Motorway, 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	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.	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.
SCPP construction ancillary facilities (C4 and C5)	West Botany Street: left-in, left-out Bruce Street: right-in, left-out	West Botany Street: all movements Bruce Street: right-in, left-out
Princes Highway construction ancillary facility (C6)	President Avenue: left-in, left-out	President Avenue: left-in, left-out

7.4 Construction impact assessment

This section presents the impact assessment from construction activities on proposed access routes, public transport, pedestrians and cyclists. An indication of the need to close, divert or otherwise reconfigure elements of the road, cycle and pedestrian network is also presented and assessed.

7.4.1 Background traffic volumes and patterns

Based on the construction program presented in **Figure 2-3**, 2021 has been used as the assessment year for construction impacts, as this is when peak construction traffic volumes are expected.

As shown in **Table 7-5**, between the 2015 base case and 2021 there are significant changes to forecast traffic volumes, particularly in the AM peak hour. The base volumes were taken from intersection turning count surveys with forecast growth calculated as described in **section 4.2.2**.

Table 7-5 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[8]	EB	1,030	1,260	+22	650	820	+26
	WB	390	670	+72	690	770	+12

^Traffic volume rounded to nearest 10

7.4.2 Intersection performance

The intersection performance results on the road network under the 2021 'without construction' and 'with construction' forecast volumes for the AM and PM peak hours are summarised in **Table 7-6**. The assessment was undertaken using LinSig intersection models as described in **section 4.2.4**. The intersections identified are those where construction traffic is passing through the network in significant volumes, particularly along West Botany Street and the vicinity of the M5 East ramps at Marsh Street.

The construction modelling 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.

[8] Bestic Street volumes are to a 2018 base

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), and the Marsh Street / Flora Street / Arncliffe construction ancillary facility (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 the intersection, with this approach experiencing the best levels of service at the 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.

Table 7-6 2021 AM and PM peak hour intersection operational performance summary^

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

Traffic volumes associated with the Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) are not considered in the intersection analysis as they are forecast to only operate for about nine months and generate minimal construction traffic, as shown in **Table 7-1**.

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 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 7-Eleven 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 the current operation of the 7-Eleven petrol station and the auto service centre. 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 minimal or reduced from current operations.

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

These intersections would operate on demand and would not be expected to require more than minimum green time of six seconds. The impact on traffic movements is therefore expected to be minor. A 'keep clear' facility may be required at the Rockdale construction ancillary facility (C2) to accommodate right turning heavy vehicles close to the Bay Street intersection. This would be confirmed in the CTAMP.

7.4.3 Temporary closures and diversion during construction

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.

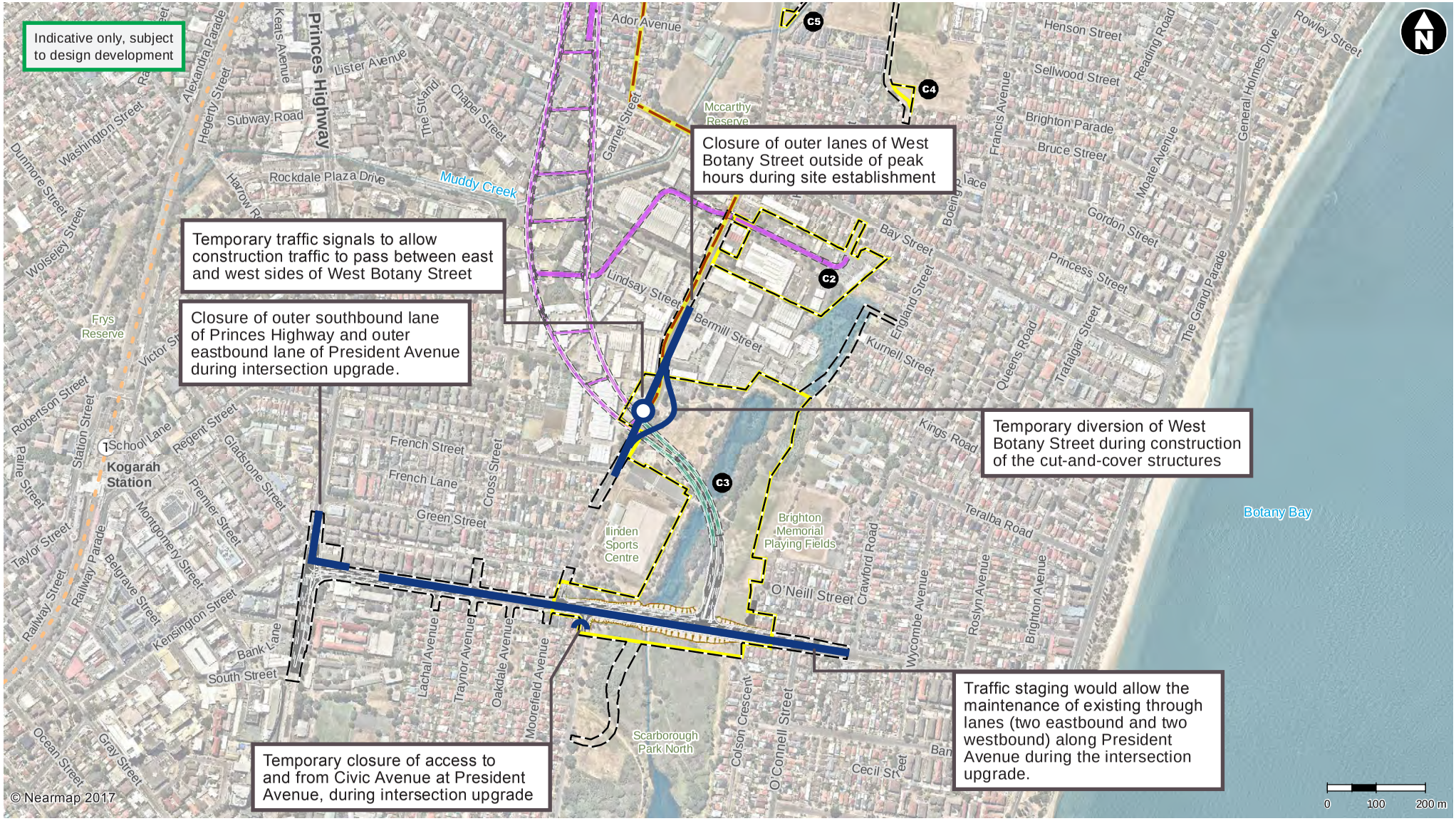
Detailed traffic staging and the use of temporary retaining walls would allow the maintenance of existing through lanes (at least two eastbound and two westbound) and turn movements along President Avenue during construction. President Avenue would have to be closed to traffic during the lifting of the President Avenue shared cycle and pedestrian 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 the President Avenue construction ancillary facility (C3).

Other changes to the road network around President Avenue are anticipated to include the following (refer to **Figure 7-10**):

1. Temporary diversion of West Botany Street for the cut-and-cover structures across West Botany Street
2. Reinstatement of original alignment of West Botany Street following construction of the cut and cover structures
3. Temporary traffic signals along West Botany Street at the President Avenue construction ancillary facility (C3) to allow construction traffic to pass from MOC3 on the eastern side to the western side of West Botany Street
4. Temporary closure of Civic Avenue to ensure the safety of construction workers and road users during the President Avenue intersection upgrade
5. Reopening of Civic Avenue to 'left in' and 'left out' turns only following the President Avenue intersection upgrade
6. Permanent closure of access to and from President Avenue at Moorefield Avenue and O'Neill Street (at President Avenue) during the President Avenue intersection upgrade
7. Temporary closure of the outer southbound lane of Princes Highway and outer eastbound lane of President Avenue for several weeks during the Princes Highway / President Avenue intersection upgrade works to complete the widening works. Vehicular access will be blocked during utilities relocation and pavement widening works, as the existing lanes are already less than three metres wide in this location, limiting the potential to temporarily narrow the existing lanes
8. Reopening of lanes at the Princes Highway / President Avenue intersection following the upgrade works.

The detailed design process will 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.

The posted speed along West Botany Street and President Avenue may be reduced for safety reasons and to facilitate traffic management during construction.



LEGEND

- Surface works
- Embankment
- Construction boundary
- Underground construction
- Construction ancillary facility
- Permanent power supply line
- Permanent power supply construction boundary
- Waterbody
- Railway line
- Railway station
- Temporary change to the road network
- Temporary traffic signal
- Temporary road closure

Figure 7-10 Temporary changes to the road network during construction

7.4.4 Impact 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 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 the President Avenue construction ancillary facility (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 10.3.8.

7.4.5 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.

As illustrated in **Figure 7-4**, the President Avenue construction ancillary facility (C3) would be located on land currently used for two sports pitches in Bicentennial Park East and would require the removal of the existing 60-space car park in the north western corner of Bicentennial Park (accessed from West Botany Street). On-street parking along sections of President Avenue adjacent to the sports centre would also be removed during construction. The car park and on-street parking would be reinstated following completion of construction. The majority of the 200-space and 22-space parking areas located adjacent to the north and west of the Ilinden Sports Centre would not be impacted by the project. However, construction of the cut and cover structure would require some (about five) car spaces to be temporarily removed from the 200-space parking area.

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 small impact on sports field parking. The development of the CTAMP would include consultation with Bayside Council and local stakeholders 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.

7.4.6 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 cul-de-sacs. These changes would slightly increase travel times for motorists. However, the creation of cul-de-sacs 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.

7.4.7 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, where, as a worst case scenario, construction would generate between about 195-245 PCU in the peak hours on the M5 East and between about 195-210 PCU in the peak hours on West Botany 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 detailed in **section 11.1**.

7.4.8 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. Bus stops are located at the following locations within the construction boundary:

- President Avenue (eastbound) at O'Neill Street, Brighton-Le-Sands
- President Avenue (eastbound) at West Botany Street, Kogarah
- President Avenue (westbound) at Traynor Avenue, Kogarah
- President Avenue (eastbound) at Cross Street, Kogarah
- President Avenue (eastbound) opposite TAFE Sydney, Kogarah
- Two stops at James Cook Boys Technology High School, Kogarah – located along the southbound side of Princes Highway.

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 generally be minimal impacts on rail services.

7.4.9 Active transport (walking and cycling)

The impacts on pedestrians and cyclists were assessed based on broad criteria outlined in **Table 7-7**, which were developed to determine the potential impact and corresponding management and mitigation measures. 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 7-7 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 7-8**. 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 7-8 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.

7.4.10 Proposed 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.

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 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 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.

7.5 Cumulative construction impacts

The following projects that may have potential cumulative construction impacts were reviewed:

- M4-M5 Link
- New M5 Motorway
- Sydney Gateway
- Sydney Metro City & Southwest (Chatswood to Sydenham).

7.5.1 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)[9].

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.

7.5.2 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.

7.5.3 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.

7.5.4 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[10].

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 underway 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[11].
- 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[12].

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

[9] WestConnex M4-M5 Link EIS, Aug 2017
[10] Sydney Metro Chatswood to Sydenham EIS, May 2016
[11] Ibid
[12] Ibid

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 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.

8 Assessment of operational impacts without the project

8.1 Sydney metropolitan road network

This section details the 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.

8.1.1 'Do minimum' (2026)

The 2026 'do minimum' case assumes NorthConnex, the WestConnex program of works and Sydney Gateway projects are complete, but that the F6 Extension Stage 1 has not been built. It is called 'do minimum' rather than 'do nothing' as it assumes ongoing improvements would be made to the broader transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.

Figure 8-1 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2014/2015 'base case' and the 2026 '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 2026 'do minimum' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. The band thickness is indicative of the magnitude of this change.

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 Motorway. The forecast traffic on the WestConnex motorway is illustrated by the red bands on these links.

Increased daily traffic is also 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. The amount of red on **Figure 8-1** represents this background increase in traffic.

Table 8-1 compares the vehicle kilometres travelled (VKT) and the vehicle hours travelled (VHT) in the 2026 'do minimum' scenario with the 'base case' scenario for general traffic. An increase in VKT and VHT is forecast on an average weekday on the Sydney road network compared to the 2014/15 base case scenario. The forecast indicates declining productivity of the road network.

Table 8-1 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	0.370	2.140	2.510
Do minimum	2026	28.290	84.710	113.000	0.520	3.100	3.620
Percentage change		+29%	+27%	+28%	+41%	+45%	+44%

Source: SMPM v.1, February 2018

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 East 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 as would be expected due to the working port function of Port Botany.

Table 8-2 compares the vehicle kilometres travelled (VKT) and the vehicle hours travelled (VHT) in the 2026 'do minimum' scenario with the 'base case' scenario for heavy vehicles.

Table 8-2 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%

Source: SMPM v.1, February 2018

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.

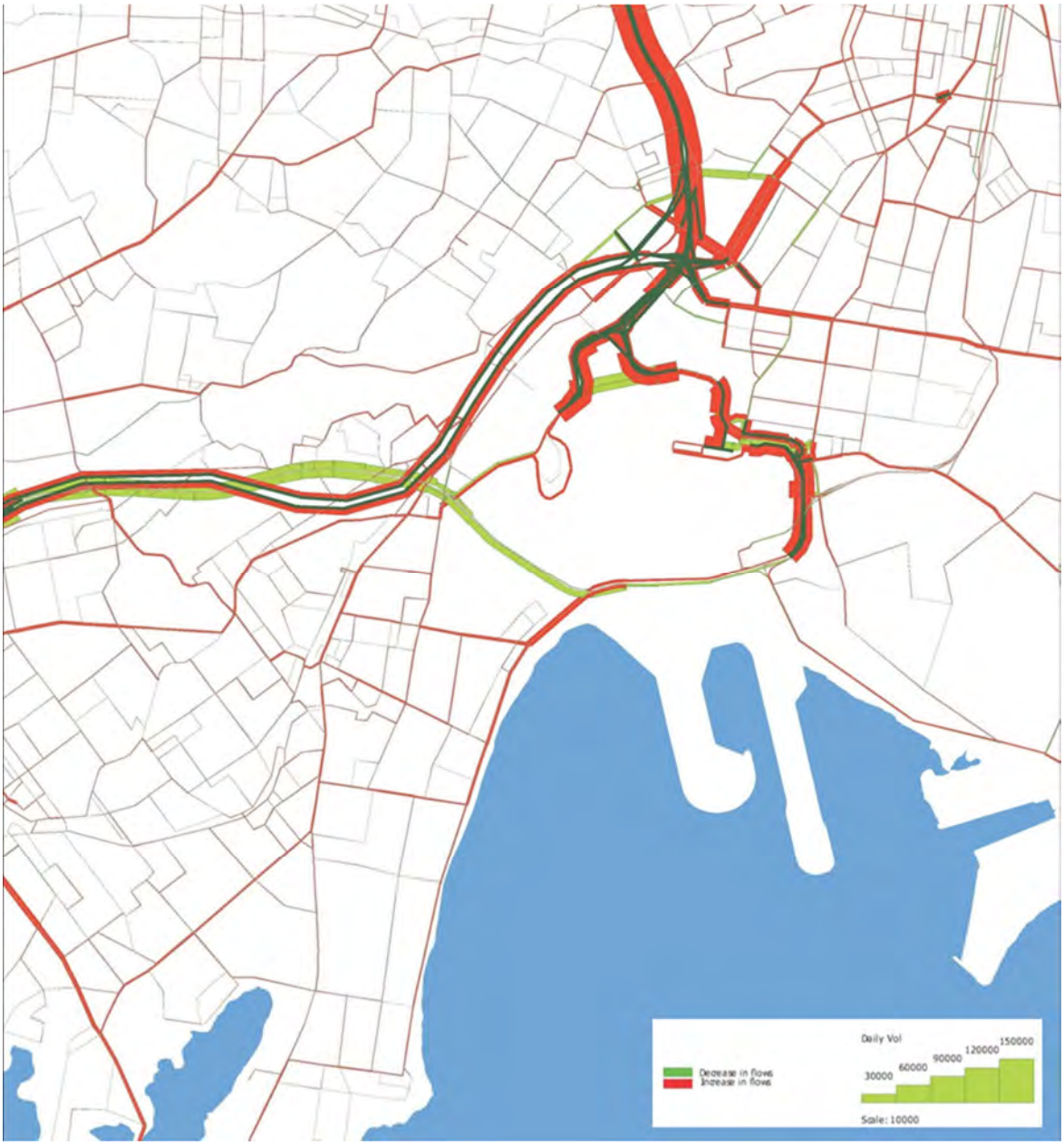


Figure 8-1 Difference in AWT between 2026 'do minimum' and base year scenarios

Source: SMPM v.1, February 2018

8.1.2 'Do minimum' (2036)

The 2036 'do minimum' case assumes NorthConnex, the WestConnex program of works and Sydney Gateway projects are complete, but that the F6 Extension Stage 1 has not been built. It is called 'do minimum' rather than 'do nothing' as it assumes ongoing improvements would be made to the broader transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.

Figure 8-2 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2036 'do minimum' and the 2014/2015 'base case' scenarios. As before, roads that are expected to carry less traffic in the future 2036 'do minimum' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red.

General traffic

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 Motorway. The forecast traffic on the WestConnex motorway is illustrated by the red bands on these links.

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.

The amount of red shown on **Figure 8-2** is representative of the background increase in traffic due to the forecast growth in population and employment across the Sydney metropolitan area.

Table 8-3 compares the VKT and the VHT in the 2026 and 2036 'do minimum' scenarios with the 'base case' scenario for general traffic. Again, an increase in VKT and VHT is forecast on an average weekday on the Sydney road network compared to the 2014/15 base case scenario. The increase in VHT is more than VKT indicating that the network is becoming so congested that an increase in traffic on the network is causing a faster increase in travel time.

Table 8-3 Comparison of daily MVKT and MVHT for metropolitan Sydney in 2036 '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	0.370	2.140	2.510
Do minimum	2026	28.290	84.710	113.000	0.520	3.100	3.620
Do minimum	2036	32.800	100.940	133.740	0.750	4.880	5.630
Percentage change (2014/15 to 2036)		+49%	+52%	+51%	+103%	+128%	+124%

Source: SMPM v1, February 2018

On-road freight

The key changes in heavy vehicle traffic between the 2014/2015 '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 East 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 results in a forecast net increase in heavy vehicles on the M5 East Motorway, despite the shift in a significant proportion of these vehicles to the WestConnex motorway.

Table 8-4 compares the VKT and the VHT in the 2026 and 2036 'do minimum' scenarios with the 'base case' scenario for heavy vehicles.

Table 8-4 Comparison of daily MVKT and MVHT for metropolitan Sydney in 2036 '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
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 v1, February 2018

On-road public transport

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.

Figure 8-2 Difference in AWT between 2036 'do minimum' and base year scenarios

Source: SMPM v.1, February 2018

8.2 Operational performance – President Avenue intersection and surrounds

8.2.1 Changes to road network in 'do minimum' scenario

Projects within other Roads and Maritime programs were included in the operational modelling for the 'do minimum' scenario. 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, Kogarah / Gray St intersections and The Grand Parade and President Avenue, Brighton-Le-Sands intersection.

8.2.2 Network performance

2026 'do minimum' scenario

Table 8-5 and **Table 8-6** present a comparison of the performance of the VISUM modelled road network between the 2014/15 'base case' scenario and 2026 'do minimum' scenario for the AM and PM peak hours.

AM peak hour

In 2026, there is a forecast increase in demand of about 14 per cent compared to the base case, primarily due to forecast changes in population and employment distribution. This growth in demand is forecast to cause a significant worsening in network performance of the modelled road network with average vehicle speed forecast to decrease by about 16 per cent and average time spent by a vehicle in the modelled network forecast to increase by about 18 per cent compared to the base case.

Table 8-5 President Avenue intersection and surrounds: VISUM modelled network performance – 2026 AM peak hour (2014/15 'base case' vs 2026 'do minimum' scenario)

Network measure	2014/15 'base case'	2026 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	28,070	32,100	+14%
Total vehicle kilometres travelled in network (km)	81,220	90,670	+12%
Total time travelled approaching and in network (hr)	3,470	4,630	+33%
Total vehicles arrived	27,130	29,580	+9%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	2.8	-3%
Average time travelled in network (mins)	7.4	8.7	+18%
Average speed (km/h)	23.4	19.6	-16%
Unreleased vehicles			
Unreleased demand (veh)	0	200	-
% of total traffic demand	0%	<1%	-

PM peak hour

Similar to the AM peak hour, there is a forecast increase in demand of about 16 per cent compared to the base case, primarily due to forecast changes in population and employment distribution. This growth in demand is forecast to cause a significant worsening in network performance of the modelled road network with average vehicle speed in the modelled network forecast to reduce by about 15 per cent and average time spent by a vehicle in the modelled network forecast to increase by about 13 per cent compared to the base case.

Table 8-6 President Avenue intersection and surrounds: VISUM modelled network performance – 2026 PM peak hour (2014/15 'base case' vs 2026 'do minimum' scenario)

Network measure	2014/15 'base case'	2026 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	28,990	32,670	+13%
Total vehicle kilometres travelled in network (km)	86,010	93,110	+8%
Total time travelled approaching and in network (hr)	3,090	3,940	+28%
Total vehicles arrived	28,700	31,090	+8%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.0	2.9	-3%
Average time travelled in network (mins)	6.4	7.2	+13%
Average speed (km/h)	27.9	23.6	-15%
Unreleased vehicles			
Unreleased demand (veh)	0	220	-
% of total traffic demand	0%	<1%	-

2036 'do minimum' scenario

Table 8-7 and **Table 8-8** present a comparison of the performance of the modelled road network between the 2026 and 2036 'do minimum' scenarios for the AM and PM peak hours.

AM peak hour

By 2036, there is a forecast increase in demand of about 10 per cent compared to the 2026 'do minimum' scenario, primarily due to forecast changes in population and employment distribution. This additional growth in demand is forecast to again cause a significant worsening in network performance of the modelled road network with average vehicle speed forecast to reduce by about 10 per cent and average time spent by a vehicle in the modelled network forecast to increase by about 10 per cent compared to the 2026 'do minimum' scenario.

Table 8-7 President Avenue intersection and surrounds: VISUM modelled network performance – 2036 AM peak hour (2026 'do minimum' vs 2036 'do minimum'' scenario)

Network measure	2026 'do minimum'	2036 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	32,100	35,010	+9%
Total vehicle kilometres travelled in network (km)	90,670	96,120	+6%
Total time travelled approaching and in network (hr)	4,630	5,480	+18%
Total vehicles arrived	29,580	31,180	+5%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	2.8	0%
Average time travelled in network (mins)	8.7	9.4	+8%

Network measure	2026 'do minimum'	2036 'do minimum'	Percentage change
Average speed (km/h)	19.6	17.5	-11%
Unreleased vehicles			
Unreleased demand (veh)	200	510	-
% of total traffic demand	<1%	1%	-

PM peak hour

Similar to the AM peak hour, by 2036, there is a forecast increase in demand of nine per cent compared to the 2026 'do minimum' scenario, primarily due to forecast changes in population and employment distribution. This additional growth in demand is forecast to again cause a significant worsening in network performance of the modelled road network with the average time spent by a vehicle in the modelled network forecast to increase by around 13 per cent and the average vehicle speed in the modelled network forecast to reduce by about 13 per cent compared to the 2026 'do minimum' scenario.

Table 8-8 President Avenue intersection and surrounds: VISUM modelled network performance – 2036 PM peak hour (2026 'do minimum' vs 2036 'do minimum'' scenario)

Network measure	2026 'do minimum'	2036 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	32,670	35,460	+9%
Total vehicle kilometres travelled in network (km)	93,110	98,530	+6%
Total time travelled approaching and in network (hr)	3,940	4,810	+22%
Total vehicles arrived	31,090	32,720	+5%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	2.8	-3%
Average time travelled in network (mins)	7.2	8.1	+13%
Average speed (km/h)	23.6	20.5	-13%
Unreleased vehicles			
Unreleased demand (veh)	220	370	-
% of total traffic demand	<1%	1%	-

8.2.3 Intersection performance

Table 8-9 presents Vissim modelled intersection performance in the AM and PM peak hour for key intersections in the President Avenue corridor study area, while **Table 8-10** presents the VISUM modelled intersection performance in the AM and PM peak hour for key intersections in the wider modelled road network.

As noted in **section 4.3.2**, for the purpose of analysing intersection performance, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed, allowing an assessment of intersections within the modelled network, irrespective of any downstream queuing that would mask the actual operation of the intersection.

The intersection performance results demonstrate the following intersections are forecast to experience more delay in the 'do minimum' scenario by 2036, due to background traffic growth:

- The President Avenue / O'Connell Street intersection and the Princes Highway / President Avenue intersection, mainly due to high demand from Princes Highway (northbound) turning right into President Avenue, during the AM peak hour.
- The Princes Highway / Wickham Street / Forest Road, General Holmes Drive / Bestic Street, Princes Highway / Bay Street, West Botany Street / Bay Street and West Botany Street / Bestic Street intersections during the AM peak hour
- The Princes Highway / Wickham Street / Forest Road, Princes Highway / Bay Street, West Botany Street / Bay Street and West Botany Street / Bestic Street intersections during the PM peak hours.

Table 8-9 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 8-10 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

8.2.4 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 8-3** 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.

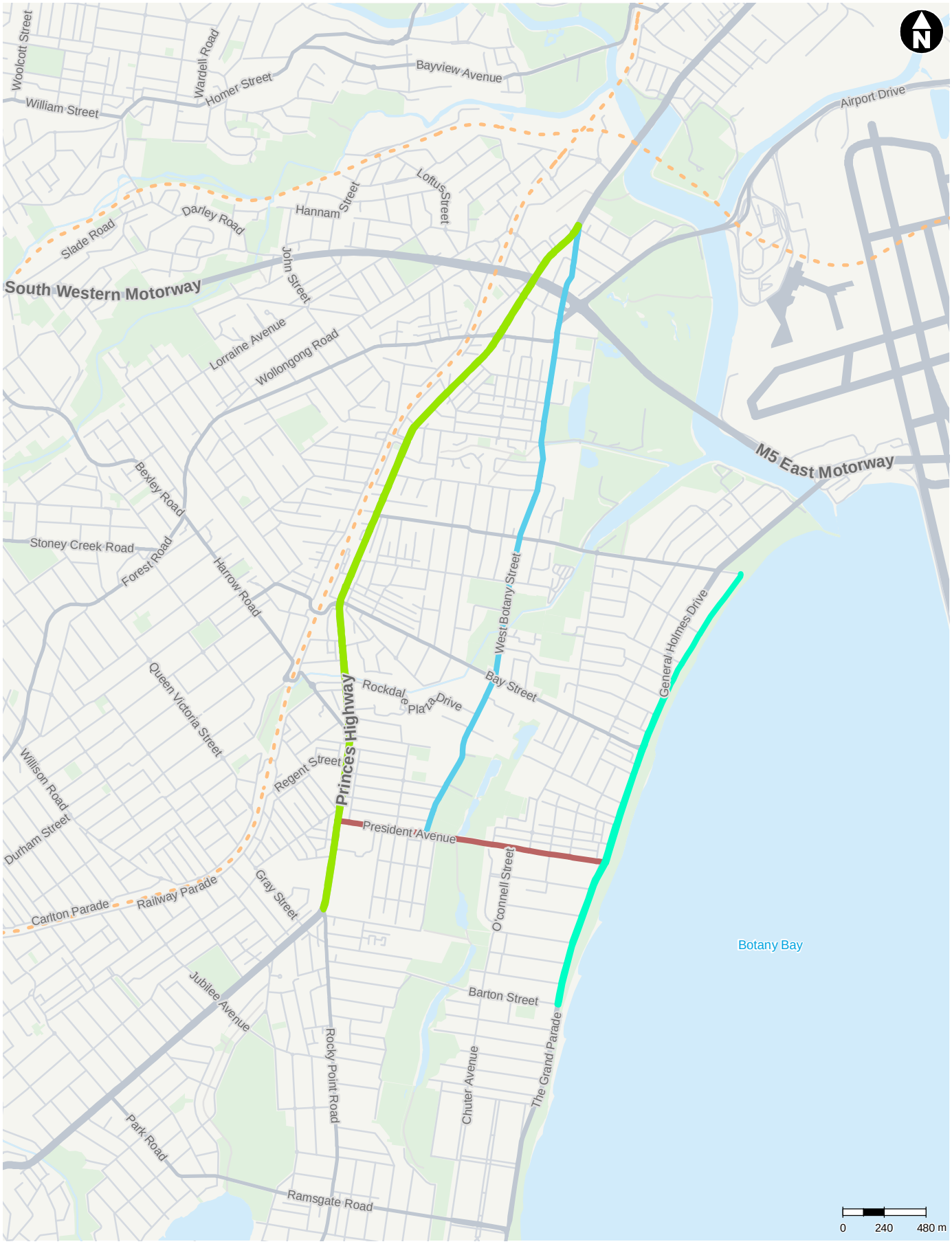


Figure 8-3 President Avenue intersection and surrounds: selected travel time routes

Figure 8-4 and **Figure 8-5** show a comparison of VISUM travel times recorded on the Princes Highway, West Botany Street and The Grand Parade routes in the 2014/2015 'base case' and 2026 and 2036 'do minimum' scenarios in the AM and PM peak hours.

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. Similar results are forecast in the PM peak hour, with increased travel times 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 forecast deterioration in network performance in the 'do minimum' scenarios associated with the forecast growth in traffic demand.

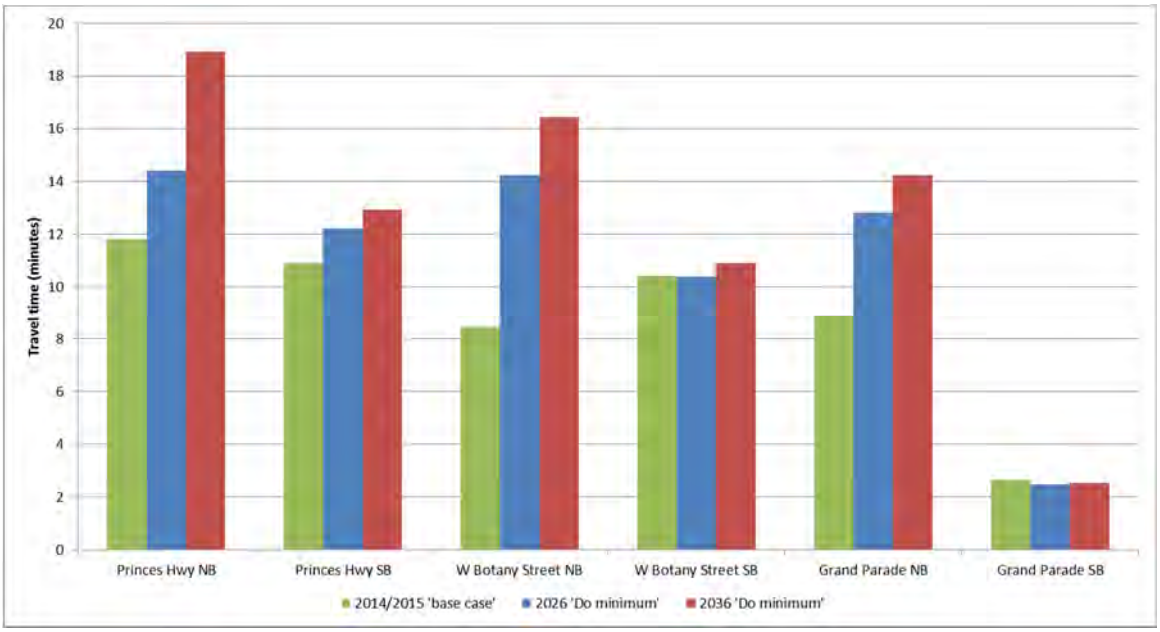


Figure 8-4 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – AM peak 'do minimum' scenarios

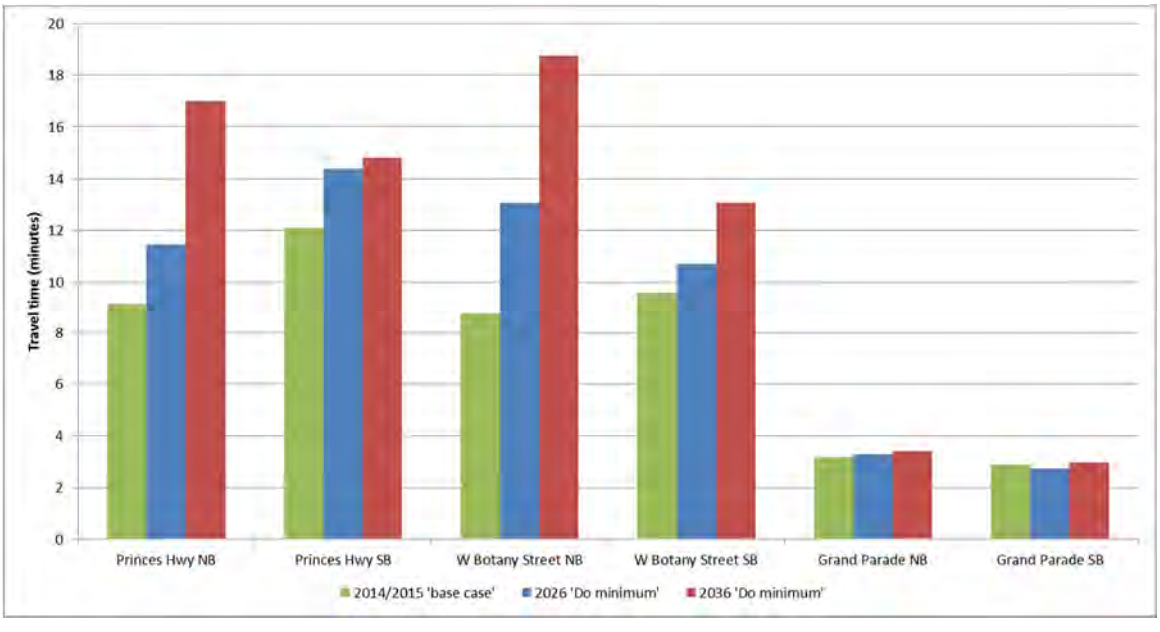


Figure 8-5 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – PM peak 'do minimum' scenarios

Table 8-11 presents a comparison of average travel times and speeds on the President Avenue route in the 2026 and 2036 'do minimum' scenarios extracted from the President Avenue corridor Vissim models. The increased travel times and reduced average speeds in the peak directions in each peak period reflect the deterioration in network performance in the 'do minimum' scenarios.

Table 8-11 President Avenue corridor: Vissim modelled average travel times and speeds – 2026 and 2036 'do minimum' scenarios

President Avenue routes	2014/15 'base case'		2026 'do minimum'		2036 'do minimum'	
	Travel Time (min)	Average speed (km/h)	Travel Time (min)	Average speed (km/h)	Travel Time (min)	Average speed (km/h)
AM peak hour						
Westbound	2.41	38	2.63	35	3.70	25
Eastbound	2.68	34	3.06	30	2.78	33
PM peak hour						
Westbound	2.71	34	2.89	32	3.13	29
Eastbound	2.73	34	2.60	36	2.44	38

8.2.5 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 6.2.3** – 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.

8.2.6 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 *Western Sydney Rail Needs Scoping Study* (Transport for NSW, 2016), indicates that by 2051, with Sydney Metro Northwest and Sydney Metro City & Southwest operational and running 20 x eight-car trains per hour, but without further investment in new rail lines or investment, there will be severe overcrowding, which will force some passengers to wait for the next train, on the T4 line. The *Draft Greater Sydney Services and Infrastructure Plan* (Transport for NSW, 2017) has highlighted that improvement to the T4 line will be investigated within the next ten years.

Bus services

Figure 8-6 shows the comparison of average bus travel time for five bus routes (303, 478, 400/410, 422 and 947) across the President Avenue intersection and surrounds modelled road network extracted from the VISUM models for the 'base case' and 2026 and 2036 'do minimum' scenarios 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.

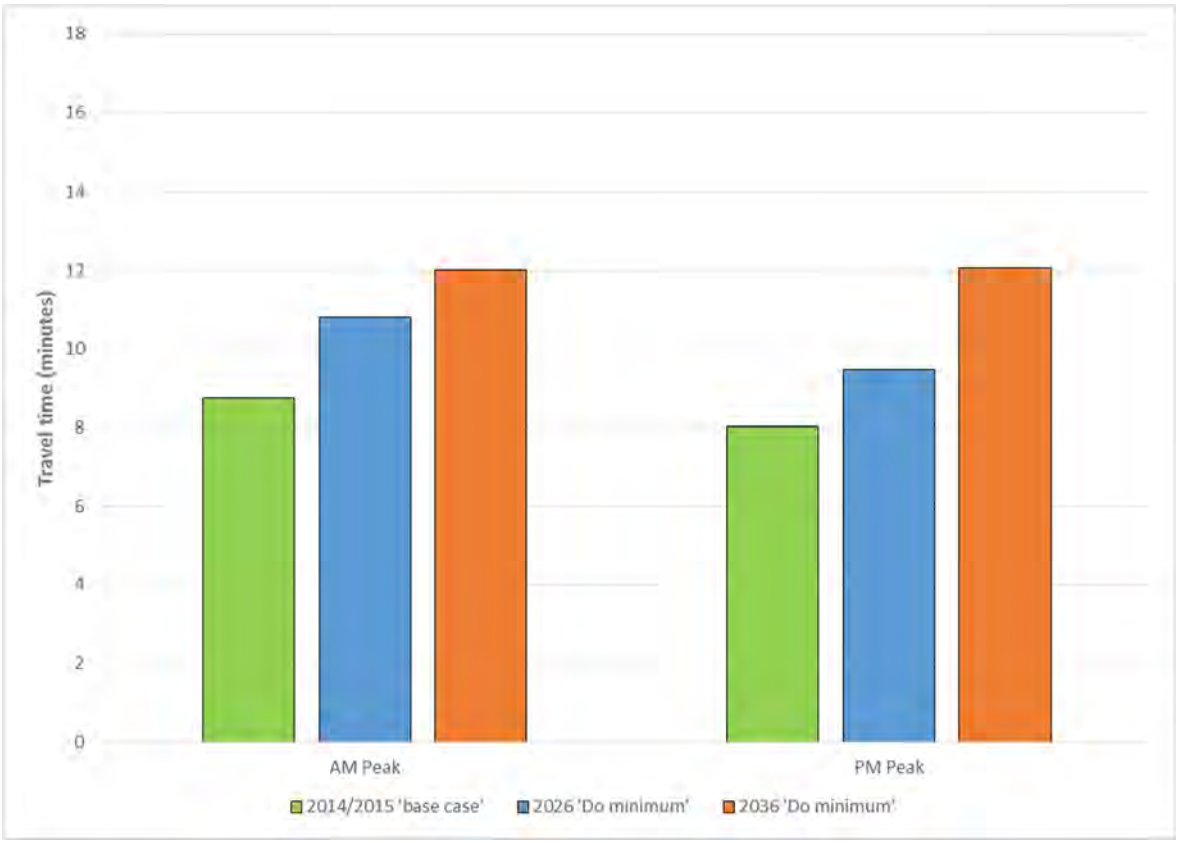


Figure 8-6 President Avenue intersection and surrounds: VISUM modelled average bus travel times – 'do minimum' comparison

Analysis was also carried out to understand the bus patronage changes forecast by the Sydney Strategic Travel Model (STM) for travel zones that fall within the traffic and transport assessment study area shown in Figure 1-2. A summary of the forecast is shown in **Table 8-12**.

The model forecasts fairly significant growth in both inbound and outbound trips, both in the peak periods and across the day. By 2026, it is forecast that bus patronage demand will have increased by around 20 per cent. Between 2026 and 2036, a further 20 per cent increase is forecast.

Table 8-12 Forecast bus patronage growth for the traffic and transport assessment study area

Time period[1]	Growth: base to 2026		Growth: 2026 to 2036	
	Inbound	Outbound	Inbound	Outbound
AM peak	23%	22%	19%	21%
PM peak	19%	26%	19%	18%
Daily total	26%	17%	17%	17%

[1] AM peak refers to STM 2 hour peak, PM peak refers to STM 3 hour PM peak, Daily total refers to the STM 24 hour total

Source: Transport Performance and Analytics (TPA) STM, 2018

8.2.7 Active transport (walking and cycling) facilities

The *Rockdale Town Centre Public Domain Plan* (Rockdale Council (now part of Bayside Council), 2012) envisages the activation of the Princes Highway though the Rockdale Town Centre to include predominantly retail activity with ground floor shops, and activity spilling out onto the pavement from cafes and restaurants. The plan also includes plans to improve streetscape amenity on the Princes Highway around Bestic Street and Rockdale Plaza Drive.

Existing and forecast traffic volumes on the Princes Highway are likely to increase the difficulty in achieving these outcomes. 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.

The Public Domain Plan aims to provide pedestrian and cycle connections between open spaces to encourage vitality with increased opportunities for a variety of recreational activities. This is shown in **Figure 8-7**.

The *Brighton-Le-Sands Parking Strategy* (Rockdale Council (now part of Bayside Council), 2014) contains a number of initiatives to increase utilisation of walking, cycling and public transport to access the Brighton-Le-Sands village centre. These include improving the pedestrian walking environment and creating a cycle network, as illustrated in **Figure 8-8**.

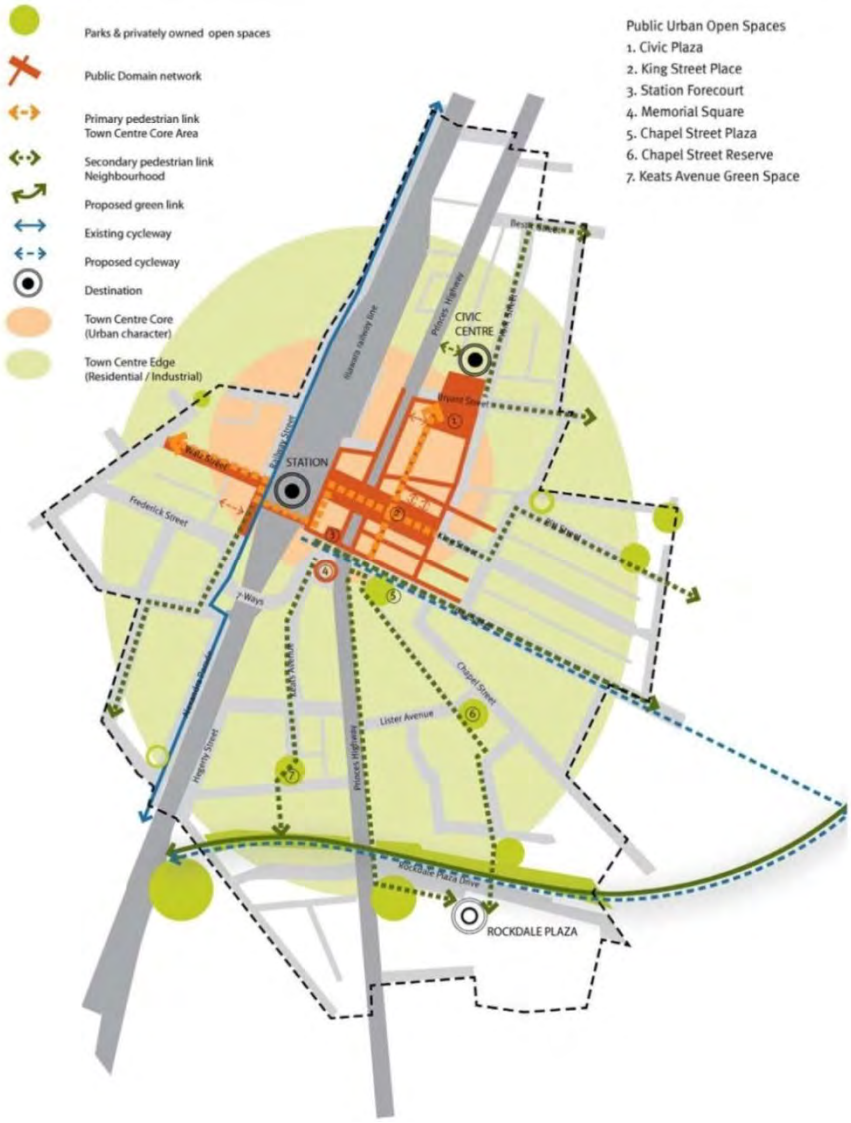


Figure 8-7 Rockdale Town Centre: Public Urban Space Network and Connectivity

Source: *Rockdale Town Centre Public Domain Plan (*Rockdale Council (now part of Bayside Council)), 2012

Figure 8-8 Brighton-Le-Sands: Recommended pedestrian path upgrades and cycle path network

Source: *Brighton-Le-Sands Parking Strategy* (Rockdale Council (now part of Bayside Council)), 2012

8.3 Operational performance – St Peters interchange and surrounds

8.3.1 Changes to road network in 'do minimum' scenario

The following changes to the road network are planned and were therefore included in the 2026 and 2036 'do minimum' scenarios:

- In accordance with planned Pinch Point works by Roads and Maritime at the Princes Highway / Railway Road intersection, the Railway Road approach was changed to a left lane marked for left turning traffic only, which joins Princes Highway at a give-way slip lane, and a right lane marked for right turning traffic only at the signals. The two-lane section develops about 70 metres before the stop line. The Princes Highway northbound approach has three through lanes with the left-hand lane shared with left turning traffic. The Princes Highway southbound approach consists of two through lanes and a single right turn lane.
- The Airport North project, which consists of improvements to the Domestic Triangle and O'Riordan Street corridor between Robey Street and Bourke Road, as follows:
    - Provision of a third lane in both directions on O'Riordan Street between Robey Street and Bourke Road
    - At the O'Riordan Street / King Street intersection, provision of new southbound dedicated right turn lane, approximately 75 metres long
    - At the O'Riordan Street / Robey Street intersection, the Robey Street eastbound approach is signalised to provide a crossing for pedestrians, the O'Riordan Street southbound approach has four through lanes and a signalised slip lane for left turning traffic
    - At the Qantas Drive / Robey Street intersection, the eastbound left turn is converted from free flowing to dual signalised left-turn lanes with the provision of pedestrian crossing. Qantas Drive is changed to three eastbound through lanes and two westbound through lanes with dual right-turn lanes into Robey Street from the east. The airport exit is changed to three northbound through lanes to Robey Street, two right-turn lanes to Qantas Drive eastbound and two left-turn lanes through the signal to Qantas Drive westbound.
    - At the O'Riordan Street / Robey Street intersection four southbound through lanes are provided.
    - The O'Riordan Street / Joyce Drive intersection on the north approach changes to three right-turn lanes, one of which is for buses, and two left-turn lanes. There is another dedicated free-flow left-slip lane from O'Riordan Street which leads directly to a new access to the airport located further east on Joyce Drive/General Holmes Drive
- A number of network improvements in the Mascot Town Centre Precinct:
    - At the O'Riordan Street / Bourke Road intersection, the northbound left turn into Bourke Road is converted from a single lane to two lanes and the southbound right-turn from Bourke Road into O'Riordan Street is changed to three lanes at the stop line.
    - The south approach of the Bourke Street / Coward Street intersection is changed to two signalised left-turn lanes and a shared through and right lane
    - The north approach of the Kent Road / Coward Street intersection is changed to dual signalised left-turn lanes and a shared through and right lane
    - The Ricketty Street / Kent Road intersection is changed on the north approach to provide two southbound through lanes into Kent Road
    - At the Gardeners Road / Kent Road intersection, the layout is changed from a T-junction to a four-legged intersection. The northern leg is to provide access to local businesses and is a left-in / left-out arrangement. The west approach has two through lanes and dual right turn lanes approximately 90 metres long. The east approach is similar to the previous design, with three through lanes, but the left turn bay is converted to a signalised slip lane with a pedestrian crossing. The southbound exit is changed to two lanes to accommodate the dual right-turn lanes from the west approach. This then flares out to three lanes.
    - The Gardeners Road / O'Riordan Street intersection is changed to provide three through lanes eastbound and westbound on Gardeners Road with separate right and left turn lanes

from Gardeners Road into O'Riordan Street northbound. The south approach is widened to provide two northbound through lanes and a separate right-turn lane. There is also a short signalised left-turn lane.

- The west approach to the Gardeners Road / Botany Road intersection is changed to provide a second right-turn lane.

- The Mascot Town Centre Precinct changes are shown in **Figure 8-9**, **Figure 8-10** and **Figure 8-11**.

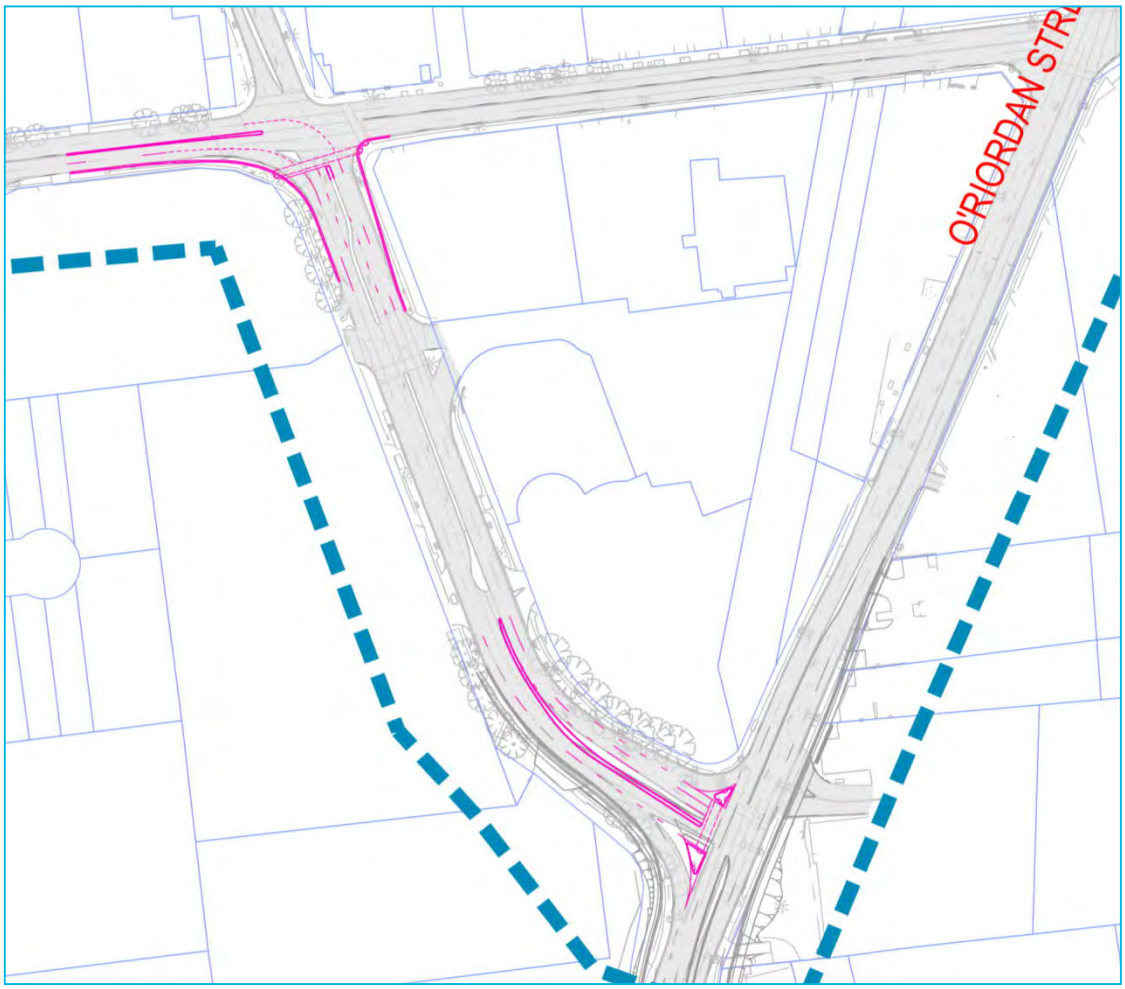


Figure 8-9 Mascot Town Centre Precinct changes – O'Riordan Street/Bourke Street and Bourke Street/Coward Street

Source: Roads and Maritime, 2017

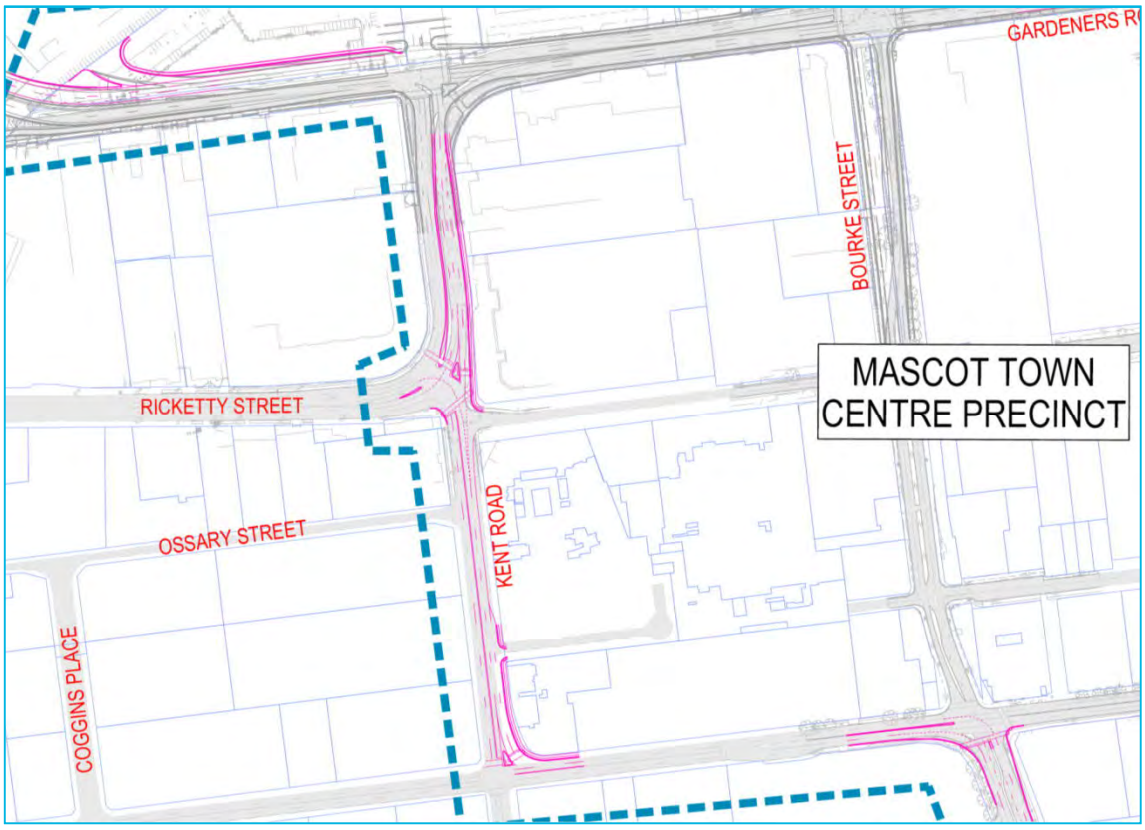


Figure 8-10 Mascot Town Centre Precinct changes – Kent Road/Coward Street, Kent Road/Rickety Street and Gardeners Road/Kent Road

Source: Roads and Maritime, 2017

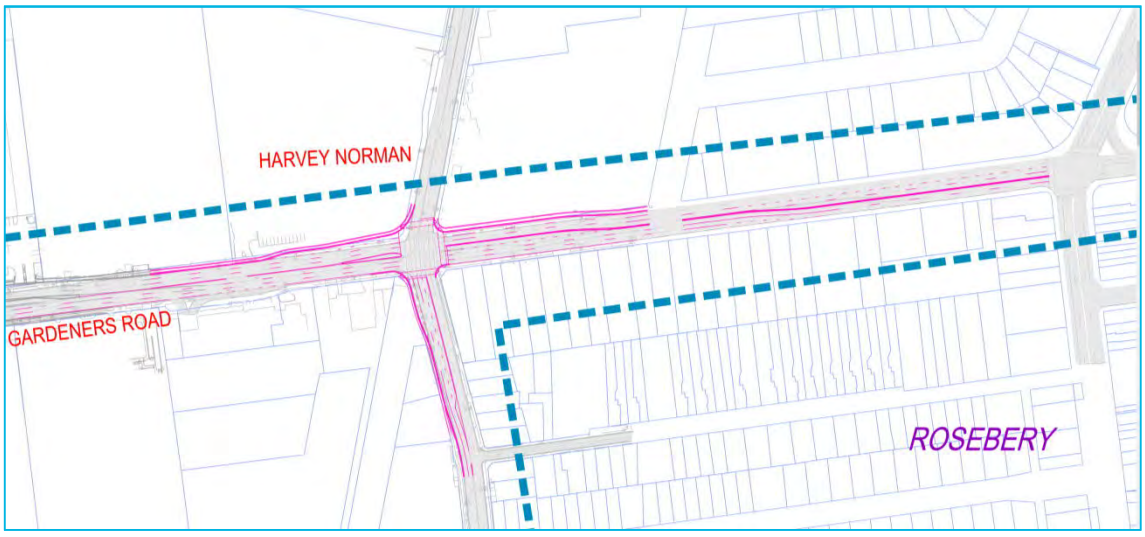


Figure 8-11 Mascot Town Centre Precinct changes – Gardeners Road/O'Riordan Street and Gardeners Road/Botany Road

Source: Roads and Maritime, 2017

- At the Campbell Road / Bourke Road intersection, the layout was changed to match the latest design of four-legged intersection at this location (shown in **Figure 8-12**).

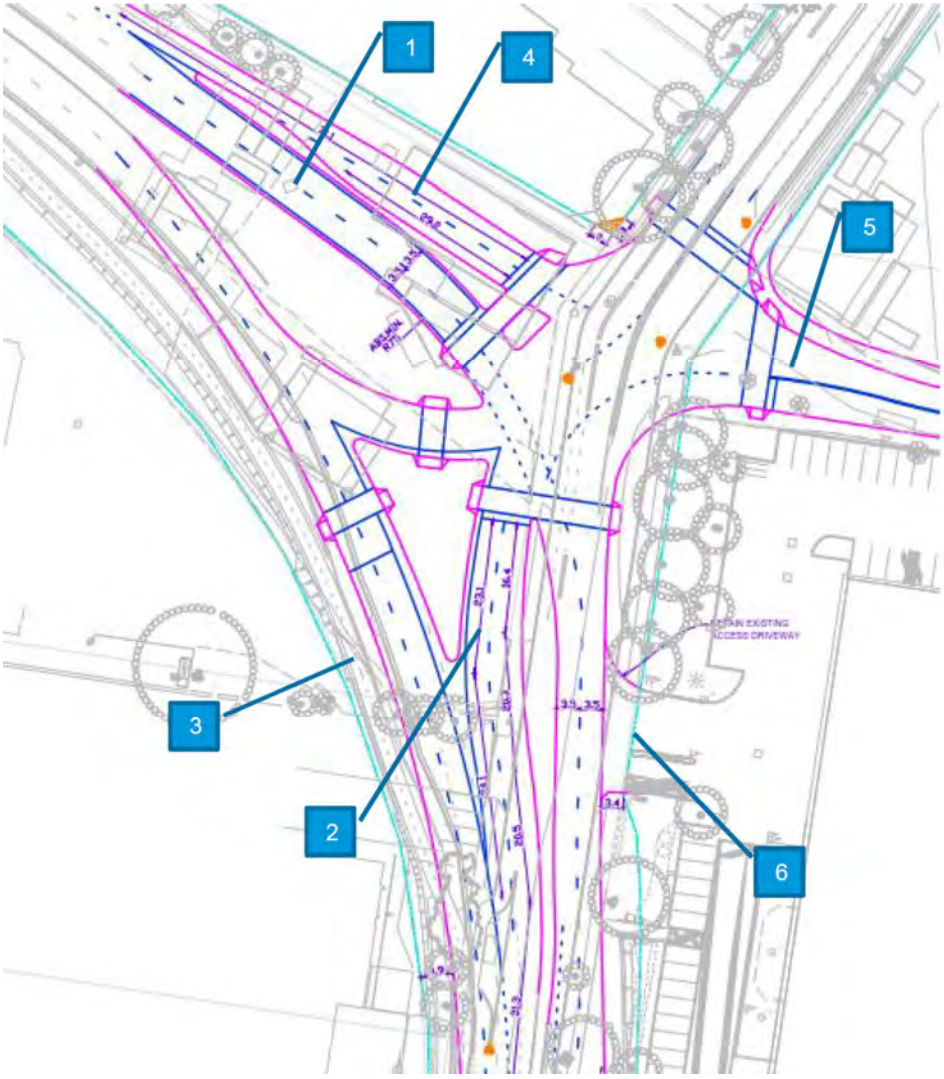


Figure 8-12 Campbell Road/Bourke Road intersection layout

Source: Roads and Maritime, 2017

- A number of network changes as part of the King Street Gateway project:
  - King Street (formerly Princes Highway), from Campbell Street to Sydney Park Road, is changed to two lanes in each direction with clearways in the peak periods and parking allowed in the kerbside lane in off-peak periods. May Street is restricted to left-in, left-out movements only
  - The King Street / Sydney Park Road intersection reduced in size to allow two northbound through lanes with a single right-turn lane from King Street into Sydney Park Road. The north approach is changed to a through lane and a shared through and left turn lane and the Sydney Park Road east approach is changed to one left-turn and one right-turn lane.
  - Sydney Park Road, between King Street and Euston Road, is changed to one lane in each direction with local widening at Mitchell Road to provide separate single left-turn and right-turn lanes from Sydney Park Road into Mitchell Road northbound. The Mitchell Road approach is restricted to a single left-turn lane and a shared through and right-turn lane with the right-turn permitted only for buses.
  - At the Sydney Park Road / Euston Road intersection, Sydney Park Road has a local widening on the approach to provide a left-turn, a through lane and a right-turn lane.

- The Sydney Gateway project network is included in the models and is comprised of:
  - A layout for the interchange connecting Qantas Drive to the M4-M5 Link and St Peters Interchange ramps
  - Realignment of Qantas Drive from the International Airport to the new Domestic Terminal accesses on Qantas Drive/Joyce Drive
- The general layout and alignment of the new Sydney Gateway and St Peters Interchange is shown in **Figure 8-13**.

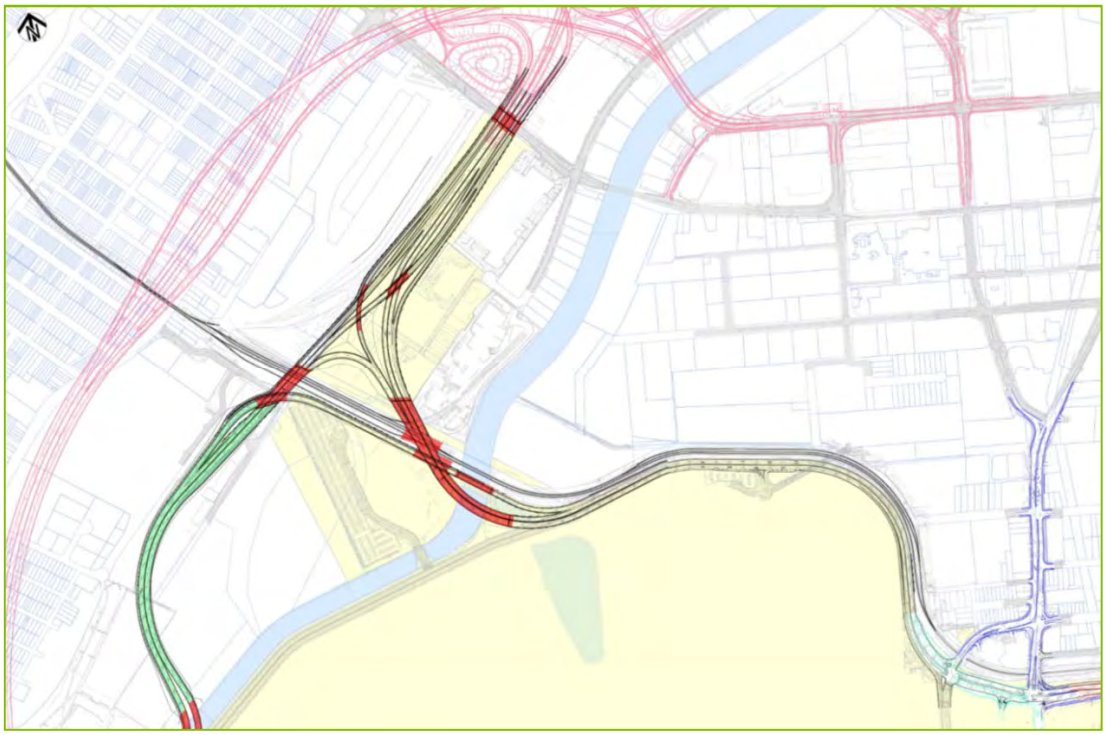


Figure 8-13 Sydney Gateway alignment

Source: Roads and Maritime, 2017

During initial modelling, the early design merge arrangement at the Sydney Gateway/Qantas Drive merge (eastbound) was found to have insufficient capacity to meet the 2026 demand volumes. A changed lane arrangement providing four eastbound lanes on Qantas Drive from the merge point to just before the Lancastrian Road intersection was proposed and included in the future year models.

- Roads and Maritime Airport North and Airport East Projects Include
  - A new intersection at the Wentworth Street / Botany Road intersection with a new southern leg between Botany Road and General Holmes Drive
  - A new intersection on General Holmes Drive with the southern extension of Wentworth Street.

The following minor road improvements were also identified during initial modelling, that would likely be required to accommodate the 2026 'do minimum' traffic demands. These included:

- Lane marking changes to provide a shared through/right lane on the east approach to the Princes Highway/Railway Road intersection
- Lane marking changes to provide a shared through/right lane on the north approach to the Wentworth/Botany Road intersection.

8.3.2 Network performance

2026 'do minimum' scenario

In the future year scenarios, the most significant change to the modelled road network around the St Peters interchange and surrounds is the inclusion of Sydney Gateway and the motorway links between the New M5 Motorway to and from the M4-M5 Link north of the St Peters interchange. The traffic on these motorways that do not travel to or from the local St Peters road network has little impact on the performance of the local roads.

To prevent skewing of the network performance results, the through trips (between the New M5 Motorway and the M4-M5 Link) have been removed from the network performance measures. In the 'do something' and 'do something cumulative' scenarios, the through trips on these motorway links increase significantly. Including vehicles travelling at relatively high speeds on the motorway would artificially increase the reported average speed for the whole network. When comparing this to the 2014/15 'base' scenario network, for example, this would not accurately reflect the relative performance of the networks. The results reported in the following sections include only the traffic travelling on the surface network and traffic between the surface network and the tunnels.

Table 8-13 and **Table 8-14** present a comparison of the performance of the modelled road network between the 2015 base scenario and 2026 'do minimum' scenario for the AM and PM peak hours.

AM peak hour

This comparison indicates the demand through the modelled network around the St Peters interchange is forecast to increase by about 24 per cent by 2026. As a result, an overall decrease in network performance is forecast, which is reflected in increased average travel times and an increase in the number of unreleased trips during the peak hour. However, the average travel speed through the network is higher than the base case. This is due to the large amount of additional road infrastructure included in the future 'do minimum' scenarios, including the St Peters interchange, with connections to and from the New M5 Motorway 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.

Table 8-13 St Peters interchange network performance – AM peak hour (2015 Base vs 2026 'do minimum' scenario)

Network measure	2014/15 Base	2026 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	25,420	31,410	+24%
Total vehicle kilometres travelled in network (km)	75,770	120,120	+59%
Total time travelled approaching and in network (hr)	3,090	4,230	+37%
Total vehicles arrived	24,920	30,910	+24%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	2.7	3.4	+26%
Average time travelled in network (mins)	6.7	7.3	+9%
Average speed (km/h)	24.6	28.4	+15%
Unreleased vehicles			
Unreleased demand (veh)	230	760	-
% of total traffic demand	1%	2%	-

PM peak hour

The comparison shows that, despite 29 per cent more demand in the 2026 'do minimum' scenario, the modelled network is forecast to perform similarly to the base case in the PM peak hour. The number of vehicles arriving at their destination is forecast to increase by a similar proportion as the total demand and the forecast average speed in the network is comparable with the base case. Again, this is due to the large amount of additional road infrastructure included in the future 'do minimum' scenarios, including the St Peters interchange, with connections to and from the New M5 Motorway 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.

Table 8-14 St Peters interchange network performance – PM peak hour (2015 Base vs 2026 'do minimum' scenario)

Network measure	2014/15 Base	2026 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	24,580	31,620	+29%
Total vehicle kilometres travelled in network (km)	71,710	118,900	+66%
Total time travelled approaching and in network (hr)	2,530	4,120	+63%
Total vehicles arrived	24,590	31,130	+27%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	2.7	3.4	+26%
Average time travelled in network (mins)	5.7	6.9	+21%
Average speed (km/h)	28.4	29.7	+5%
Unreleased vehicles			
Unreleased demand (veh)	0	570	-
% of total traffic demand	0%	2%	-

2036 'do minimum' scenario

Table 8-15 and **Table 8-16** present a comparison of the performance of the modelled road network between the 2026 and 2036 'do minimum' scenarios for the AM and PM peak hours.

AM peak hour

The AM peak hour network performance indicates a further increase in demand in the 2036 'do minimum' scenario (compared to the 2026 'do minimum' scenario) and the overall forecast network performance declines without the project. With eight per cent higher demand than the 2026 'do minimum' scenario, the number of vehicles arriving at their destination increases in the 2036 'do minimum' scenario by four per cent, while the total travel time increases by 56 per cent. All average vehicle performance metrics are forecast to decrease, with average speed in the network forecast to reduce by around 28 per cent compared to the 2026 'do minimum' scenario to just over 20 kilometres per hour and the number of unreleased vehicles more than doubling compared with the 2026 'do minimum' network.

Table 8-15 St Peters interchange network performance – AM peak hour (2026 'do minimum' vs 2036 'do minimum')

Network measure	2026 'do minimum'	2036 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	31,410	33,910	+8%
Total vehicle kilometres travelled in network (km)	120,120	131,580	+10%
Total time travelled approaching and in network (hr)	4,420	6,880	+56%
Total vehicles arrived	30,910	32,050	+4%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	3.4	3.5	+3%
Average time travelled in network (mins)	7.3	10.2	+40%
Average speed (km/h)	28.4	20.4	-28%
Unreleased vehicles			
Unreleased demand (veh)	760	1,730	-
% of total traffic demand	2%	5%	-

PM peak hour

The PM peak hour network performance results show that, similar to the AM peak hour, the congestion levels in the network are expected to increase. While the proportional increase in travel time is not as high as in the AM peak hour, there is still an increase (20 per cent) with only a nine per cent increase in traffic demand. Average vehicle performance metrics are less affected than in the AM peak hour but the network is still forecast to perform less efficiently when compared to the 2026 'do minimum' scenario.

Table 8-16 St Peters interchange network performance – PM peak hour (2026 'do minimum' vs 2036 'do minimum')

Network measure	2026 'do minimum'	2036 'do minimum'	Percentage change
All vehicles			
Total traffic demand (veh)	31,620	34,420	+9%
Total vehicle kilometres travelled in network (km)	118,900	129,370	+9%
Total time travelled approaching and in network (hr)	4,120	4,930	+20%
Total vehicles arrived	31,130	33,150	+6%
Average per vehicle			
Average vehicle kilometres travelled in network (km)	3.4	3.4	0%
Average time travelled in network (mins)	6.9	7.3	+6%
Average speed (km/h)	29.7	27.9	-6%
Unreleased vehicles			
Unreleased demand (veh)	570	1,340	-
% of total traffic demand	2%	4%	-

8.3.3 Intersection performance

Table 8-17 presents the modelled AM and PM peak hour average delay and LoS for key intersections around the St Peters interchange. The Gardeners Road / Kent Road intersection, which was a minor intersection in the base case network but becomes more significant in the future year networks, is included in the future year reporting.

As noted in **section 4.3.2**, for the purpose of analysing intersection performance, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed, allowing an assessment of intersections within the modelled network, irrespective of any downstream queuing that would mask the actual operation of the intersection.

Modelling results show that in both the AM and PM peak hours, the performance for each intersection 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 hour), 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 8-17 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

8.3.4 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 8-14** 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 Motorway) 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 8-15 and **Figure 8-16** show a comparison of travel times recorded on these routes in the 2014/2015 base, 2026 and 2036 'do minimum' scenarios.

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 WestConnex South (exit ramp from New M5 Motorway) to Euston Road.

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.

Figure 8-14 St Peters interchange: selected travel time routes

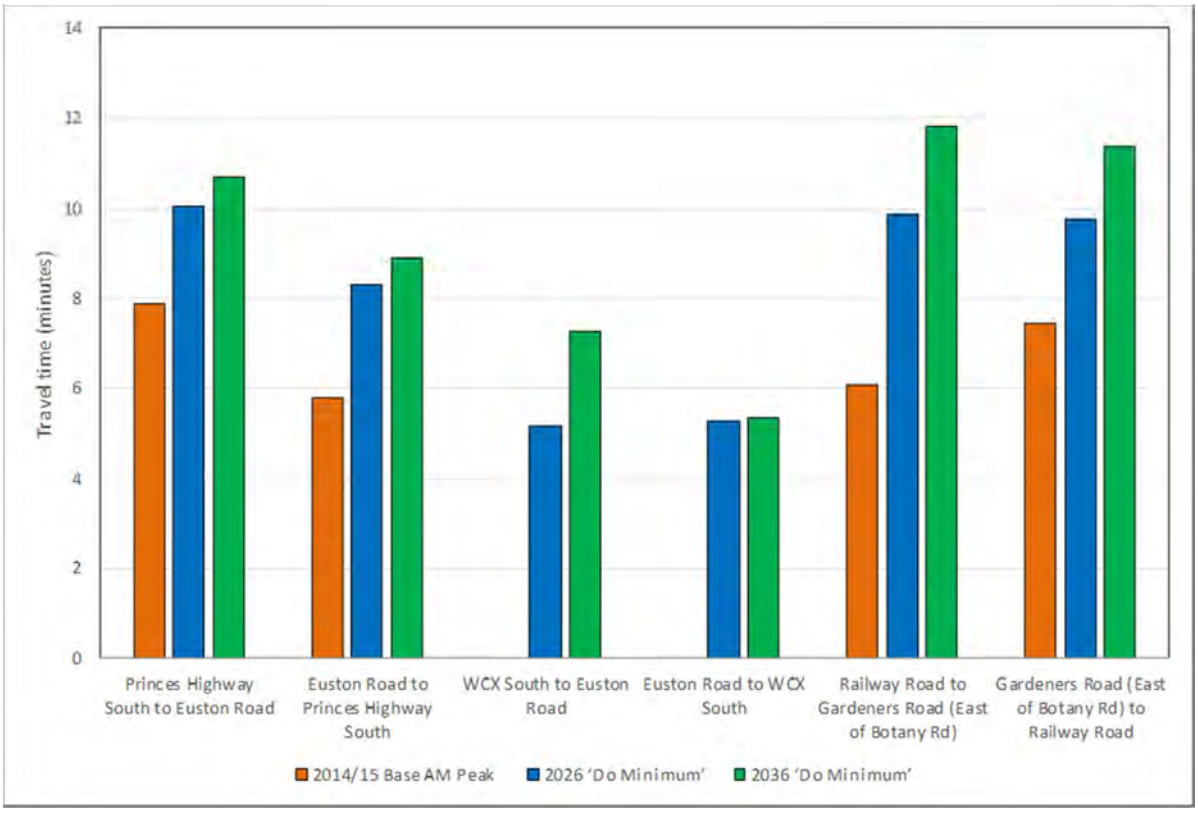


Figure 8-15 St Peters interchange: Average travel time (mins) – AM peak 'do minimum' scenarios

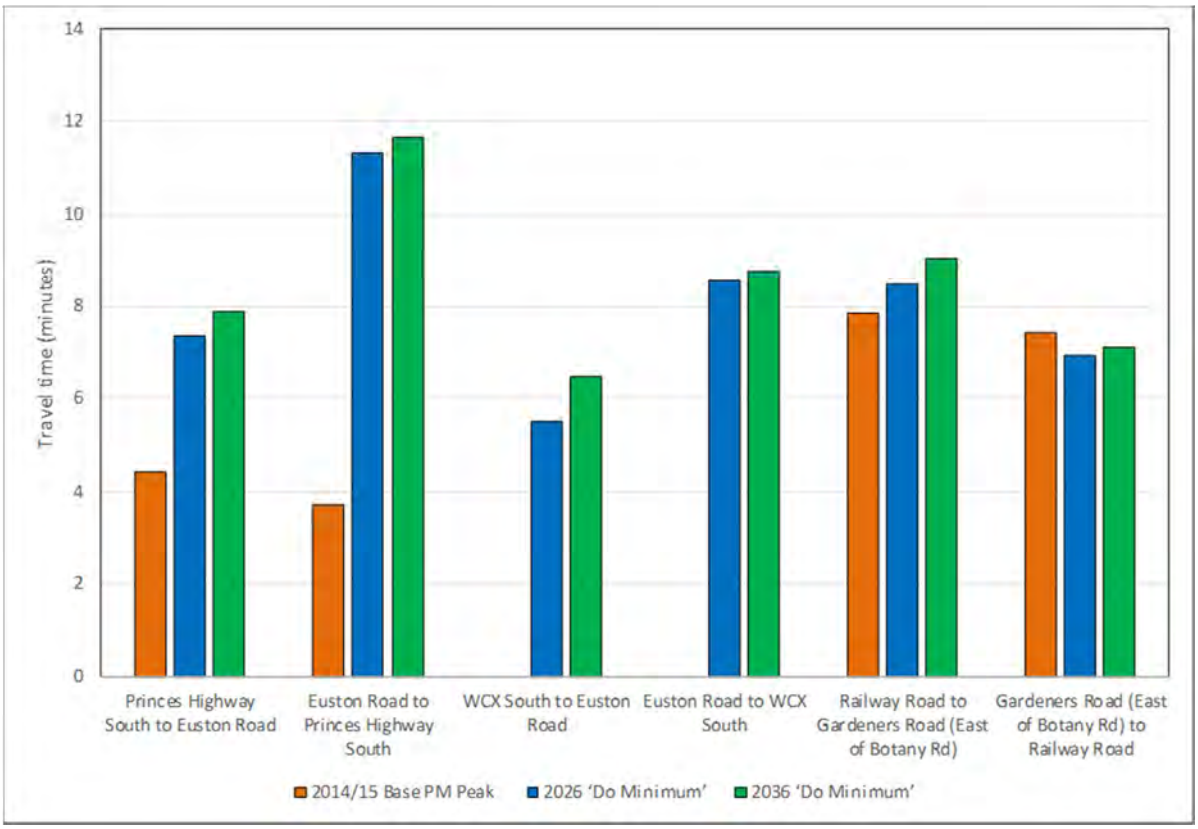


Figure 8-16 St Peters interchange: Average travel time (mins) – PM peak 'do minimum' scenarios

8.3.5 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 in **section 6.4.3** – 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.

8.3.6 Public transport services

Rail services

The area around the St Peters interchange is served by the Sydney Trains T4 Eastern Suburbs and Illawarra Line, and T8 Airport and South Line. The *Western Sydney Rail Needs Scoping Study* (Transport for NSW, 2016), indicates that by 2051, with Sydney Metro Northwest and Sydney Metro City & Southwest operational and running 20 x eight-car trains per hour, but without further investment in new rail lines or investment, there will be overcrowding impacting reliability on the T8 line, and more severe overcrowding, which will force some passengers to wait for the next train, on the T4 line. The *Draft Greater Sydney Services and Infrastructure Plan* (Transport for NSW, 2017) has highlighted that improvement to the T4 line will be investigated within the next ten years.

Bus services

Figure 8-17 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.

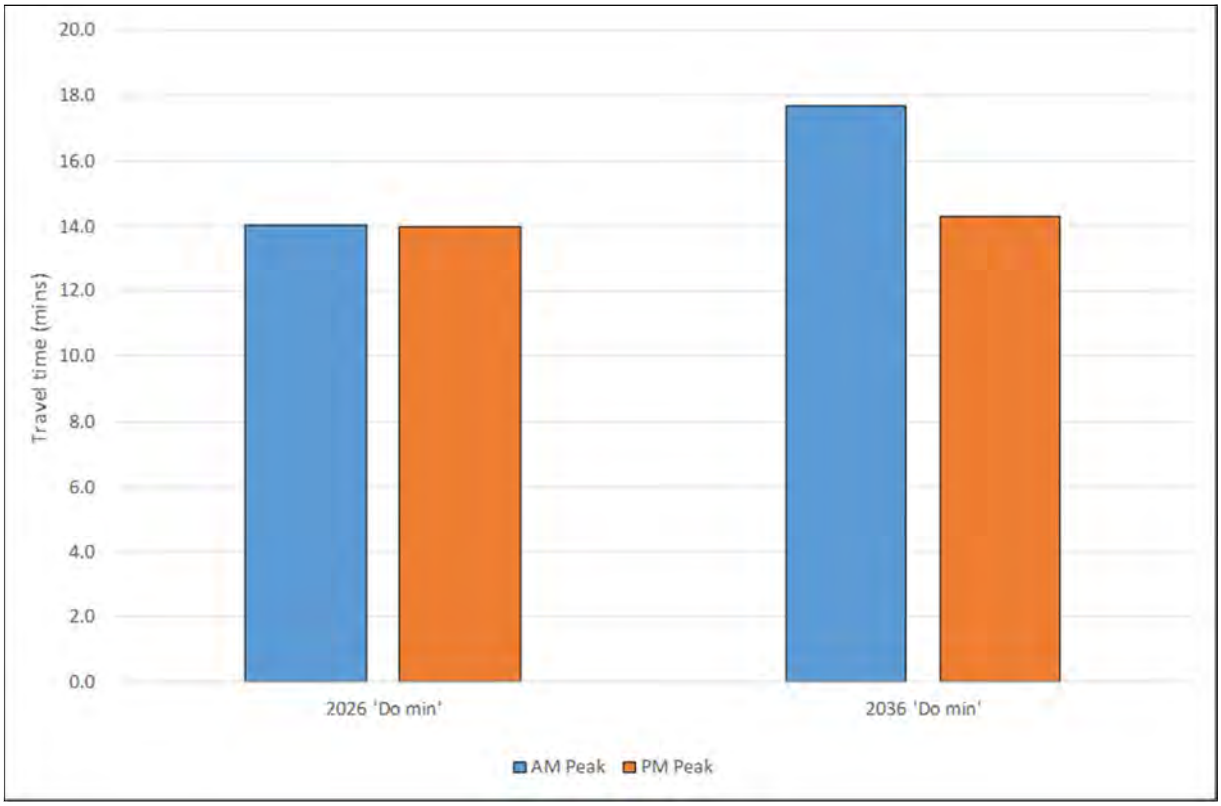


Figure 8-17 St Peters interchange: Average travel time for buses – 'do minimum' comparison

8.3.7 Active transport (walking and cycling) 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 Motorway project.

A number of active transport facilities are planned for construction as part of the New M5 Motorway 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 Motorway 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 with the Princes Highway at the intersection with Canal Road.

9 Future year traffic volumes and patterns with the project

9.1 Introduction

Section 4.2 provides details of the modelling approach used to derive future year traffic demand for road and intersection locations within the project area. As previously discussed, the SMPM underpins all future year traffic forecasts, as it has been specifically developed to assess major road infrastructure improvements in Sydney.

Specifically, the objective of the SMPM demand modelling was to forecast use of the project and traffic on the metropolitan road network of Sydney, estimating traffic volumes for different periods of the day based on expected land use changes. For the purpose of assessing the impacts of the project on surrounding roads, with an exclusive focus on the study area rather the wider Sydney road network, the adopted three stage approach: forecasting, rebasing and operational traffic modelling, provides a more accurate representation of how future year traffic growth would affect observed traffic demands than direct output from the SMPM.

However, a wider assessment can also be undertaken using only traffic forecasting data as this provides evidence of high level patterns across parallel strategic corridors within and external to the study area for peak and daily time periods. Consequently, traffic volumes were directly sourced from the SMPM for key roads in the study area, with the results documented in subsequent sections, based on the following modelling characteristics and scenarios:

- Time periods:
  - AWT
  - One hour AM peak
  - One hour PM peak
- Modelled scenarios:
  - Operation ‘do minimum’ (2026)
  - Operation ‘do something’ (2026)
  - Operation ‘do minimum’ (2036)
  - Operation ‘do something’ (2036)
  - Operation ‘cumulative’ (2036).

9.2 Screenline/parallel routes analysis

The purpose of the screenline analysis is to examine how traffic may shift between alternative parallel routes or corridors through the study area, including providing an indication as to whether 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 9-1**. For each screenline, directional and two-way traffic volume outputs from the different modelling scenarios for each future year (2026 and 2036) were analysed.

The results of the screenline assessment are provided in a series of analysis tables in **section 9.3**. These tables provide details of directional and two-way traffic volumes on each road, the screenline share (per cent) of each road and the total directional and two-way traffic volumes across the full screenline. Consequently, each table provides sufficient information to provide an understanding of:

- Future year AWT volumes and patterns in the project area for each modelled scenario
- The level of travel demand that would transfer to the project, and the resultant impacts on surface road traffic
- The volume of traffic that is forecast to shift to alternative routes.

It is noted that the screenline analysis presented is based on volumes taken directly from the SMPM for high level comparison and have not been rebased as described in **section 4.2**. These forecast traffic volumes include both fixed and induced traffic demand.

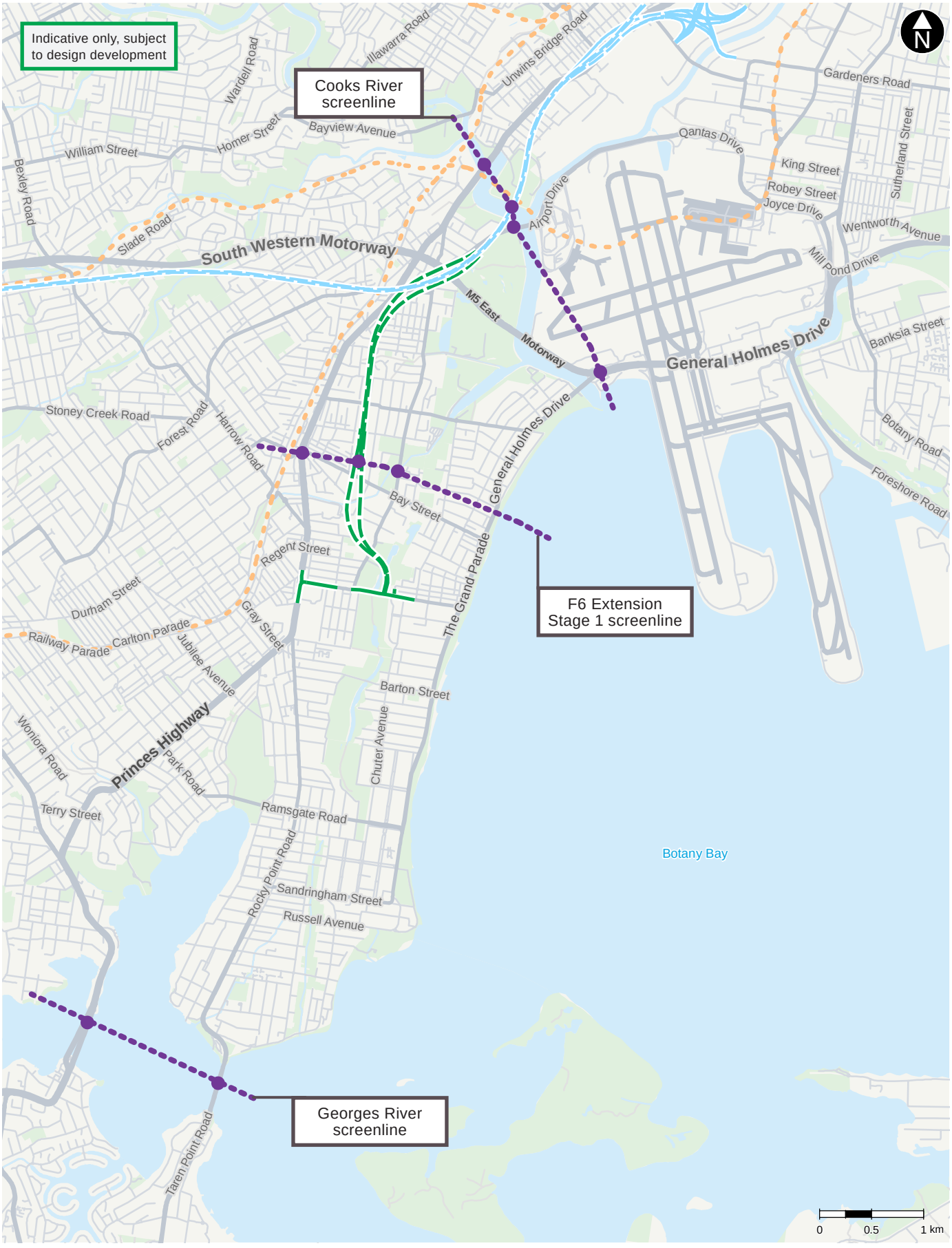


Figure 9-1 Screenline locations

9.3 F6 Extension Stage 1 screenline

9.3.1 Average weekday traffic (AWT) analysis

Table 9-1 presents a comparison of the forecast AWT volumes from SMPM for each of the F6 Extension Stage 1 screenline locations under the 2026 and 2036 'do minimum' and 'do something' scenarios. The table also shows the change in traffic volumes with the project in place and the share of traffic movement on each link.

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.

Table 9-2 presents a comparison of the forecast AWT volumes from SMPM for each of the F6 Extension Stage 1 screenline locations under the 2036 'do minimum' and 'cumulative' scenarios. The table also shows the change in traffic volumes and the share of traffic movement on each link.

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 9-2 illustrates the forecast two-way AWT volumes crossing the F6 Extension Stage 1 screenline under all five scenarios.

Table 9-1 F6 Extension Stage 1 screenline SMPM comparison for 'do something' and 'do minimum' scenarios – AWT volumes

Direction	Location	2026 'do minimum'		2026 'do something'		Change	2036 'do minimum'		2036 'do something'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Princes Hwy	19,400	28%	18,000	23%	-7%	19,700	28%	18,500	22%	-6%
	F6 Extension	-	-	15,900	20%	-	-	-	19,800	24%	-
	West Botany St	9,200	13%	8,500	11%	-8%	9,700	14%	8,600	10%	-11%
	General Holmes Dr	40,700	59%	36,200	46%	-11%	42,200	59%	37,200	44%	-12%
	Total	**69,300**		**78,600**		**13%**	**71,600**		**84,100**		**17%**
Southbound	Princes Hwy	19,500	25%	18,600	21%	-5%	19,900	25%	19,300	20%	-3%
	F6 Extension	-	-	20,000	23%	-	-	-	23,300	25%	-
	West Botany St	13,700	18%	11,400	13%	-17%	14,100	17%	11,700	12%	-17%
	General Holmes Dr	43,300	57%	37,500	43%	-13%	47,200	58%	40,000	42%	-15%
	Total	**76,500**		**87,500**		**14%**	**81,200**		**94,300**		**16%**
Two-way	Princes Hwy	38,900	27%	36,600	22%	-6%	39,600	26%	37,800	21%	-5%
	F6 Extension	-	-	35,900	22%	-	-	-	43,100	24%	-
	West Botany St	22,900	16%	19,900	12%	-13%	23,800	16%	20,300	11%	-15%
	General Holmes Dr	84,000	58%	73,700	44%	-12%	89,400	59%	77,200	43%	-14%
	Total	**145,800**		**166,100**		**14%**	**152,800**		**178,400**		**17%**

Source: SMPM v.1, February 2018

Table 9-2 F6 Extension Stage 1 screenline SMPM comparison for 2036 'cumulative' and 'do minimum' scenarios – AWT volumes

Direction	Location	2036 'do minimum'		2036 'cumulative'		Change
		Volume	Share	Volume	Share	
Northbound	Princes Hwy	19,700	28%	17,800	20%	-10%
	F6 Extension	-	-	27,400	31%	-
	West Botany St	9,700	14%	8,500	9%	-12%
	General Holmes Dr	42,200	59%	35,800	40%	-15%
	Total	**71,600**		**89,500**		**25%**
Southbound	Princes Hwy	19,900	25%	18,600	18%	-7%
	F6 Extension	-	-	31,200	31%	-
	West Botany St	14,100	17%	12,300	12%	-13%
	General Holmes Dr	47,200	58%	39,900	39%	-15%
	Total	**81,200**		**102,000**		**26%**
Two-way	Princes Hwy	39,600	26%	36,400	19%	-8%
	F6 Extension	-	-	58,600	31%	-
	West Botany St	23,800	16%	20,800	11%	-13%
	General Holmes Dr	89,400	59%	75,700	40%	-15%
	Total	**152,800**		**191,500**		**25%**

Source: SMPM v.1, February 2018

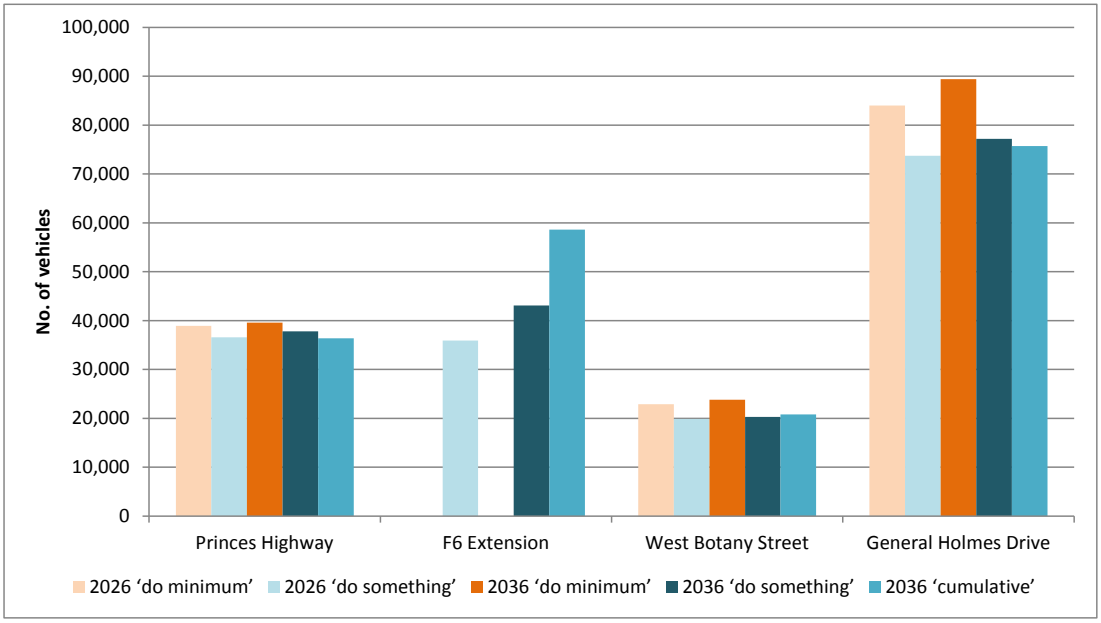


Figure 9-2 F6 Extension Stage 1 screenline comparison of two-way AWT volumes

Source: SMPM v.1, February 2018

9.3.2 Peak hour analysis

Figure 9-3 and **Figure 9-4** 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.

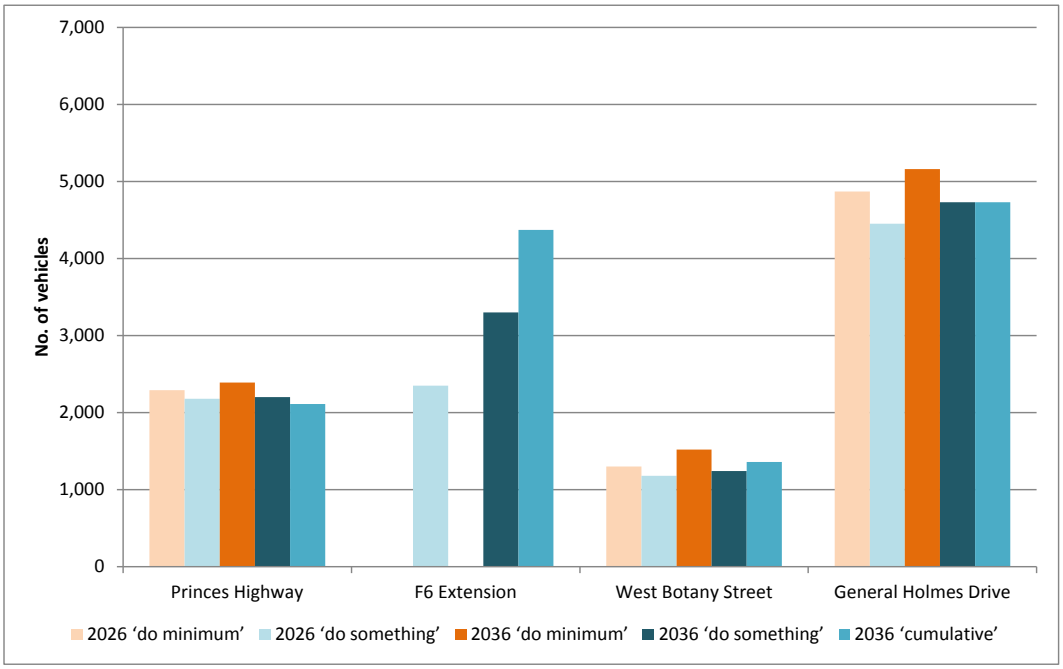


Figure 9-3 F6 Extension Stage 1 screenline comparison of two-way AM peak one-hour volumes

Source: SMPM v.1, February 2018

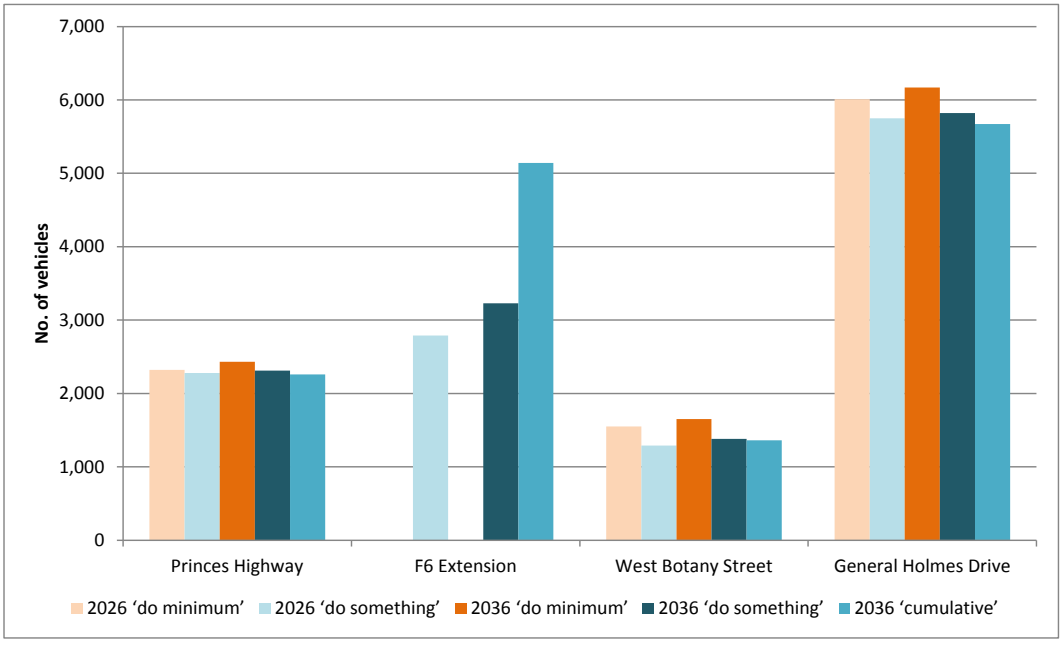


Figure 9-4 F6 Extension Stage 1 screenline comparison of two-way PM peak one-hour volumes

Source: SMPM v.1, February 2018

9.4 Cooks River screenline

9.4.1 Average weekday traffic (AWT) analysis

Table 9-3 presents a comparison of the forecast AWT volumes from SMPM for each of the Cooks River screenline locations under the 2026 and 2036 'do minimum' and 'do something' scenarios. The table also shows the change in traffic volumes with the project in place and the share of traffic movement on each link.

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. There is around a 10 per cent decrease on Marsh Street, and around a five per cent decrease on General Holmes Drive, east of the M5 East.
- 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 Motorway, with traffic on this section of the New M5 Motorway 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 Motorway travelling to and from the project.

Table 9-4 presents a comparison of the forecast AWT volumes from SMPM for each of the Cooks River screenline locations under the 2036 'do minimum' and 'cumulative' scenarios. The table also shows the change in traffic volumes and the share of traffic movement on each link.

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 9-5 illustrates the forecast two-way AWT volumes crossing the Cooks River screenline under all five scenarios.

Table 9-3 Cooks River screenline SMPM comparison for 'do something' and 'do minimum' scenarios – AWT volumes

Direction	Location	2026 'do minimum'		2026 'do something'		Change	2036 'do minimum'		2036 'do something'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Eastbound	Princes Hwy	37,000	22%	35,000	20%	-5%	39,900	22%	37,700	20%	-6%
	New M5 Motorway	18,500	11%	31,500	18%	70%	22,100	12%	38,300	20%	73%
	Marsh St	24,200	14%	21,900	13%	-10%	26,800	15%	23,900	13%	-11%
	General Holmes Dr	89,188	53%	85,758	49%	-4%	94,954	52%	91,277	48%	-4%
	Total	**168,888**		**174,158**		**3%**	**183,754**		**191,177**		**4%**
Westbound	Princes Hwy	40,400	23%	38,900	21%	-4%	41,600	22%	40,300	20%	-3%
	New M5 Motorway	22,700	13%	39,300	21%	73%	26,000	13%	45,600	23%	75%
	Marsh St	35,500	20%	31,900	17%	-10%	37,400	19%	33,500	17%	-10%
	General Holmes Dr	80,171	45%	74,810	40%	-7%	87,639	45%	81,251	40%	-7%
	Total	**178,771**		**184,910**		**3%**	**192,639**		**200,651**		**4%**
Two-way	Princes Hwy	77,400	22%	73,900	21%	-5%	81,500	22%	78,000	20%	-4%
	New M5 Motorway	41,200	12%	70,800	20%	72%	48,100	13%	83,900	21%	74%
	Marsh St	59,700	17%	53,800	15%	-10%	64,200	17%	57,400	15%	-11%
	General Holmes Dr	169,359	49%	160,568	45%	-5%	182,593	49%	172,528	44%	-6%
	Total	**347,659**		**359,068**		**3%**	**376,393**		**391,828**		**4%**

Source: SMPM v.1, February 2018

Table 9-4 Cooks River screenline SMPM comparison for 2036 'cumulative' and 'do minimum' scenarios – AWT volumes

Direction	Location	2036 'do minimum'		2036 'cumulative'		Change
		Volume	Share	Volume	Share	
Eastbound	Princes Hwy	39,900	22%	37,600	19%	-6%
	New M5 Motorway	22,100	12%	47,400	24%	114%
	Marsh St	26,800	15%	24,100	12%	-10%
	General Holmes Dr	94,954	52%	87,272	44%	-8%
	Total	**183,754**		**196,372**		**7%**
Westbound	Princes Hwy	41,600	22%	40,400	20%	-3%
	New M5 Motorway	26,000	13%	52,400	25%	102%
	Marsh St	37,400	19%	33,800	16%	-10%
	General Holmes Dr	87,639	45%	80,188	39%	-9%
	Total	**192,639**		**206,788**		**7%**
Two-way	Princes Hwy	81,500	22%	78,000	19%	-4%
	New M5 Motorway	48,100	13%	99,800	25%	107%
	Marsh St	64,200	17%	57,900	14%	-10%
	General Holmes Dr	182,593	49%	167,460	42%	-8%
	Total	**376,393**		**403,160**		**7%**

Source: SMPM v.1, February 2018

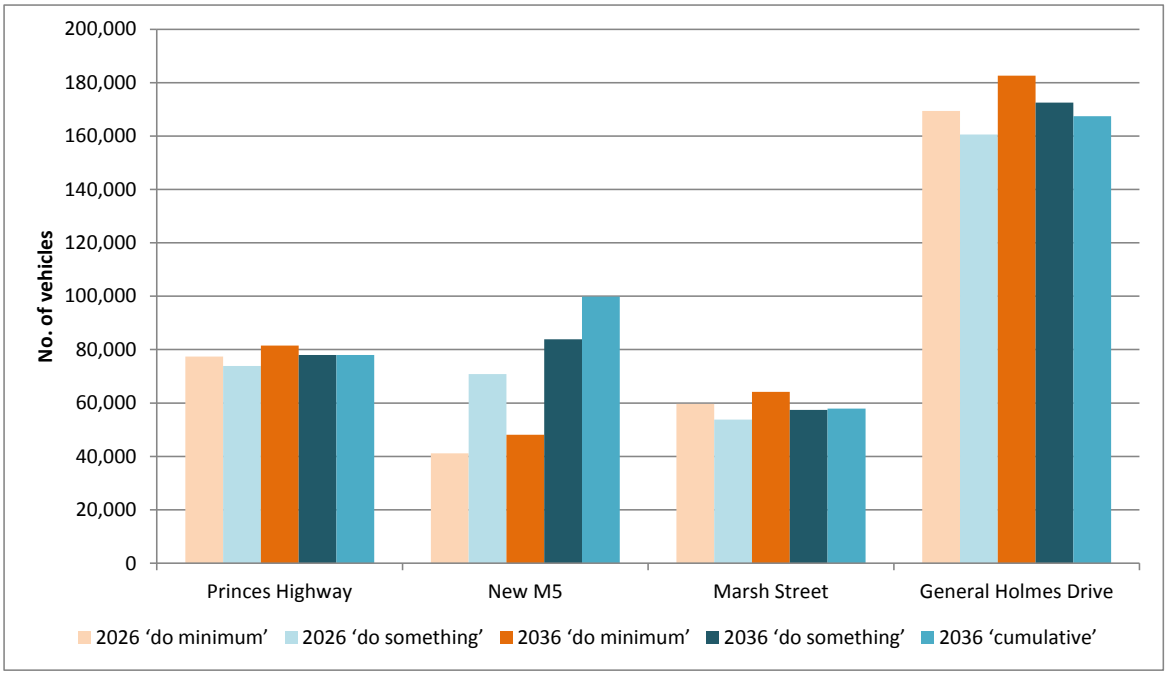


Figure 9-5 Cooks River screenline comparison of two-way AWT volumes

Source: SMPM v.1, February 2018

9.4.2 Peak hour analysis

Figure 9-6 and **Figure 9-7** 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 shift onto the New M5 Motorway. 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.

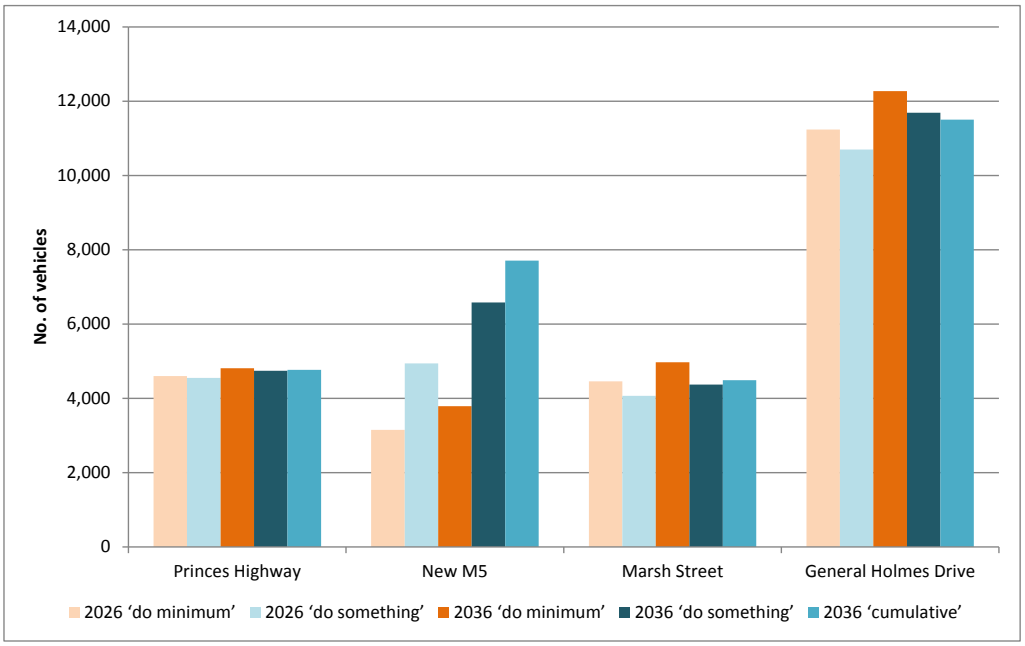


Figure 9-6 Cooks River screenline comparison of two-way AM peak one-hour volumes

Source: SMPM v.1, February 2018

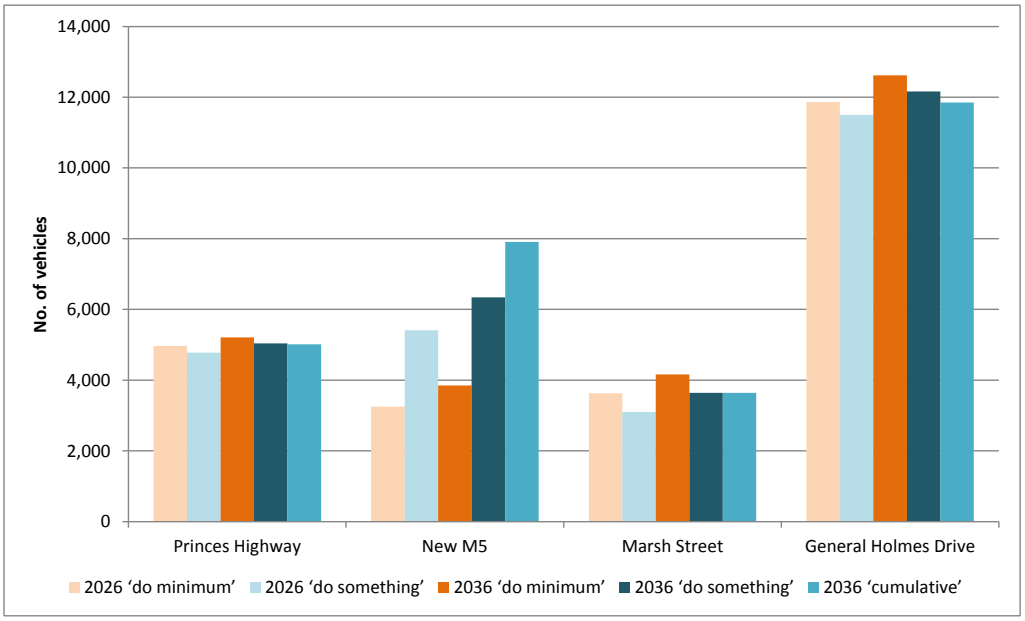


Figure 9-7 Cooks River screenline comparison of two-way PM peak one-hour volumes

Source: SMPM v.1, February 2018

9.5 Georges River screenline

9.5.1 Average weekday traffic (AWT) analysis

Table 9-5 presents a comparison of the forecast AWT volumes from SMPM for each of the Georges River screenline locations under the 2026 and 2036 'do minimum' and 'do something' scenarios. The table also shows the change in traffic volumes with the project in place and the share of traffic movement on each link.

The screenline volumes indicate that the introduction of the project is forecast to have little impact on daily traffic at the Georges River crossing points, with an increase of about one per cent forecast for traffic crossing the screenline in 2026 and 2036 when comparing the 'do something' scenario with the 'do minimum' scenario.

Table 9-6 presents a comparison of the forecast AWT volumes from SMPM for each of the Georges River screenline locations under the 2036 'do minimum' and 'cumulative' scenarios. The table also shows the change in traffic volumes and the share of traffic movement on each link.

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 9-8 illustrates the forecast two-way AWT volumes crossing the Georges River screenline under all five scenarios.

Table 9-5 Georges River screenline SMPM comparison for 'do something' and 'do minimum' scenarios – AWT volumes

Direction	Location	2026 'do minimum'		2026 'do something'		Change	2036 'do minimum'		2036 'do something'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Princes Hwy	53,000	66%	53,600	66%	1%	56,000	65%	56,400	65%	1%
	Captain Cook Bridge	27,100	34%	27,500	34%	1%	29,500	35%	30,500	35%	3%
	Total	**80,100**		**81,100**		**1%**	**85,500**		**86,900**		**2%**
Southbound	Princes Hwy	53,000	63%	53,300	63%	1%	56,700	63%	57,000	62%	1%
	Captain Cook Bridge	30,500	37%	31,200	37%	2%	34,000	37%	34,900	38%	3%
	Total	**83,500**		**84,500**		**1%**	**90,700**		**91,900**		**1%**
Two-way	Princes Hwy	106,000	65%	106,900	65%	1%	112,700	64%	113,400	63%	1%
	Captain Cook Bridge	57,600	35%	58,700	35%	2%	63,500	36%	65,400	37%	3%
	Total	**163,600**		**165,600**		**1%**	**176,200**		**178,800**		**1%**

Source: SMPM v.1, February 2018

Table 9-6 Georges River screenline SMPM comparison for 2036 'cumulative' and 'do minimum' scenarios – AWT volumes

Direction	Location	2036 'do minimum'		2036 'cumulative'		Change
		Volume	Share	Volume	Share	
Northbound	Princes Hwy	56,000	65%	49,900	55%	-11%
	Captain Cook Bridge / F6 Extension	29,500	35%	20,900	23%	-29%
	New arterial bridge	-	-	19,700	22%	-
	Total	**85,500**		**90,500**		**6%**
Southbound	Princes Hwy	56,700	63%	49,000	49%	-14%
	Captain Cook Bridge / F6 Extension	34,000	37%	29,800	30%	-12%
	New arterial bridge	-	-	20,700	21%	-
	Total	**90,700**		**99,500**		**10%**
Two-way	Princes Hwy	112,700	64%	98,900	52%	-12%
	Captain Cook Bridge / F6 Extension	63,500	36%	50,700	27%	-20%
	New arterial bridge	-	-	40,400	21%	-
	Total	**176,200**		**190,000**		**8%**

Source: SMPM v.1, February 2018

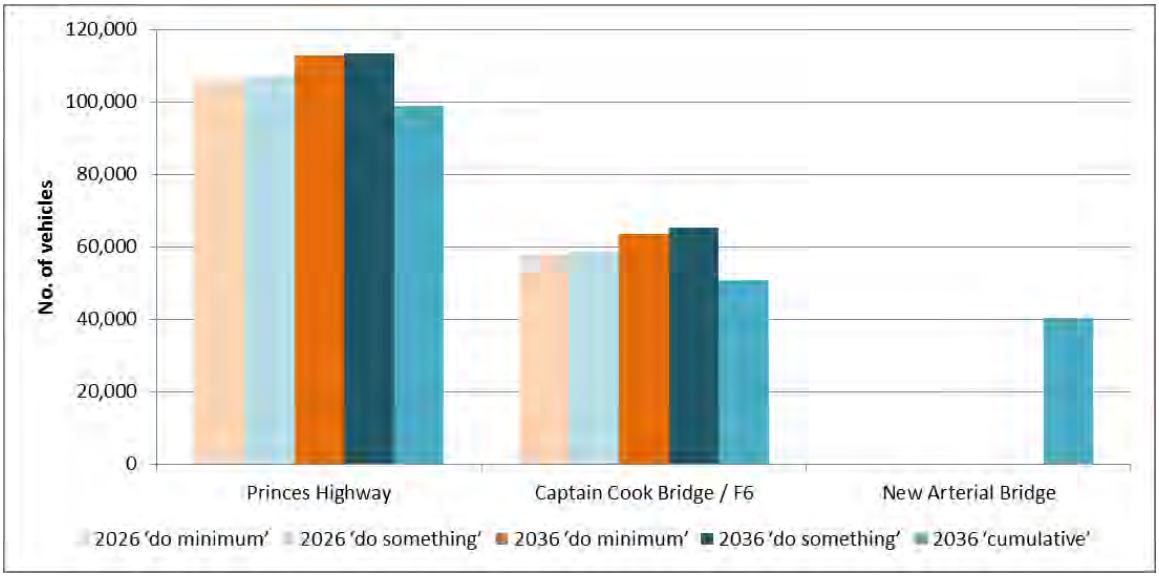


Figure 9-8 Georges River screenline comparison of two-way AWT volumes

Source: SMPM v.1, February 2018

9.5.2 Peak hour analysis

Figure 9-9 and **Figure 9-10** 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 bridge.

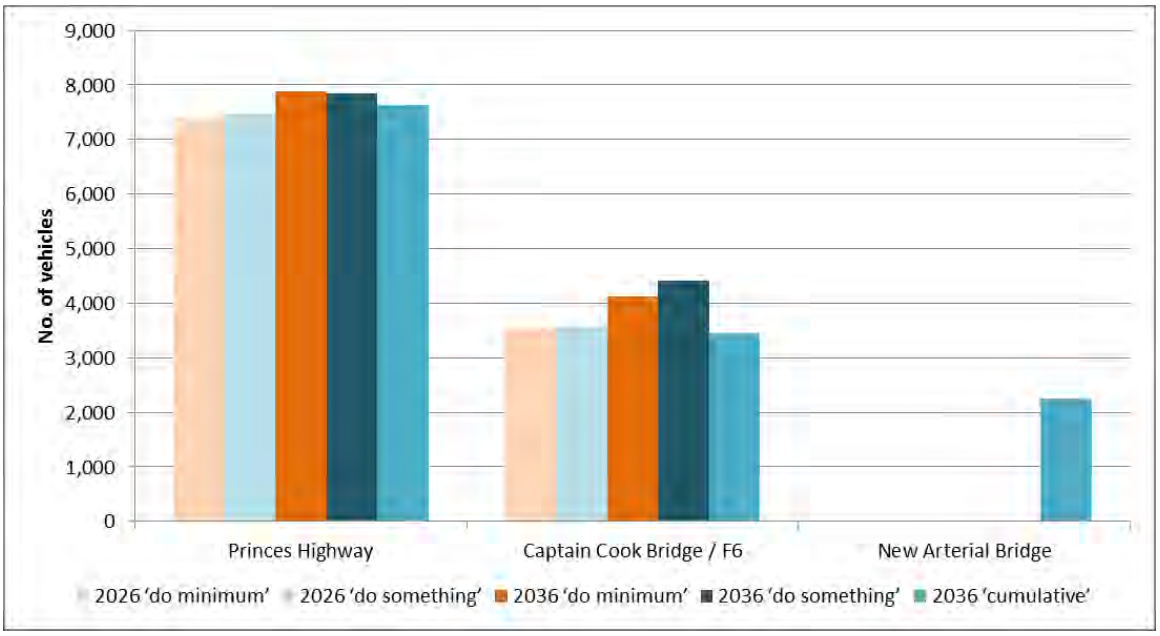


Figure 9-9 Georges River screenline comparison of two-way AM peak one-hour volumes

Source: SMPM v.1, February 2018

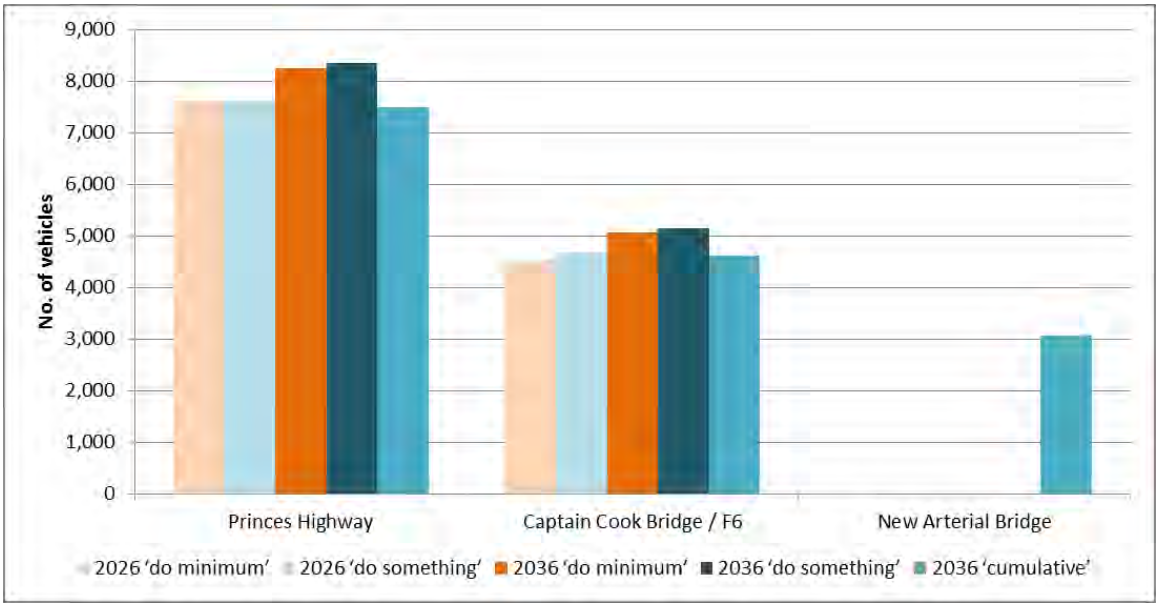


Figure 9-10 Georges River screenline comparison of two-way PM peak one-hour volumes

Source: SMPM v.1, February 2018

9.6 Heavy vehicle analysis

Figure 9-11, **Figure 9-12** and **Figure 9-13** 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 those forecast for all vehicles, the percentage reduction on surface roads is much larger than for all vehicles. With the project, heavy vehicles volumes are forecast to drop by more than 40 per cent on the Princes Highway and more than 30 per cent on General Holmes Drive in 2026 and 2036.

The patterns of change forecast for heavy vehicles crossing the Cooks River screenline are similar to those for all vehicles, with the project forecast to cause a shift of vehicles away from non-motorway roads and onto this section of the New M5 Motorway. However, forecasts indicate the project would have a greater impact on heavy vehicles, with a shift in heavy vehicles onto the New M5 Motorway of about 20 per cent, compared to a shift of between 5-10 per cent forecast for all vehicles.

Similar to the observations for all vehicles, the introduction of the project does not have a significant impact on forecast heavy vehicle travel patterns at the Georges River screenline in the 2026 and 2036 'do something' scenarios, when compared to the corresponding 'do minimum' scenarios. However, in the 'cumulative' scenario, a 20 percent increase in daily heavy vehicles crossing the screenline is forecast. 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.

Further screenline heavy vehicle analysis, including an analysis of forecast two-way heavy vehicle volumes during the AM and PM peak hours, can be found in Annexure B.

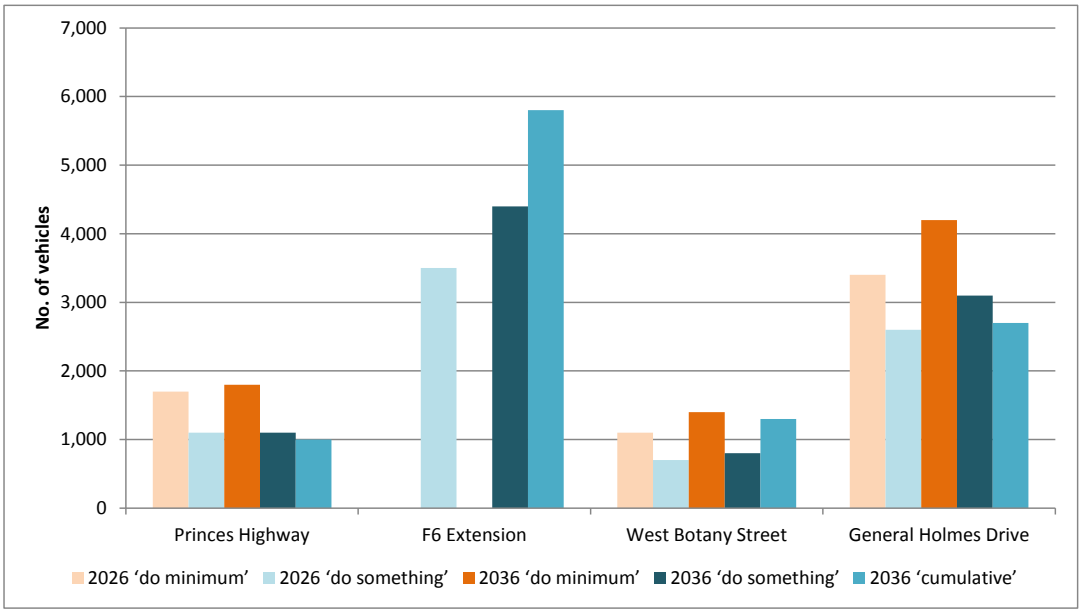


Figure 9-11 Comparison of two-way AWT heavy vehicle volumes at the F6 Extension Stage 1 screenline

Source: SMPM v.1, February 2018

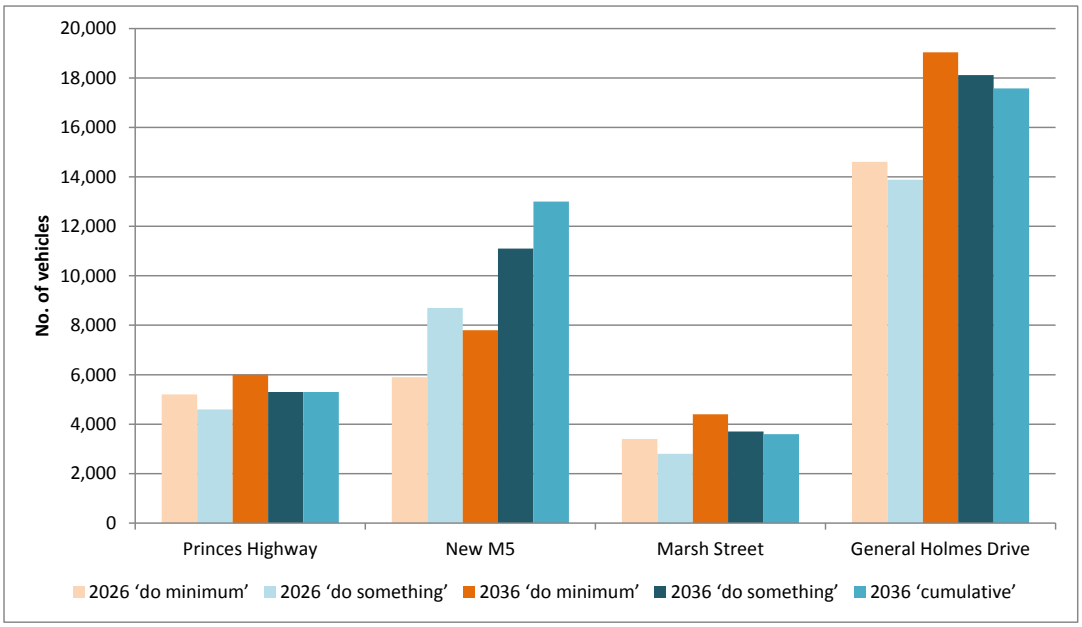


Figure 9-12 Comparison of two-way AWT heavy vehicle volumes at the Cooks River screenline

Source: SMPM v.1, February 2018

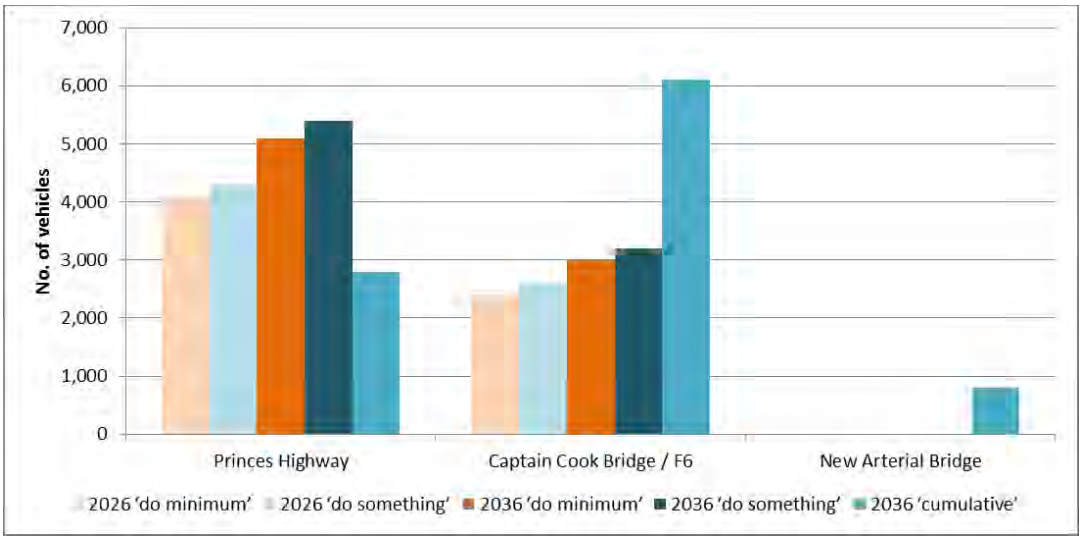


Figure 9-13 Comparison of two-way AWT heavy vehicle volumes at the Georges River screenline

Source: SMPM v.1, February 2018

9.7 Toll avoidance

Preference surveys to understand the value people in Sydney place on travel time savings associated with major infrastructure improvements were undertaken as part of the development of the SMPM. The SMPM includes tolling and general cost parameters that reflect the findings from these surveys. The SMPM considers that different motorists place different values on paying tolls to make time savings, including heavy vehicle motorists.

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 Motorway 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 presented in **Chapter 9** 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.

The proposed Road Network Performance Review Plan will require an Operational Traffic Performance Review at 12 months and at five years after the project is open to traffic. This review will examine potential management measures following the collection of updated data that will facilitate an understanding of actual project outcomes. Roads and Maritime will, as part of the ongoing consultation with Councils, develop post-opening mitigation measures, if required.

10 Assessment of operational impacts with the project

10.1 Sydney metropolitan road network

10.1.1 'Do something' (2026)

Figure 10-1 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2026 'do something' and the 2026 '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 2026 'do something' scenario are shown in green and roads where traffic volumes are predicted 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. This can be clearly seen by the thick red lines along the project alignment (indicating the forecast traffic volumes using the project) and the corresponding reduction in traffic on the surface network as illustrated by the green lines in **Figure 10-1**.

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 10-1 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 10-1 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 President Avenue intersection), due to vehicles using these roads to access the project at President Avenue.

Table 10-2 compares the VKT and the VHT in the 2026 'do minimum' and 'do something' scenarios for heavy vehicles.

Table 10-2 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 are 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 10-1 Difference in AWT between 2026 'do something' and 'do minimum' scenarios

Source: SMPM v.1, February 2018

10.1.2 'Do something' (2036)

Figure 10-2 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. 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

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 10-3**. The addition of the project provides an overall benefit to the network where more or longer trips could be made on the road network 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 10-3 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 10-4 compares the VKT and the VHT in the 2036 'do minimum' and 'do something' scenarios for heavy vehicles.

Table 10-4 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 10-2 Difference in AWT between 2036 'do something' and 'do minimum' scenarios

Source: SMPM v.1, February 2018

10.2 Operational performance – F6 Extension Stage 1

10.2.1 Changes to road network in '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.

10.2.2 Mid-block level of service

The motorway links were divided into the following sections for reporting as shown in **Figure 10-3**:

- New M5 Motorway
    1. West of the project ramps (posted speed = 80 km/h)
    2. Between the project ramps and St Peters interchange ramps (posted speed = 80 km/h)
    3. North of the St Peters interchange ramps (posted speed = 80 km/h)
    4. St Peters interchange entry and exit ramps (posted speed = 80 km/h)
- F6 Extension Stage 1
    5. President Avenue entry and exit ramps (posted speed = 60 km/h)
    6. Merge / diverge between ramps and mainline (posted speed = 80 km/h)
    7. Between President Avenue ramps and New M5 Motorway (posted speed = 80 km/h)
    8. Merge to / diverge from New M5 Motorway (posted speed = 80 km/h).

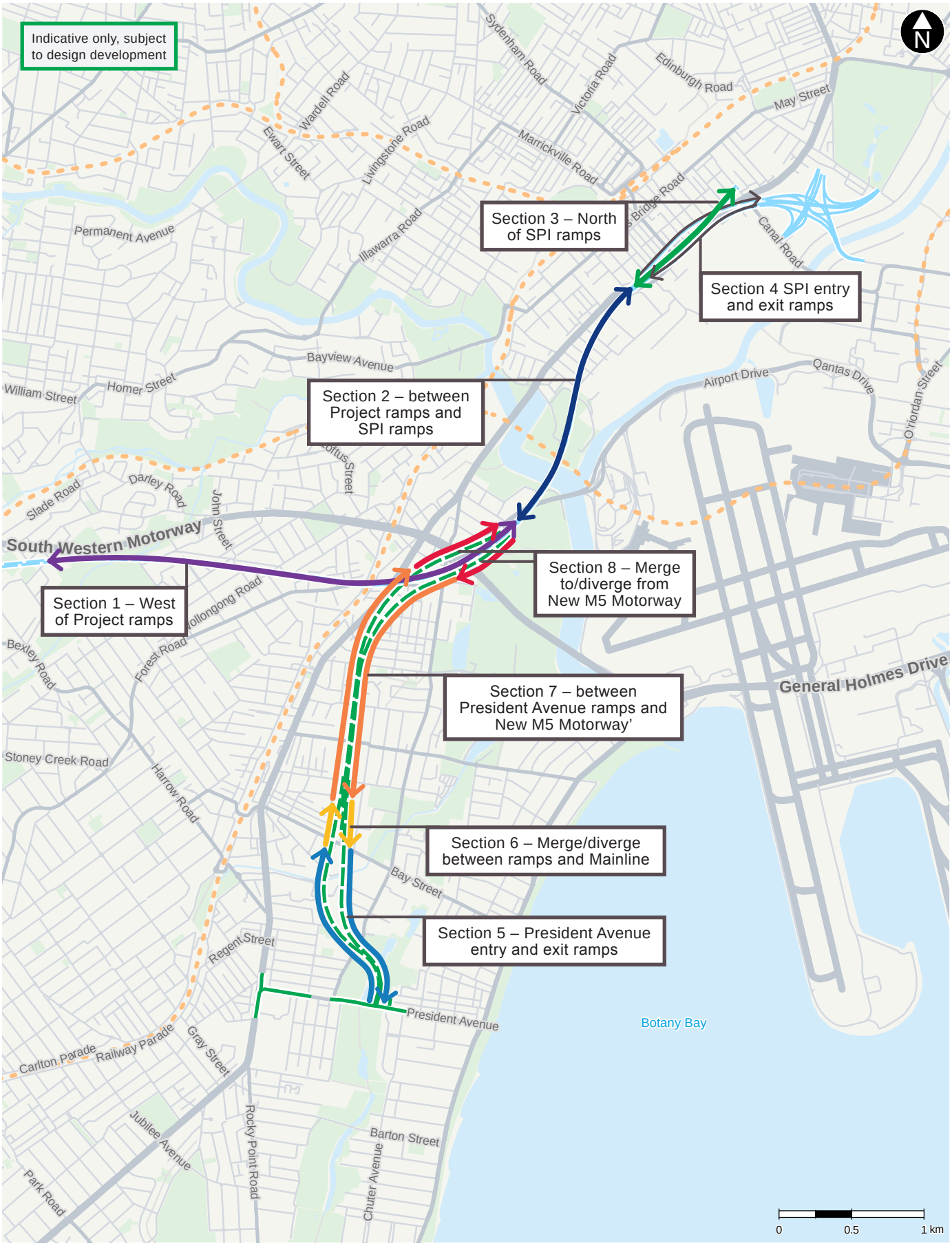


Figure 10-3 F6 Extension Stage 1 - Motorway and ramp sections

Table 10-5 and **Table 10-6** present the LoS for the 2026 'do something' scenarios in the AM and PM peak hours. 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.

Table 10-5 F6 Extension Stage 1 LOS – 2026 AM peak hour 'do something' scenario

Section	Location	No of lanes	Modelled flow (PCU)	Posted speed (km/h)	Modelled speed (km/h)	% of posted speed	Evaluation criteria		LoS
							Density (PCU/km/ln)	V/C ratio	
New M5 Motorway – eastbound									
1	West of Project ramps	2	2,190	80	74	93%	14.7	-	C
2	Between Project ramps and SPI ramps	4	4,300	80	74	93%	14.5	-	C
3	North of SPI ramps	2	1,290	80	76	95%	8.5	-	B
4	SPI exit ramp	2	3,000	80	73	91%	20.5	-	D
New M5 Motorway – westbound									
4	SPI entry ramp	2	1,040	80	76	95%	6.8	-	A
3	North of SPI ramps	2	510	80	77	96%	3.3	-	A
2	Between SPI ramps and Project ramps	4	1,550	80	77	96%	5.0	-	A
1	West of Project ramps	2	950	80	76	95%	6.2	-	A
F6 Extension Stage 1 – northbound									
5	President Avenue entry ramp	2	2,100	60	59	98%	-	0.58	C
6	Merge between ramp and mainline	2	2,100	80	74	93%	14.3	-	C
7	Between President Avenue ramps and New M5 Motorway	2	2,100	80	74	93%	14.2	-	C
8	Merge to New M5 Motorway	2	2,100	80	74	93%	14.2	-	C
F6 Extension Stage 1 – southbound									
8	Diverge from New M5 Motorway	2	600	80	77	96%	3.9	-	A
7	Between New M5 Motorway and President Avenue ramps	2	600	80	77	96%	3.9	-	A
6	Diverge between ramp and mainline	2	600	80	77	95%	3.9	-	A
5	President Avenue exit ramp	2	600	60	60	100%	-	0.17	A

Table 10-6 F6 Extension Stage 1 LOS – 2026 PM peak hour 'do something' scenario

Section	Location	No of lanes	Modelled flow (PCU)	Posted speed (km/h)	Modelled speed (km/h)	% of posted speed	Evaluation criteria		LoS
							Density (PCU/km/ln)	V/C ratio	
New M5 Motorway – eastbound									
1	West of Project ramps	2	810	80	76	95%	5.3	-	A
2	Between Project ramps and SPI ramps	4	1,480	80	76	95%	4.9	-	A
3	North of SPI ramps	2	510	80	76	95%	3.3	-	A
4	SPI exit ramp	2	970	80	76	95%	6.4	-	A
New M5 Motorway – westbound									
4	SPI entry ramp	2	3,440	80	73	91%	23.4	-	E
3	North of SPI ramps	2	1,260	80	77	96%	8.2	-	B
2	Between SPI ramps and Project ramps	4	4,710	80	75	94%	15.7	-	C
1	West of Project ramps	2	2,280	80	74	93%	15.4	-	C
F6 Extension Stage 1 – northbound									
5	President Avenue entry ramp	2	680	60	59	98%	-	0.19	A
6	Merge between ramp and mainline	2	680	80	75	94%	4.5	-	A
7	Between President Avenue ramps and New M5 Motorway	2	680	80	76	95%	4.4	-	A
8	Merge to New M5 Motorway	2	680	80	76	95%	4.4	-	A
F6 Extension Stage 1 – southbound									
8	Diverge from New M5 Motorway	2	2,430	80	74	93%	16.4	-	D
7	Between New M5 Motorway and President Avenue ramps	2	2,430	80	74	93%	16.4	-	D
6	Diverge between ramp and mainline	2	2,430	80	73	91%	16.6	-	D
5	President Avenue exit ramp	2	2,430	60	57	95%	-	0.68	D

Table 10-7 and **Table 10-8** present the mid-block LoS for the 2036 'do something' scenarios in the AM and PM peak hours. 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. Options to increase capacity to improve these forecast levels of service are limited as the ramps are in the process of being constructed and options to reduce demand to improve these forecast levels of service are limited, as this would increase traffic on the surface road network.

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.

Provision has been made for Smart (or Managed) Motorway infrastructure in the project design. A Smart Motorway uses technology to monitor, provide intelligence and control the motorway to ease congestion and keep traffic flowing more effectively. Technology, including lane use management signs, vehicle detection equipment, CCTV cameras and entry ramp signals, allows road operators to manage, in real-time, traffic entering, exiting and traversing the motorway. A comprehensive network-wide strategy could have significant benefits in maintaining acceptable operating conditions on the motorway in the future.

Table 10-7 F6 Extension Stage 1 LOS – 2036 AM peak hour 'do something' scenario

Section	Location	No of lanes	Modelled flow (PCU)	Posted speed (km/h)	Modelled speed (km/h)	% of posted speed	Evaluation criteria		LoS
							Density (PCU/km/ln)	V/C ratio	
New M5 Motorway – eastbound									
1	West of Project ramps	2	2,990	80	73	91%	20.4	-	D
2	Between Project ramps and SPI ramps	4	5,970	80	72	90%	20.7	-	D
3	North of SPI ramps	2	2,060	80	75	94%	13.7	-	C
4	SPI exit ramp	2	3,920	80	72	90%	27.2	-	E
New M5 Motorway – westbound									
4	SPI entry ramp	2	1,170	80	77	96%	7.6	-	B
3	North of SPI ramps	2	660	80	77	96%	4.3	-	A
2	Between SPI ramps and Project ramps	4	1,820	80	76	95%	6.0	-	A
1	West of Project ramps	2	1,040	80	76	95%	6.9	-	A
F6 Extension Stage 1 – northbound									
5	President Avenue entry ramp	2	2,980	60	58	97%	-	0.83	E
6	Merge between ramp and mainline	2	2,980	80	73	91%	20.5	-	D
7	Between President Avenue ramps and New M5 Motorway	2	2,980	80	73	91%	20.5	-	D
8	Merge to New M5 Motorway	2	2,980	80	73	91%	20.5	-	D
F6 Extension Stage 1 – southbound									
8	Diverge from New M5 Motorway	2	790	80	76	95%	5.1	-	A
7	Between New M5 Motorway and President Avenue ramps	2	790	80	76	95%	5.1	-	A
6	Diverge between ramp and mainline	2	790	80	76	95%	5.1	-	A
5	President Avenue exit ramp	2	790	60	59	98%	-	0.22	A

Table 10-8 F6 Extension Stage 1 LOS – 2036 PM peak hour 'do something' scenario

Section	Location	No of lanes	Modelled flow (PCU)	Posted speed (km/h)	Modelled speed (km/h)	% of posted speed	Evaluation criteria		LoS
							Density (PCU/km/ln)	V/C ratio	
New M5 Motorway – eastbound									
1	West of Project ramps	2	870	80	76	95%	5.7	-	A
2	Between Project ramps and SPI ramps	4	1,690	80	76	95%	5.5	-	A
3	North of SPI ramps	2	600	80	76	95%	3.9	-	A
4	SPI exit ramp	2	1,090	80	76	95%	7.2	-	B
New M5 Motorway – westbound									
4	SPI entry ramp	2	3,870	80	72	90%	26.7	-	E
3	North of SPI ramps	2	1,830	80	76	95%	12.0	-	C
2	Between SPI ramps and Project ramps	4	5,700	80	74	93%	19.2	-	D
1	West of Project ramps	2	2,930	80	73	91%	20.0	-	D
F6 Extension Stage 1 – northbound									
5	President Avenue entry ramp	2	830	60	59	98%	-	0.23	A
6	Merge between ramp and mainline	2	830	80	75	94%	5.5	-	A
7	Between President Avenue ramps and New M5 Motorway	2	830	80	76	95%	5.4	-	A
8	Merge to New M5 Motorway	2	830	80	76	95%	5.5	-	A
F6 Extension Stage 1 – southbound									
8	Diverge from New M5 Motorway	2	2,780	80	74	93%	18.8	-	D
7	Between New M5 Motorway and President Avenue ramps	2	2,780	80	73	91%	18.9	-	D
6	Diverge between ramp and mainline	2	2,780	80	73	91%	19.1	-	D
5	President Avenue exit ramp	2	2,780	60	57	95%	-	0.77	D

10.2.3 Traffic crashes

Table 10-9 presents the crashes forecast under the 'do something' scenario compared to the 'do minimum' scenario for the F6 Extension Stage 1 mainline and for the New M5 Motorway between the interface location with the F6 Extension Stage 1 and the St Peters interchange. This section of the New M5 Motorway was considered as it experiences a significant change in traffic volumes with the project. Analysis has been undertaken based on the 2013-2017 crash rates in Sydney motorway tunnels including the M5 East Motorway tunnel, Sydney Harbour Tunnel and Eastern Distributor tunnel.

The project results 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, and so the number and cost of traffic crashes also increases on this section of the New M5 Motorway. This increase, together with the crashes forecast for F6 Extension Stage 1 mainline, should 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.

Table 10-9 F6 Extension Stage 1: crash comparison between 'do something' and 'do minimum' scenarios

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

Note: ADT rounded to the nearest 100 vehicles

10.3 Operational performance – President Avenue intersection and surrounds

10.3.1 Changes to road network in '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 10-4** and **Figure 10-5** 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. This is illustrated in **Figure 10-4**. Current clearway restrictions on Princes Highway would be retained, with future clearway restrictions on President Avenue applied in both directions in 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. This is illustrated in **Figure 10-5**. Future clearway restrictions on President Avenue are applied in both directions in 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:

- Converting Civic Avenue to allow left in / left out movements only at President Avenue
- Creating cul-de-sacs at the intersections of President Avenue / Moorefield Avenue and President Avenue / O'Neill Street.

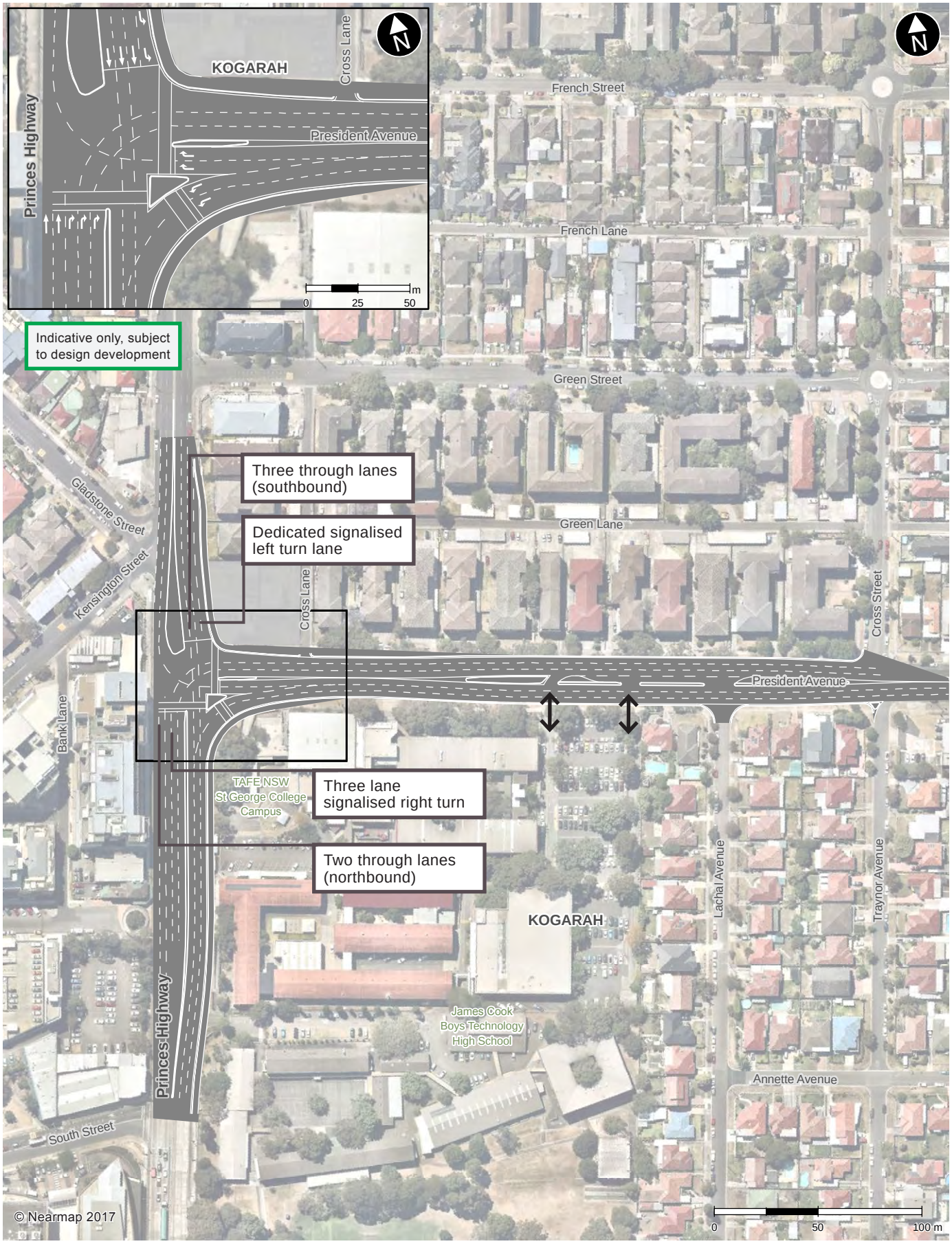
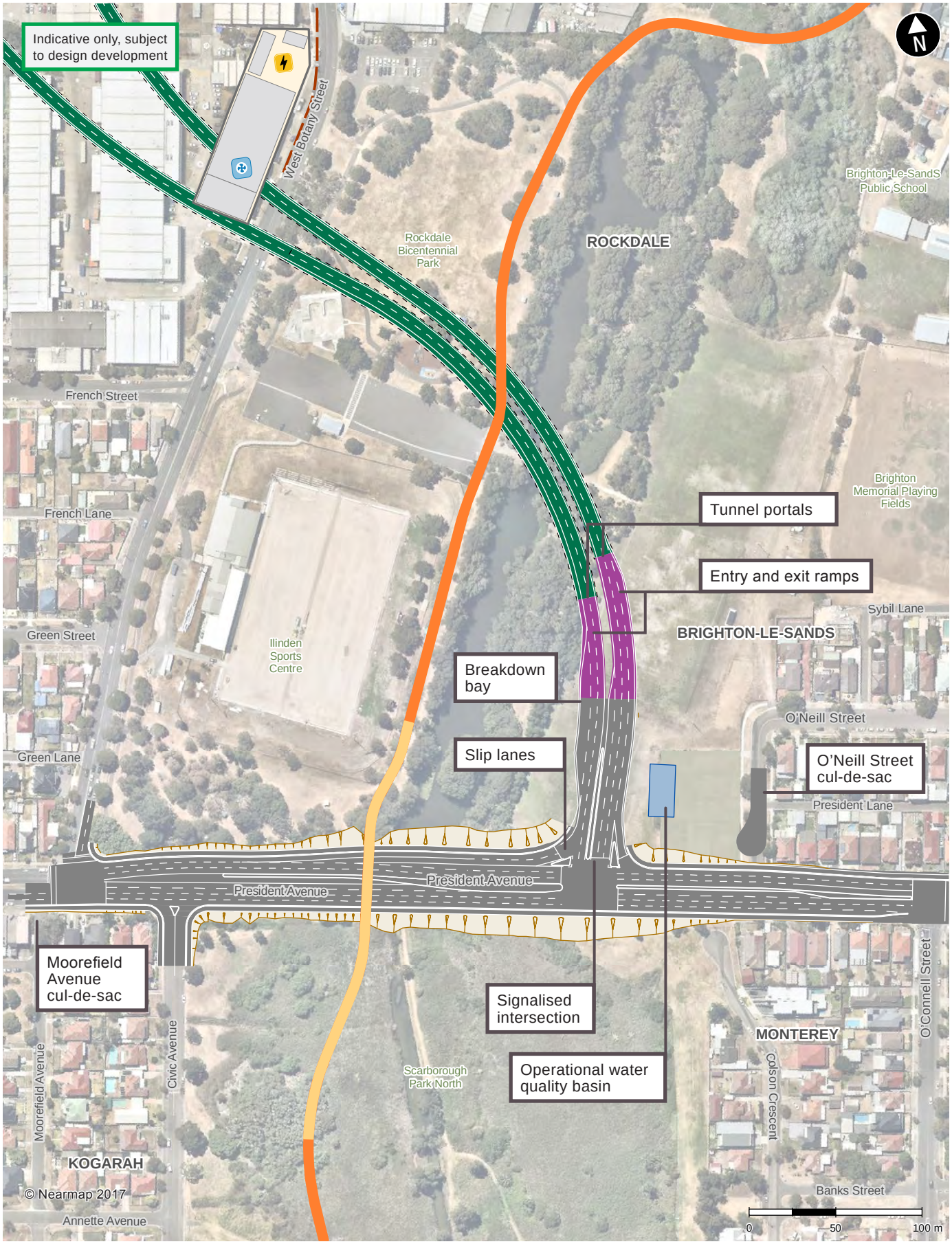


Figure 10-4 President Avenue / Princes Highway intersection layout



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 10-5 F6 Extension Stage 1 ramps / President Avenue intersection layout

10.3.2 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 10.1.

2026 'do something' scenario

Table 10-10 and **Table 10-11** 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 10-10 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 about 11 per cent higher than in the 'do minimum' scenario.

Table 10-11 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 10-12 and **Table 10-13** 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.

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 10-12 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 10-13 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%	–

10.3.3 Intersection performance

Table 10-14 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, as described in **section 10.3.1**.

As noted in section 4.3.2, for the purpose of analysing intersection performance, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed, allowing an assessment of intersections within the modelled network, irrespective of any downstream queuing that would mask the actual operation of the intersection.

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. Roads and Maritime would develop a strategy in consultation with Council to minimise the impacts of the project on O'Connell Street, which may involve Local Area Traffic Management (LATM) measures.
- 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.

A proposed Road Network Performance Review Plan would confirm the operational traffic impacts of the projects on surrounding arterial roads and major intersections. These reviews would be scheduled at 12 months and five years after the commencement of operation of the project and would examine potential management measures, following the collection of data that would facilitate a clearer understanding of actual project impacts.

Table 10-14 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 Extension 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 Extension 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 10-15 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 10-15 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

10.3.4 Travel times

Figure 10-6 and **Figure 10-7** show a comparison of VISUM travel times recorded on the Princes Highway, West Botany Street and The Grand Parade routes identified in **Figure 8-3** 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 in the 'do something' scenarios. This is 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.

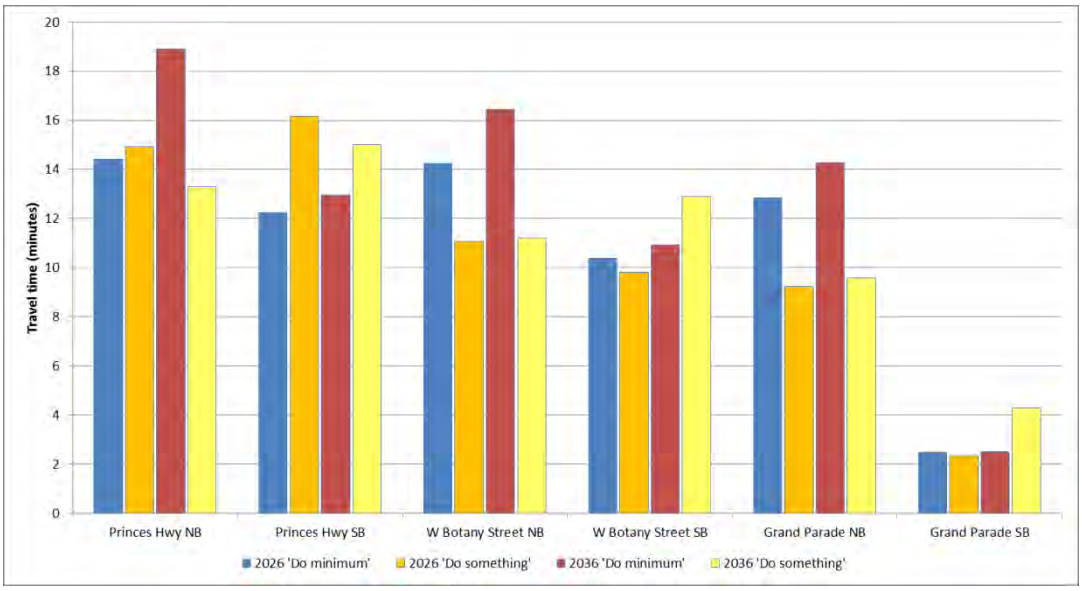


Figure 10-6 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – AM peak 'do minimum' vs 'do something' scenarios

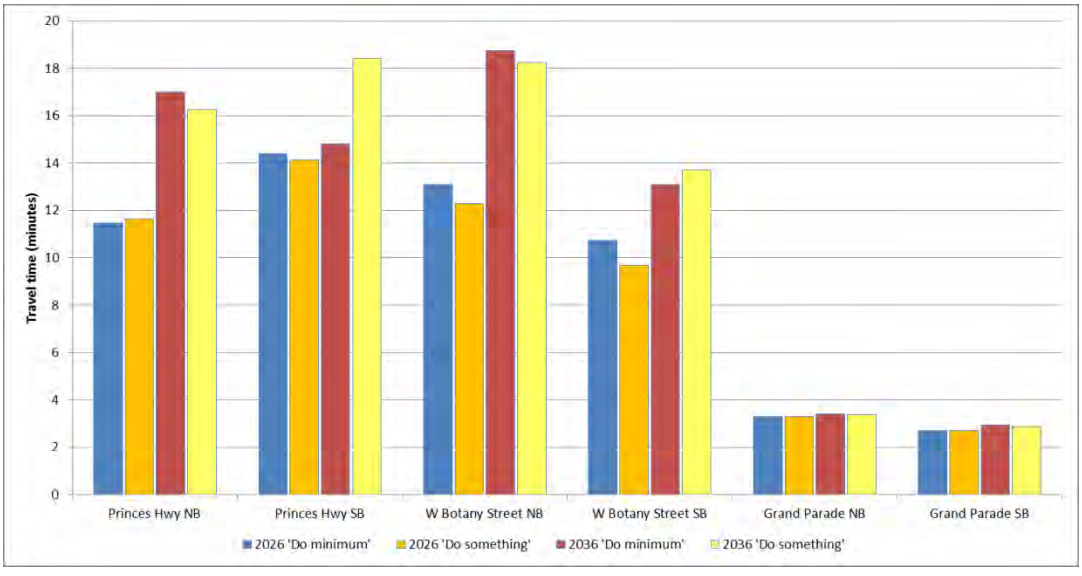


Figure 10-7 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – PM peak 'do minimum' vs 'do something' scenarios

Table 10-16 presents a comparison of average travel times and speeds on the President Avenue route (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 10-16 President Avenue corridor: Vissim modelled travel times and speeds – 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

10.3.5 Traffic crashes

Table 10-17 presents the crashes forecast under the 2026 'do something' scenario compared to the 'do minimum' scenario.

Daily traffic on the roads around the President Avenue intersection and surrounds is forecast to decrease overall, in the 2026 'do something' scenario compared to the 'do minimum' scenario, 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.

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. On President Avenue, traffic crashes are forecast to increase by two crashes per annum. Changes in traffic crashes with the project on other roads are smaller, with the average number of crashes increasing by one crash per annum on O'Connell Street / Chuter Avenue and on Bay Street.

Table 10-17 President Avenue intersection and surrounds: crash comparison between 2026 'do something' and 'do minimum' scenarios

Road Section	Section length (km)	ADT (veh)	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

Road Section	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
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

Note: ADT rounded to the nearest 100 vehicles

Table 10-18 compares the crashes forecast under the 2036 scenarios. Similar to 2026, there are forecast decreases in daily traffic in the 2036 'do something' scenario compared to the 'do minimum' scenario, with the most significant decreases in traffic forecast on The Grand Parade / General Holmes Drive, West Botany Street and Marsh Street / Airport Drive. There is a forecast overall decrease in the number and cost of traffic crashes on the roads around the President Avenue intersection and surrounds of just under five per cent.

Table 10-18 President Avenue intersection and surrounds: crash comparison between 2036 'do something' and 'do minimum' scenarios

Road Section	Section length (km)	ADT (veh)	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

Road Section	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
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

Note: ADT rounded to the nearest 100 vehicles

10.3.6 Public transport services

Figure 10-8 shows the comparison in forecast average bus travel time for the five bus routes (303, 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.

Bus stops along President Avenue, with the exception of the bus stop at Cross Street (on northern side of President Avenue), are located near existing signalised crossing points. These crossing points would be retained during operation of the project, and therefore there would be no significant reduction in accessibility to bus stops along President Avenue. Roads and Maritime would maintain the minimum green time requirements for pedestrians crossing President Avenue, such that increases in traffic on President Avenue would not impact accessibility to and from these bus stops.

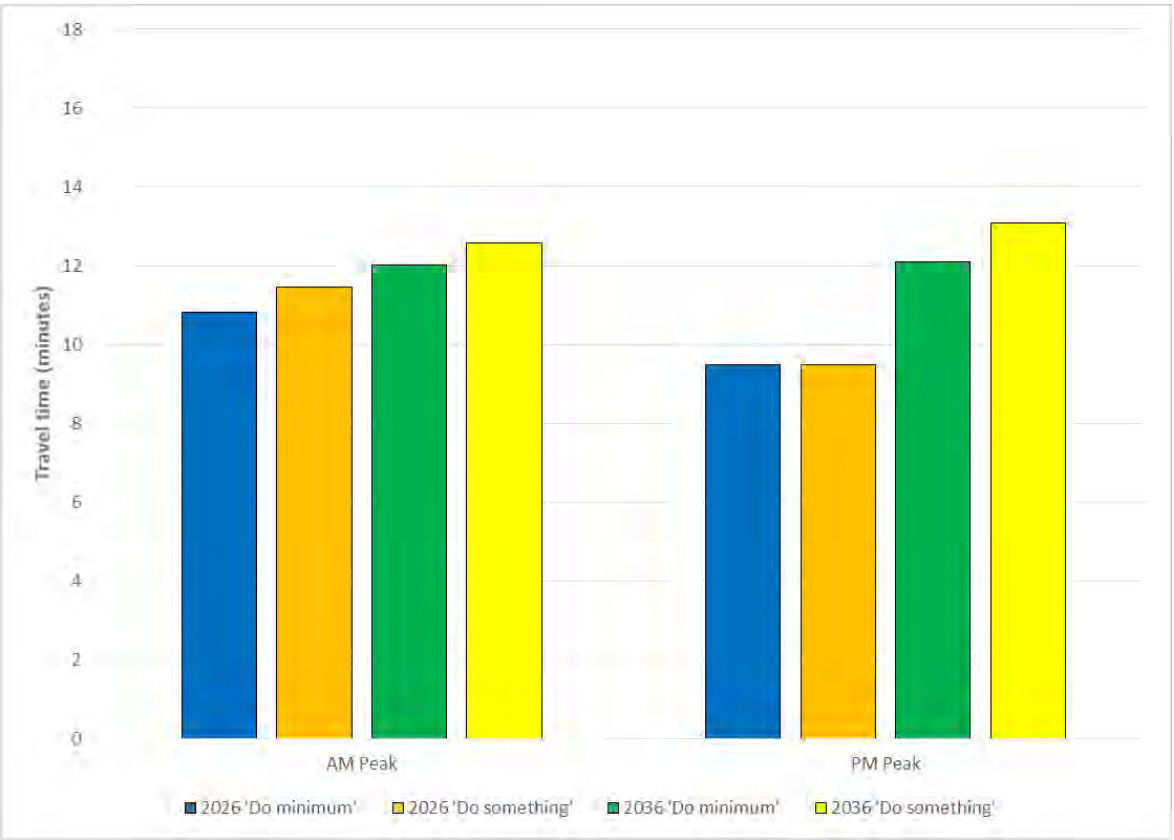


Figure 10-8 President Avenue intersection and surrounds: VISUM modelled average bus travel times – 'do minimum' vs 'do something' comparison

10.3.7 Active transport facilities – cycle and pedestrian pathways

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

A dedicated shared cycle and pedestrian 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 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. It provides 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:

- 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 as shown in **Figure 10-9**.
- 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.

The general alignment of the shared cycle and pedestrian pathways is shown on **Figure 10-11**. Detailed descriptions are also provided in **Appendix C** (Place making and urban design strategy) of the main EIS.

Figure 10-9 Typical section of the shared pedestrian and cycle pathways

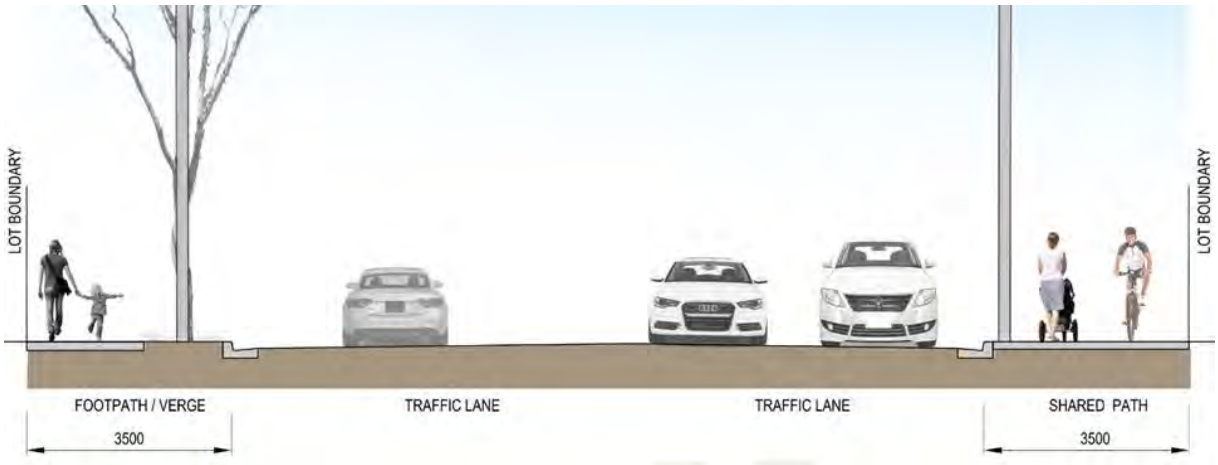


Figure 10-10 Typical section of the shared pedestrian and cycle pathways along Bay Street

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).

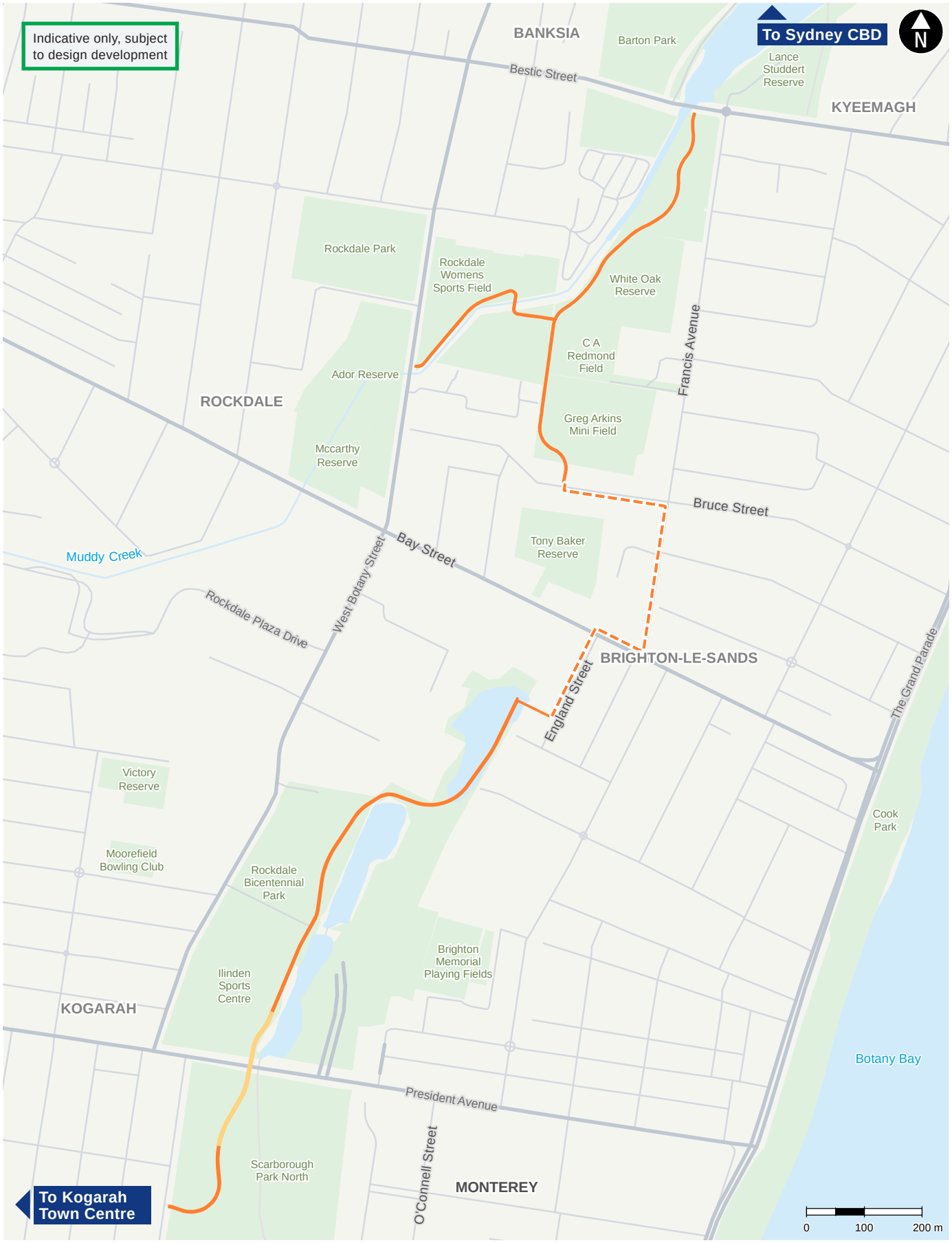


Figure 10-11 Shared cycle and pedestrian pathways

10.3.8 Impact on local property access and on-street parking

Access along President Avenue

As noted in **section 10.3.1**, 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, as shown on **Figure 10-12**:

- The President Avenue / O'Neill Street intersection currently allows all movements. With the project, O'Neill Street would be converted to a cul-de-sac due to the proximity of the new F6 Extension Stage 1 intersection. Vehicles would be able to use the President Avenue / Crawford Road intersection, about 200 metres to the east, which is a signalised intersection allowing all turning movements.
- The President Avenue / Civic Avenue intersection currently allows left in, left out and right out movements. With the project, this intersection would operate as a left in / left out intersection. The right out movement could not be accommodated due to the lengthened right turn lane on the westbound President Avenue approach to the West Botany Street intersection. Vehicles wanting to turn right onto President Avenue would be able to use the Oakdale Avenue / President Avenue intersection located about 150 metres to the west, at which all turning movements are allowed.
- The President Avenue / Moorefield Avenue, which currently allows left in / left out access, would be converted to a cul-de-sac. Vehicles would be able to use the left in / left out intersection at the President Avenue / Civic Avenue intersection to the east or the President Avenue / Oakdale Avenue intersection to the west, at which all turning movements would be allowed.

Other access arrangements on President Avenue impacted by the upgrade of President Avenue would include:

- TAFE car park entry and exit – formalised right turn in and refuge for the right turn out of the car park would be provided
- Lachal Avenue – would revert to two-way movement with formalised right turn in and refuge for the right turn out of Lachal Avenue being provided. This may result in a loss of some parking. This would be determined in consultation with Council to address potential impacts.
- Traynor Avenue – currently allows left in and right in movements from President Avenue. With the project, the left in movement would remain, but the right turn in would not be possible due to the formalised right turn in and out of Lachal Avenue. Vehicles wanting to turn right in would be able to use Lachal Avenue, about 75 metres to the west.
- Cross Street – due to the formalised right turn in and out of Lachal Avenue, the right turn in and out of Cross Street would not be possible, but the left in / left out movements would remain. Vehicles wanting to turn right in or right out would be able to use the signalised intersection at West Botany Street, about 175 metres to the east.

The creation of cul-de-sacs at the President Avenue / Moorefield Avenue and President Avenue / O'Neill Avenue intersections would occur during construction. Traffic surveys indicate fewer than 10 vehicles currently exit from Moorefield Avenue and fewer than 20 vehicles currently exit from O'Neill Avenue during each of the AM and PM peak hours. Roads and Maritime are working with Council to address any potential impacts as a result of the above proposed access changes.

The project would impact on the availability of parking along President Avenue. 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.

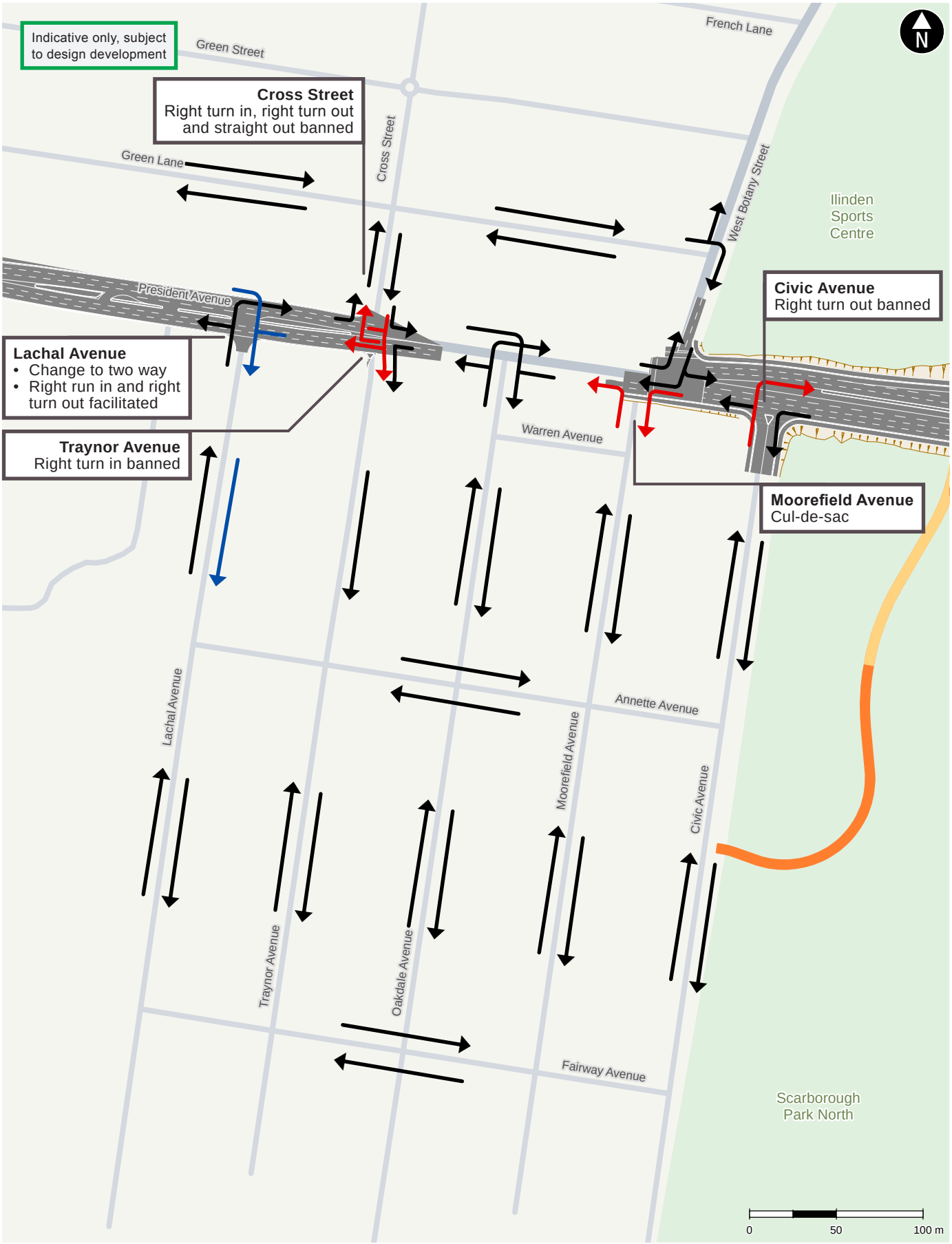


Figure 10-12 Permanent changes to the road network on President Avenue

On-street parking along President Avenue

With the project, there would also be changes to on-street parking along President Avenue during peak periods. 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 as described in **Table 10-19**.

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 Extension Stage 1 intersection, about 20 spaces would be retained
- Westbound between the F6 Extension 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 10-19 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.

It is noted that no clearways are planned on The Grand Parade as part of the project and have not been included in any analysis.

10.4 Operational performance – St Peters interchange and surrounds

10.4.1 Changes to 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.

10.4.2 Network performance

Table 10-20 and **Table 10-21** 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, due to changes in trip patterns, and the network performance metrics between the two scenarios are similar.

Table 10-20 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	120,180	<1%
Total time travelled approaching and in network (hr)	4,420	4,470	+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	7.3	0%
Average speed (km/h)	28.4	27.9	-2%
Unreleased vehicles			
Unreleased demand (veh)	760	630	-
% 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 10-21 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 10-22 and **Table 10-23** 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 total traffic demand forecast in the 'do something' scenario compared to the 'do minimum' scenario. However, the traffic pattern is different with an increase in traffic exiting the interchange to the Campbell Road / Euston Road intersection, but a similar drop in the surface to surface trips.

As a result, the total vehicle kilometres travelled increases because the trip in and out of the tunnels are generally longer trips than the surface trips. There is also a corresponding increase in travel time, which means the overall average speed is similar to the 2036 'do minimum' scenario. The forecast differences between average vehicle performance metrics are minimal.

Nonetheless, significant queuing is forecast on the exit ramp from the F6/New M5 Motorway to the Campbell Road / Euston Road intersection, which may queue back to the mainline motorway.

Table 10-22 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%

Network measure	2036 'do minimum'	2036 'do something'	% change
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.

Table 10-23 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	131,810	+2%
Total time travelled approaching and in network (hr)	4,930	5,560	+13%
Total vehicles arrived	33,150	32,760	-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	1,810	-
% of total traffic demand	4%	5%	-

10.4.3 Intersection performance

Table 10-24 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. As noted in **section 4.3.2**, for the purpose of analysing intersection performance, 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.

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 to the Campbell Road / Euston Road intersection from the F6/New M5 Motorway. As a result, the delays at this intersection increase significantly in the 2036 AM peak hour. The Princes Highway / Campbell Street intersection is already congested in the 'do minimum' scenario and these delays continue to increase in the 'do something' scenario. This intersection effectively meters the traffic to downstream intersections, so the Princes Highway / May Street and Princes Highway / Sydney Park Road intersections are less affected.

Due to the forecast queueing on the exit ramp to the Campbell Road / Euston Road intersection, vehicles are likely to divert to the Gardeners Road exit ramp. This diversion impacts the performance of the Gardeners Road / Kent Street intersection, which is already oversaturated in the 2036 AM peak hour, and is reflected in the increased delay forecast at this intersection.

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 10-24 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	39	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	68	E
Princes Hwy / Campbell St	25	B	57	E	58	E	60	E	84	F
Princes Hwy / May St	45	D	14	A	12	A	7	A	16	B
Princes Hwy / Sydney Park Rd	26	B	35	C	35	C	40	C	42	C
Sydney Park Rd / Mitchell Rd	2	A	39	C	52	D	51	D	75	F
Euston Rd / Sydney Park Rd	8	A	>100	F	>100	F	>100	F	>100	F

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 surrounding road network (including arterial roads and major intersections) 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 further inform the need for the potential mitigation measures around the St Peters interchange.

10.4.4 Travel times

Figure 10-13 and **Figure 10-14** show a comparison of travel times recorded on the travel time routes identified in **Figure 8-14** 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. As previously discussed, 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.

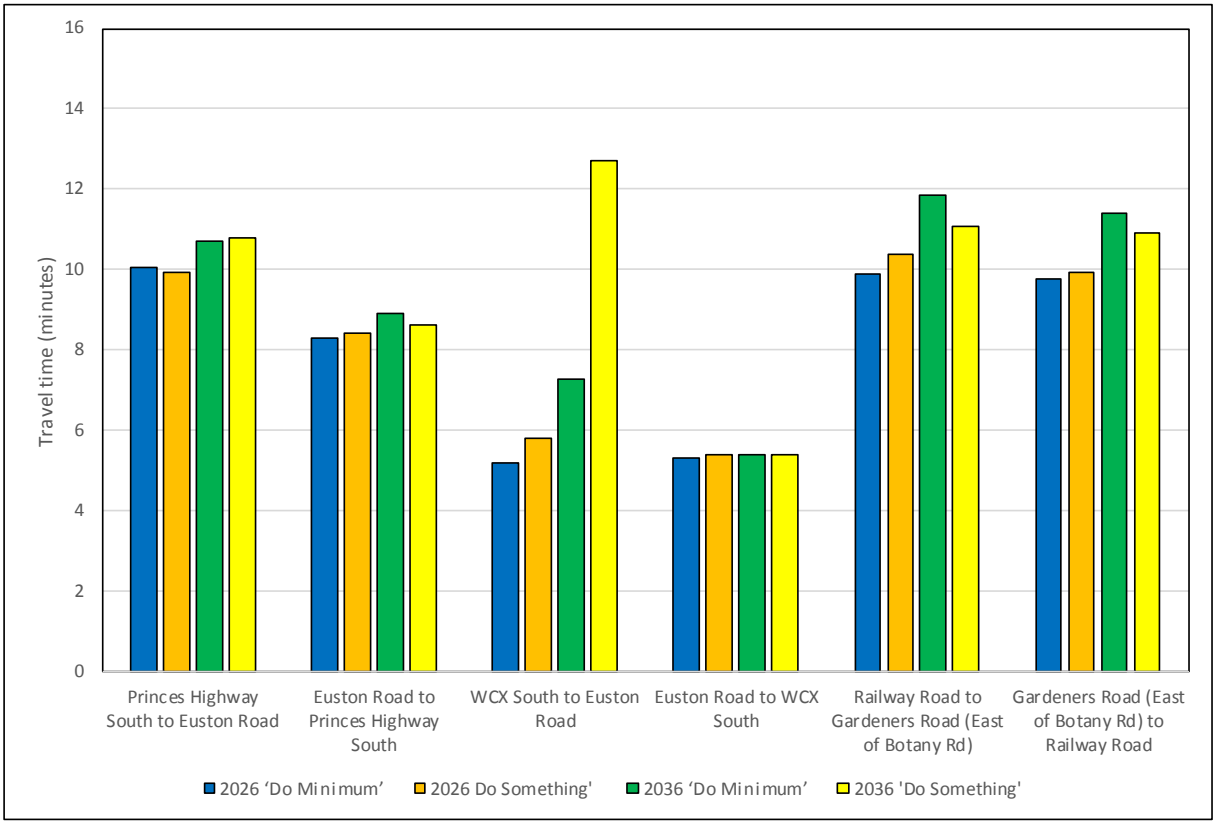


Figure 10-13 St Peters interchange: Average travel time (mins) – AM peak 'do minimum' vs 'do something' scenarios

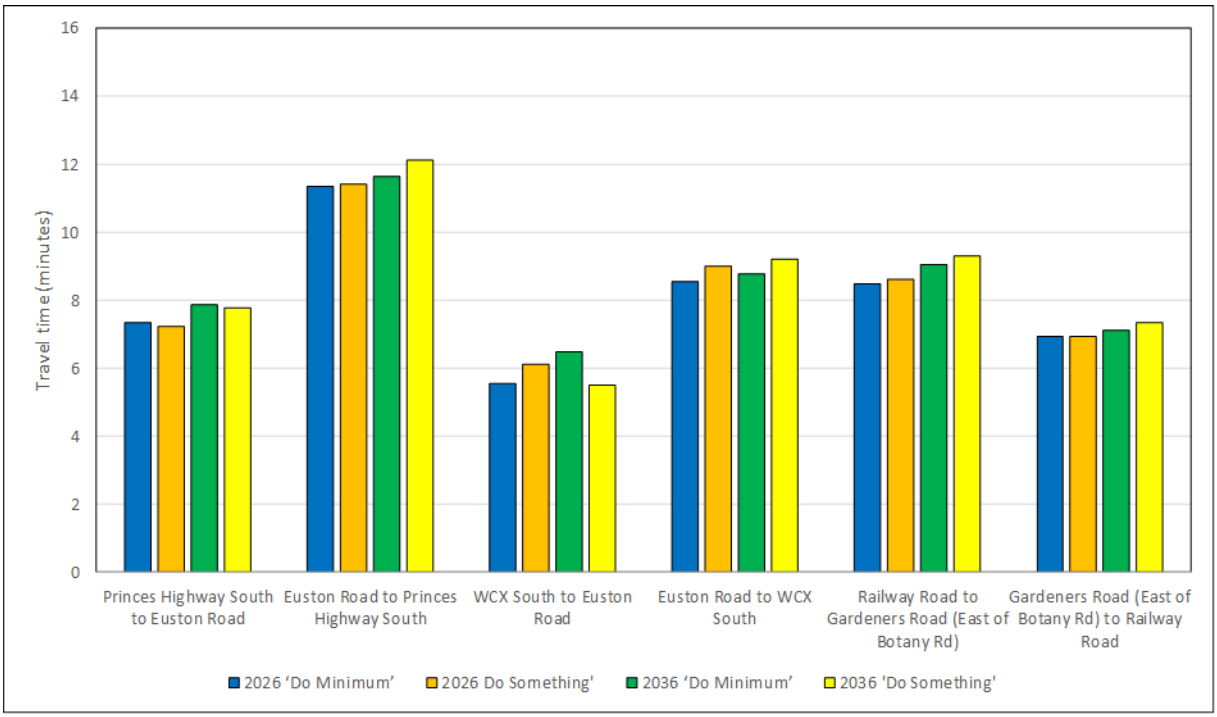


Figure 10-14 St Peters interchange: Average travel time (mins) – PM peak 'do minimum' vs 'do something' scenarios

10.4.5 Traffic crashes

Table 10-25 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 10-25 St Peters interchange and surrounds: crash comparison between 2026 'do something' and 'do minimum' scenarios

Road Section	Section length (km)	ADT (veh)	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

Note: ADT rounded to the nearest 100 vehicles

Table 10-26 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. Changes on other roads included in this assessment are five per cent or less.

The increases on certain roads and decreases on others, 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 10-26 St Peters interchange and surrounds: crash comparison between 2036 'do something' and 'do minimum' scenarios

Road Section	Section length (km)	ADT (veh)	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
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

Note: ADT rounded to the nearest 100 vehicles

10.4.6 Public transport services

Figure 10-15 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.

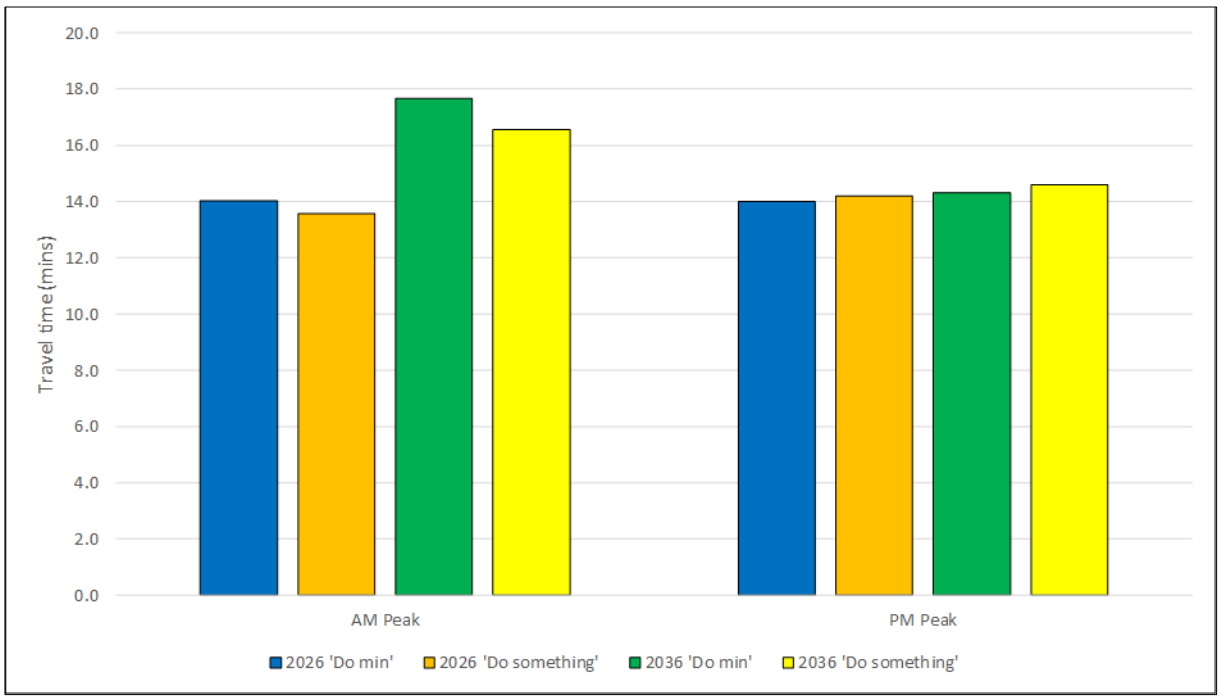


Figure 10-15 St Peters interchange: Average travel time for buses – 'do minimum' vs 'do something' comparison

10.4.7 Active transport (walking and cycling) facilities

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

10.4.8 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.

11 Management of impacts with the project

11.1 Management of construction impacts

11.1.1 Construction Traffic and Access Management Plan

A CTAMP will be prepared as part of the Construction Environmental Management Plan. The CTAMP 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), the RTA *Traffic Control at Work Sites* manual and AS1742.3: *Manual of uniform traffic control devices – Part 3: Traffic control for works on roads*, and any other relevant standard, guide or manual. It will seek to minimise delays and disruptions and identify and respond to changes in road safety as a result of project construction works.

The overarching strategy of the CTAMP will be to:

- Ensure all 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.

11.1.2 Other mitigation strategies during construction

It is expected that the construction contractor will take all reasonable measures to ensure that road user delays are minimised and that safe access is maintained for road users.

In addition to development of a CTAMP, the following mitigation strategies will be implemented to manage and control traffic during construction, in consultation with the Sydney Coordination Office, if appropriate:

- Identify potential road user delays, during the planning and consultation phases
- During detailed design and construction planning for the project, develop construction staging and temporary works that minimises conflicts with the existing road network and maximises spatial separation between work areas and travel lanes
- Isolate work areas from general traffic
- Develop alternative work methods to minimise delays and road user impacts, for example utilising more efficient plant and equipment, and applying different design solutions
- Provide closed-circuit television (CCTV) and Variable Message Signs prior to the start of construction to link with the existing Transport Management Centre (TMC) network to facilitate monitoring and management of impacts and traffic safety

- 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.
- Provide a mechanism for the community to report incidents and delays, for example a project phone number. This could be advertised along the construction site's interface with the road network
- Schedule construction-related transport movements to avoid peak traffic periods, where possible
- Develop and adopt robust community and stakeholder communication protocols regarding altered traffic conditions
- Minimise impacts on the pedestrian paths and cycle lanes, and provide timely alternatives during construction where practical and safe to do so
- Where required, 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.
- Manage local road closures and maintain adequate property access. This will be undertaken in consultation with Roads and Maritime, local councils and property owners likely to be impacted
- Identify haulage routes and communicate, along with site access requirements and restrictions, to all relevant drivers
- 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
- 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.

11.2 Management of operational impacts

11.2.1 Network changes included in project design

Changes to the surface road network are proposed within the project design to complement and/or mitigate the impacts of the project. These include:

- An intersection at President Avenue, located between Civic Avenue and O'Neill Street, including:
  - Entry and exit ramps, including sections of tunnel to provide connections to the mainline tunnel via a tunnel portal at Brighton-Le-Sands within Rockdale Bicentennial Park East
  - Widening of President Avenue around the intersection with the project entry and exit ramps, including slip lanes to provide connections to the project
- Upgrading the President Avenue / Princes Highway intersection to improve intersection capacity
- Alterations to local traffic access to and from President Avenue between Princes Highway and O'Connell Street
- Shared cycle and pedestrian pathways connecting Bestic Street, Brighton-Le-Sands to Civic Avenue, Kogarah

11.2.2 Operational traffic review

The traffic assessment has identified intersections where the operational performance would change under the future traffic demands as modelled. This assessment has been based on forecast traffic demands derived from SMPM and, consequently, the outcome may be affected by the limitations of the modelling process as described in **section 4.2**.

By 2036, peak demand conditions with or without the project are likely to start earlier and finish later than today to accommodate greater forecast traffic demand arising from increased population and changes to land use. Due to forecast congestion, some of this traffic is predicted to not be able to start or finish their journey within the peak period. Some drivers will therefore choose to make their journey either earlier or later in the peak period to avoid delay. This behaviour called 'peak spreading' is consistent with what has occurred in Sydney and in other international cities. This would cause less traffic demand to reach parts of the network than currently forecast to occur during the future one-hour peak periods.

President Avenue intersection and surrounds

The analysis has identified that the wider road network is forecast to perform slighter better with the project than without the project in 2026 and 2036, as traffic reassigns to use the new motorway. Some intersections are forecast to deteriorate compared to the 'do minimum' scenarios, mainly focused on the President Avenue corridor, though these intersection levels of service are forecast to be LoS D or better.

While the President Avenue / O'Connell Street intersection performance is forecast to be acceptable, more traffic is forecast to use O'Connell Street, which is an unclassified regional road. Roads and Maritime would develop a strategy in consultation with Council to minimise the impacts of the project on O'Connell Street, which may involve Local Area Traffic Management measures.

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 surrounding arterial roads and major intersections. The review would 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.

St Peters interchange and surrounds

The analysis has identified that the project is forecast to have a minimal impact on the St Peters interchange and surrounds road network in 2026. By 2036, while the surface road network is not significantly impacted by the project, significant queuing is forecast on the exit ramp from the F6/New M5 Motorway and the M4-M5 Link to the Campbell Road / Euston Road intersection in the AM peak hour, which may queue back to the New M5 mainline motorway.

Any mitigation measures would be developed in consultation with WestConnex and it is expected that 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 data of the operational traffic impacts of these projects on the surrounding arterial roads and major intersections. 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 and would confirm if the forecast traffic conditions are eventuating or not.

12 Assessment of cumulative impacts

12.1 Cumulative projects

This section details the forecast traffic performance of the study area during the 2036 'cumulative' scenario. The detailed assessments have been undertaken using forecast traffic volumes produced using the SMPM for the scenario with the 2036 'do something' projects completed, and Western Harbour Tunnel and Beaches Link and future stages of the F6 Extension between Kogarah and Loftus complete and open to traffic.

The proposed future Western Harbour Tunnel and Beaches Link would provide a further tunnel crossing of Sydney Harbour to the west of Sydney Harbour Bridge which, together with WestConnex, would act as a western bypass of the Sydney CBD. It would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component comprises a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest

Future stages of the F6 Extension would comprise proposed motorway links between President Avenue at Kogarah and the existing M1 Princes Highway at Loftus, generally along the 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.

12.2 Sydney metropolitan road network

Figure 12-1 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2036 'cumulative' and 'do something' 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 'cumulative' 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 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). This can be clearly seen by the thick red lines on the future stages of the F6 Extension and the corresponding reduction in traffic on the surface roads, as illustrated by the green lines.

Increases in daily traffic are forecast on President Avenue (east of the F6 Extension Stage 1 President Avenue ramps), and West Botany Street (south of Bay Street) as traffic travels to and from the project.

On-road freight

The observed increases and decreases for heavy vehicles are similar to those observed for general traffic, with forecast decreases in heavy vehicle traffic on the Princes Highway (south of President Avenue) and forecast increases in heavy vehicle traffic on West Botany Street (south of Bay Street), resultant as vehicles use these roads to access the motorway network. Increases in heavy vehicle traffic are also forecast on Rocky Point Road (south of the Princes Highway).

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.

Figure 12-1 Difference in AWT between 2036 'cumulative' and 'do something' scenarios

Source: SMPM v.1, February 2018

12.3 Operational performance – F6 Motorway Stage 1 motorway

12.3.1 Mid-block level of service

Table 12-1 and **Table 12-2** present the mid-block LOS for the 2036 'cumulative' scenario in the AM and PM peak hours. All motorway segments are forecast to operate at LoS D or better, with the exception of:

- St Peters interchange ramps (exit ramp in the AM peak and entry ramp in the PM peak) – LoS F
- Merge and diverge to and from the New M5 Motorway in both peaks – LoS F
- Mainline 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.

As noted in **section 10.2.1**, provision has been made for Smart (or Managed) Motorway infrastructure in the project design. A Smart Motorway uses technology to monitor, provide intelligence and control the motorway to ease congestion and keep traffic flowing more effectively. Technology, including lane use management signs, vehicle detection equipment, CCTV cameras and entry ramp signals, allows road operators to manage, in real-time, traffic entering, exiting and traversing the motorway. A comprehensive network-wide strategy could have significant benefits in maintaining acceptable operating conditions on the motorway in the future.

Table 12-1 F6 Extension Stage 1 LOS – 2036 AM peak hour 'cumulative' scenario

Section	Location	No of lanes	Modelled flow (PCU)	Posted speed (km/h)	Modelled speed (km/h)	% of posted speed	Evaluation criteria		LoS
							Density (PCU/km/ln)	V/C ratio	
New M5 Motorway – eastbound									
1	West of Project ramps	2	2,960	80	73	91%	20.2	-	D
2	Between Project ramps and SPI ramps	4	6,940	80	71	89%	24.6	-	E
3	North of SPI ramps	2	2,790	80	74	93%	18.8	-	D
4	SPI exit ramp	2	4,140	80	72	90%	28.9	-	F
New M5 Motorway – westbound									
4	SPI entry ramp	2	1,210	80	77	96%	7.9	-	B
3	North of SPI ramps	2	960	80	77	96%	6.3	-	A
2	Between SPI ramps and Project ramps	4	2,170	80	76	95%	7.1	-	B
1	West of Project ramps	2	1,160	80	76	95%	7.7	-	B
F6 Extension Stage 1 – northbound									
5	President Avenue entry ramp	2	2,250	60	55	92%	-	0.63	D
6	Merge between ramp and mainline	4	3,980	80	74	93%	13.4	-	C
7	Between President Avenue ramps and New M5 Motorway	3	3,980	80	72	90%	18.1	-	D
8	Merge to New M5 Motorway	2	3,980	80	70	88%	28.4	-	F
F6 Extension Stage 1 – southbound									
8	Diverge from New M5 Motorway	2	1,010	80	76	95%	6.6	-	A
7	Between New M5 Motorway and President Avenue ramps	3	1,010	80	77	96%	4.4	-	A
6	Diverge between ramp and mainline	4	1,010	80	76	95%	3.3	-	A
5	President Avenue exit ramp	2	430	60	60	100%	-	0.12	A

Table 12-2 F6 Extension Stage 1 LOS – 2036 PM peak hour 'cumulative' scenario

Section	Location	No of lanes	Modelled flow (PCU)	Posted speed (km/h)	Modelled speed (km/h)	% of posted speed	Evaluation criteria		LoS
							Density (PCU/km/ln)	V/C ratio	
New M5 Motorway – eastbound									
1	West of Project ramps	2	1,100	80	76	95%	7.2	-	B
2	Between Project ramps and SPI ramps	4	2,490	80	76	95%	8.2	-	B
3	North of SPI ramps	2	1,420	80	75	94%	9.4	-	B
4	SPI exit ramp	2	1,070	80	76	95%	7.1	-	B
New M5 Motorway – westbound									
4	SPI entry ramp	2	4,090	80	72	90%	28.5	-	F
3	North of SPI ramps	2	2,480	80	75	94%	16.4	-	D
2	Between SPI ramps and Project ramps	4	6,570	80	70	88%	23.3	-	E
1	West of Project ramps	2	2,320	80	74	93%	15.7	-	C
F6 Extension Stage 1 – northbound									
5	President Avenue entry ramp	2	870	60	58	97%	-	0.24	A
6	Merge between ramp and mainline	4	1,400	80	76	95%	4.6	-	A
7	Between President Avenue ramps and New M5 Motorway	3	1,400	80	76	95%	6.0	-	A
8	Merge to New M5 Motorway	2	1,400	80	76	95%	9.2	-	B
F6 Extension Stage 1 – southbound									
8	Diverge from New M5 Motorway	2	4,250	80	68	85%	31.1	-	F
7	Between New M5 Motorway and President Avenue ramps	3	4,250	80	75	94%	19.0	-	D
6	Diverge between ramp and mainline	4	4,250	80	72	90%	14.7	-	C
5	President Avenue exit ramp	2	1,670	60	59	98%	-	0.46	C

12.3.2 Traffic crashes

Table 12-3 presents the crashes forecast under the 2036 'cumulative' scenario compared to the 'do something' scenario for the F6 Extension Stage 1 mainline and for the New M5 Motorway between the interface location with the F6 Extension location and the St Peters interchange. Analysis has been undertaken based on the 2013-2017 crash rates in Sydney motorway tunnels including the M5 East tunnel, Sydney Harbour Tunnel and Eastern Distributor tunnel.

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 Motorway 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 Motorway between the F6 Extension and the St Peters interchange, and about 35 per cent on the F6 Extension Stage 1 mainline.

Table 12-3 F6 Extension Stage 1 : crash 2036 comparison between 'cumulative' and 'do something' scenarios

Road Section	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2036 'do something'				
New M5 Motorway (interface with F6 Extension - St Peters interchange)	4.5	81,284	140	$2,449,989
F6 Extension Stage 1 mainline (President Ave interchange - interface with New M5 Motorway)	3.4	41,756	54	$950,906
2036 'cumulative'				
New M5 Motorway (interface with F6 Extension - St Peters interchange)	4.5	96,737	166	$2,915,730
F6 Extension Stage 1 mainline (President Ave interchange - interface with New M5 Motorway)	3.4	56,763	74	$1,292,666

12.4 Operational performance – President Avenue intersection and surrounds

12.4.1 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, which would provide access to and from the future stages of the F6 Extension to the south – a single right turn lane from President Avenue eastbound into the southbound entry ramp, double left turn lanes from President Avenue westbound into the southbound entry ramp, double right turn lanes and single left turn lane from the northbound exit ramp into President Avenue and an additional southbound lane on West Botany Street to separate the left and right turns in the current shared turning lane. The through movement between West Botany Street and the F6 Extension to the south would bypass this intersection through a grade-separated structure.

12.4.2 Network performance

2036 'cumulative' scenario

Table 12-4 and **Table 12-5** 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.

AM peak hour

In the AM peak hour, the 2036 'cumulative' modelled network is forecast to perform similarly to the 'do something' modelled network. All forecast changes are less than five per cent. 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.

PM peak hour

In the PM peak hour, the 2036 'cumulative' network is also forecast to perform at a similar level to the 'do something' scenario network. Again, 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 12-4 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 12-5 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%	–

12.4.3 Intersection performance

Table 12-6 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, as described in **section 12.4.1**.

As noted in section 4.3.2, for the purpose of analysing intersection performance, 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.

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 ramps intersection, where the delay is forecast to increase, due to the addition of access to the further stages of the F6 Extension.

Table 12-6 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 Extension 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 12-7 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 12-7 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

12.4.4 Travel times

Figure 12-2 and **Figure 12-3** 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 8-3**, comparing the 2036 'do minimum', '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.

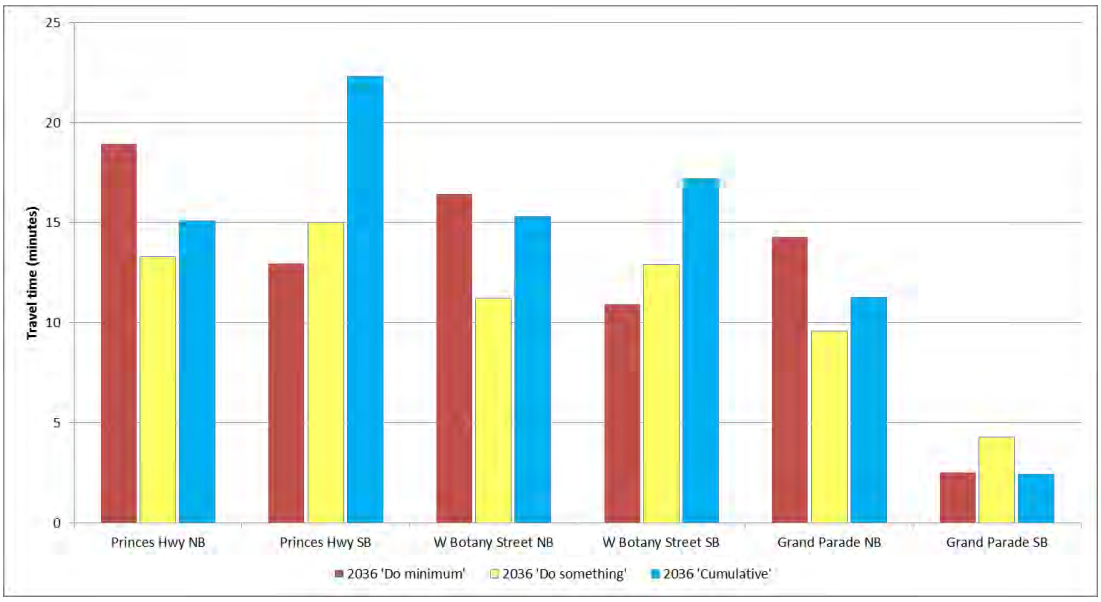


Figure 12-2 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – 2036 AM peak hour 'do minimum', 'do something' vs 'cumulative' scenarios

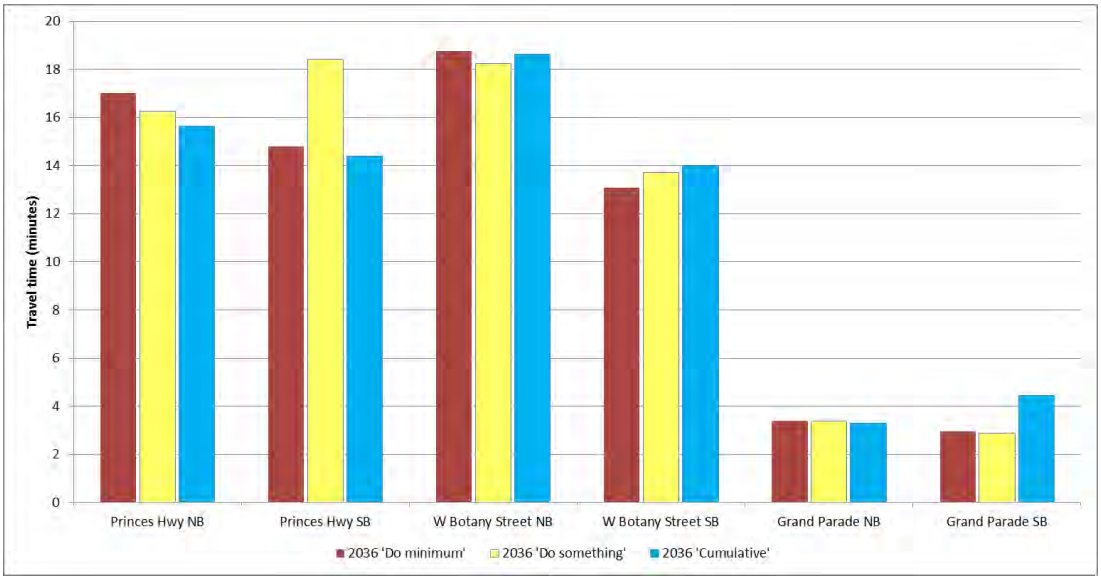


Figure 12-3 President Avenue intersection and surrounds: VISUM modelled average travel time (mins) – 2036 PM peak hour 'do minimum', 'do something' vs 'cumulative' scenarios

Table 12-8 presents a comparison of average travel times and speeds on the President Avenue route in the 2036 scenarios, extracted from the President Avenue corridor Vissim models.

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.

Table 12-8 President Avenue corridor: Vissim modelled travel times and speeds – 2036 'do minimum', 'do something' and 'cumulative' scenarios

President Avenue Routes	2036 'do minimum		2036 'do something'		2036 'cumulative'	
	Travel Time (min)	Speed (km/h)	Travel Time (min)	Speed (km/h)	Travel Time (min)	Speed (km/h)
AM peak hour						
Westbound	3.70	25	3.63	25	3.38	27
Eastbound	2.78	33	3.20	29	3.36	27
PM peak hour						
Westbound	3.13	29	3.68	25	4.15	22
Eastbound	2.44	38	3.25	28	2.77	33

12.4.5 Traffic crashes

Table 12-9 presents the crashes forecast under the 2036 'cumulative' scenario compared to the 'do something' scenario.

Forecasts indicate that daily traffic on the roads around the President Avenue intersection 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.

The number of crashes is forecast to decrease on five of the eight roads assessed, and the largest decrease is forecast to occur on The Grand Parade / President Avenue, where the average annual number and cost of crashes is forecast to decrease by about 13 crashes, a decrease of just under 15 per cent on this section of road.

On West Botany Street, the average number of and cost of annual crashes is expected to increase by about six crashes, which is an increase of 13 per cent for this road. Marsh Street / Airport Drive also experiences a small increase in traffic however this is not enough to impact the forecast number of crashes for this road.

Table 12-9 President Avenue intersection and surrounds: crash comparison between 2036 'cumulative' and 'do something' scenarios

Road Section	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
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
2036 'cumulative'				
Princes Hwy (Gannon St to Jubilee Ave)	6.4	54,200	131	$14,191,000
Rocky Point Rd (Princes Hwy to Jubilee Ave)	0.9	21,900	10	$2,137,000
West Botany St (Princes Hwy to President Ave)	3.6	21,100	54	$4,692,000
The Grand Pde / General Holmes Dr (Southern Cross Dr to Barton St)	6	83,800	79	$7,189,000
Marsh St / Airport Dr (West Botany St to North Precinct Rd)	2.4	57,800	30	$2,818,000
President Ave (Princes Hwy to The Grand Pde)	1.5	43,000	25	$6,525,000
O'Connell St / Chuter Ave (President Ave to Barton St)	0.9	14,500	4	$170,000
Bay St (Princes Hwy to The Grand Pde)	2	21,500	34	$6,602,000

Note: ADT rounded to the nearest 100 vehicles

12.4.6 Public transport services

Figure 12-4 shows the comparison in forecast average bus travel time for the five bus routes (303, 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 2036 'do minimum', 'do something' and 'cumulative' scenarios. The routes were selected as those with the highest frequency and which travelled a significant part of the modelled road network.

The results indicate that there is an forecast increase in average bus travel times of about 1.5 minutes compared to the 2036 'do something' scenario, 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, there is little difference in average bus travel times between the scenarios. The impact of the 'cumulative' scenario on the average bus travel times is therefore forecast to be minimal in the PM peak hour, when compared to the 2036 'do something' scenario.

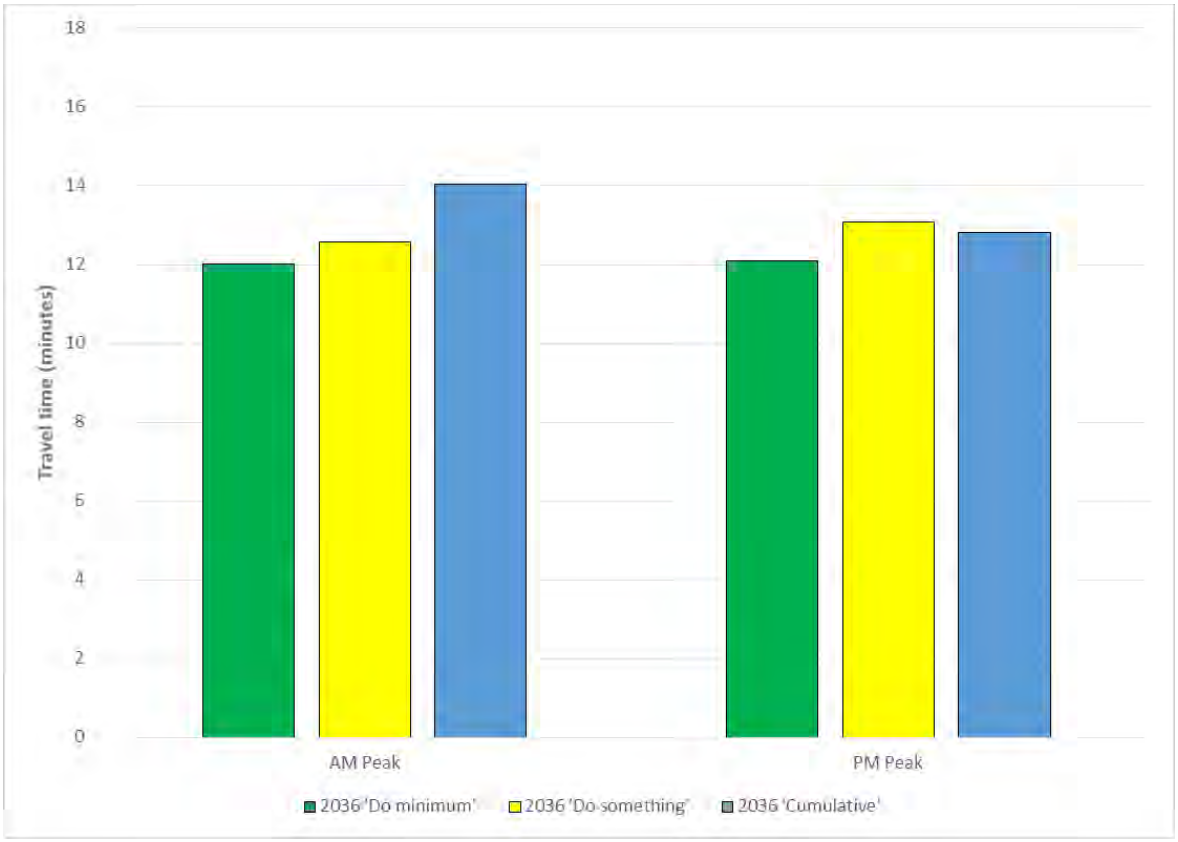


Figure 12-4 President Avenue intersection and surrounds: VISUM modelled average bus travel times – 2036 'do minimum', 'do something' vs 'cumulative' comparison

12.4.7 Active transport (walking and cycling) facilities

Changes to active transport facilities in the vicinity of the President Avenue intersection beyond those described and assessed in **section 10.3.7** 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.

12.4.8 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 10.3.8** would be considered as part of the development of future stages of the F6 Extension. No detail in this regard is currently available.

12.5 Operational performance – St Peters interchange and surrounds

12.5.1 Changes to road network in 'cumulative' scenario

No changes were made to the St Peters interchange modelled road network in the 'cumulative' scenarios compared to the 'do something' or 'do minimum' scenarios.

12.5.2 Network performance

Table 12-10 and **Table 12-11** 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.

AM peak hour

In the AM peak hour, the 2036 'cumulative' scenario is expected to increase the surface traffic demand within the St Peters interchange modelled road network by about two per cent. The impact on the network or average vehicle performance metrics is minor, with a slight improvement in average vehicle speeds and average travel times forecast in the 2036 'cumulative' scenario compared to the 2036 'do something' scenario.

PM peak hour

Similar to the AM peak hour, in the PM peak hour under the 2036 'cumulative' scenario the modelling forecasts an increase of around one percent in total traffic demand. There are only slight changes in the overall forecast network performance compared to the 2036 'do something' scenario.

Table 12-10 St Peters interchange 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)	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 12-11 St Peters interchange 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)	34,420	34,320	<1%	34,720	+1%
Total vehicle kilometres travelled in network (km)	129,370	131,810	+2%	137,600	+4%
Total time travelled approaching and in network (hr)	4,930	5,560	+13%	5,690	+2%
Total vehicles arrived	33,150	32,760	-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	1,810	–	1,850	–
% of total traffic demand	4%	5%	–	5%	–

12.5.3 Intersection performance

Table 12-12 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.

As noted in section 4.3.2, for the purpose of analysing intersection performance, 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.

The modelling results show that in both peak hours, the performance of each intersection is forecast to be similar comparing the 'do something' and 'cumulative' scenarios.

Table 12-12 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	39	C	41	C
Ricketty Street / Kent Road	41	C	44	D	48	D
Campbell Rd / Euston Rd	67	E	68	E	75	F
Princes Hwy / Campbell St	60	E	84	F	97	F
Princes Hwy / May St	7	A	16	B	14	A
Princes Hwy / Sydney Park Rd	40	C	42	C	44	D
Sydney Park Rd / Mitchell Rd	51	D	75	F	94	F
Euston Rd / Sydney Park Rd	>100	F	>100	F	>100	F

12.5.4 Travel times

Figure 12-5 and **Figure 12-6** show a comparison of travel times recorded on the travel time routes identified in **Figure 8-14** comparing the 2036 'do minimum', '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 Motorway 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.

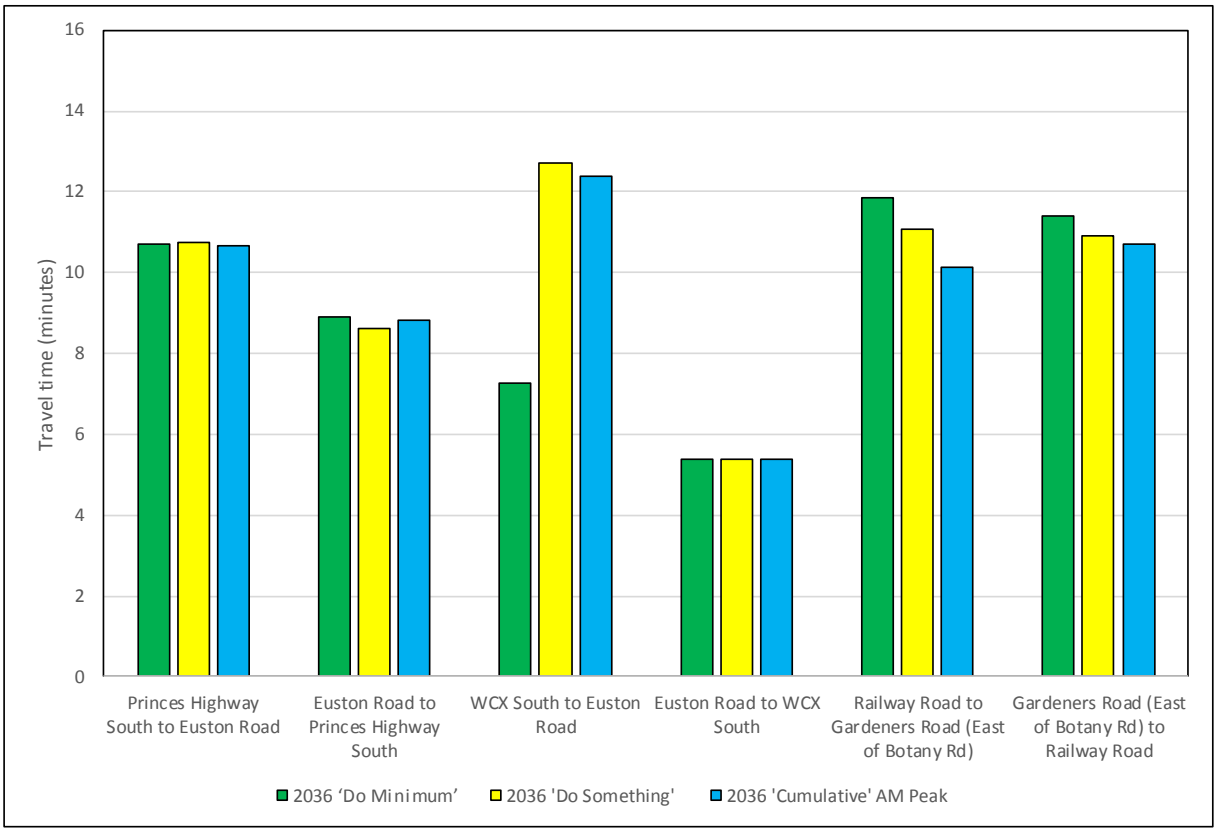


Figure 12-5 St Peters interchange: Average travel time (mins) – 2036 AM peak hour 'do minimum', 'do something' and 'cumulative' scenarios

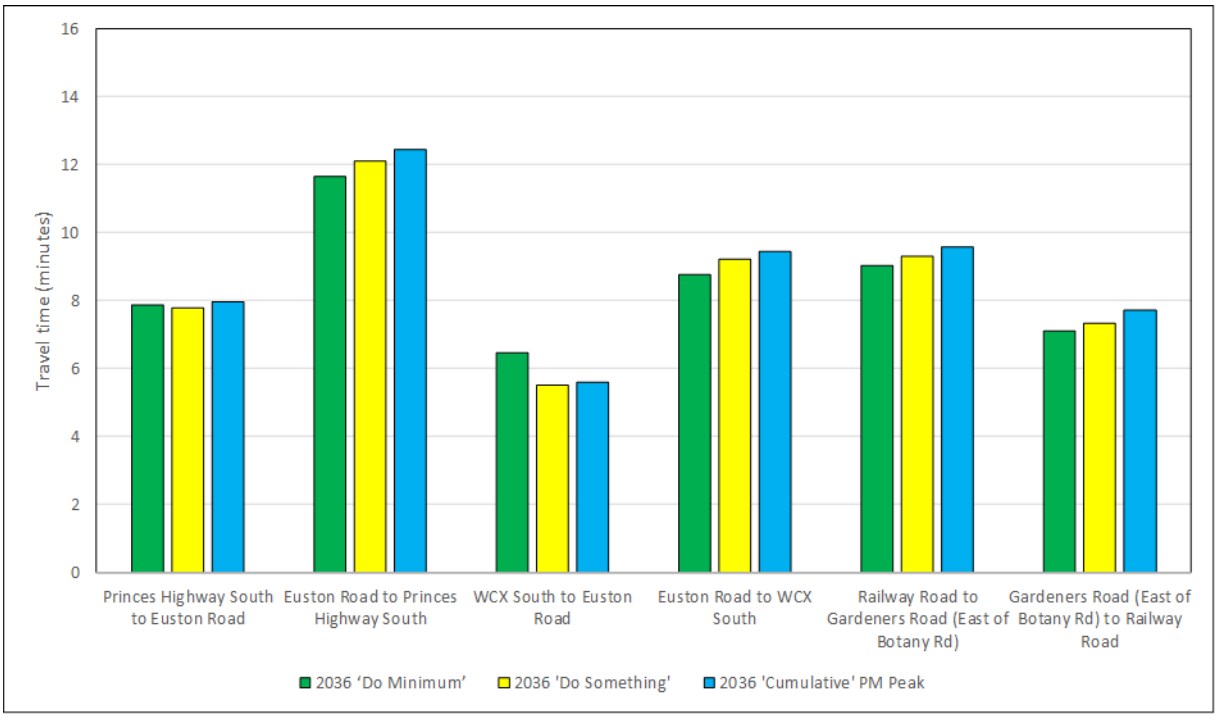


Figure 12-6 St Peters interchange: Average travel time (mins) – 2036 PM peak hour 'do minimum', 'do something' and 'cumulative' scenarios

12.5.5 Traffic crashes

Table 12-13 presents the crashes forecast under the 2036 'cumulative' scenario compared to the 'do something' scenario.

Forecasts indicate that the changes in the 'cumulative' scenario would have little 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.

Table 12-13 St Peters interchange and surrounds: crash comparison between 2036 'cumulative' and 'do something' scenarios

Road Section	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
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
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
2036 'cumulative'				
Princes Highway (Enmore Rd to Gannon St)	4.1	45,500	94	$13,713,000
Canal Road / Ricketty Street / Gardeners Road (Princes Hwy to Botany Rd)	4.7	48,100	53	$4,719,000
Euston Road (Sydney Park Rd to Campbell Rd)	0.9	59,300	109	$8,856,000
Bourke Road (Wyndham St to Gardeners Rd)	2.2	11,900	12	$1,460,000

Note: ADT rounded to the nearest 100 vehicles

12.5.6 Public transport services

Figure 12-7 shows the comparison in average bus travel time across the St Peters interchange modelled road network for the AM and PM peak hours in the 2036 'do minimum', 'do something' and 'cumulative' scenarios.

The results indicate that there is little difference in forecast bus travel times between the scenarios, with travel times forecast to change by less than one minute. The impact of the 'cumulative' scenario on the St Peters interchange bus travel times is therefore forecast to be minimal when compared to the 2036 'do something' scenario.

12.5.7 Active transport (walking and cycling) facilities

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

12.5.8 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.

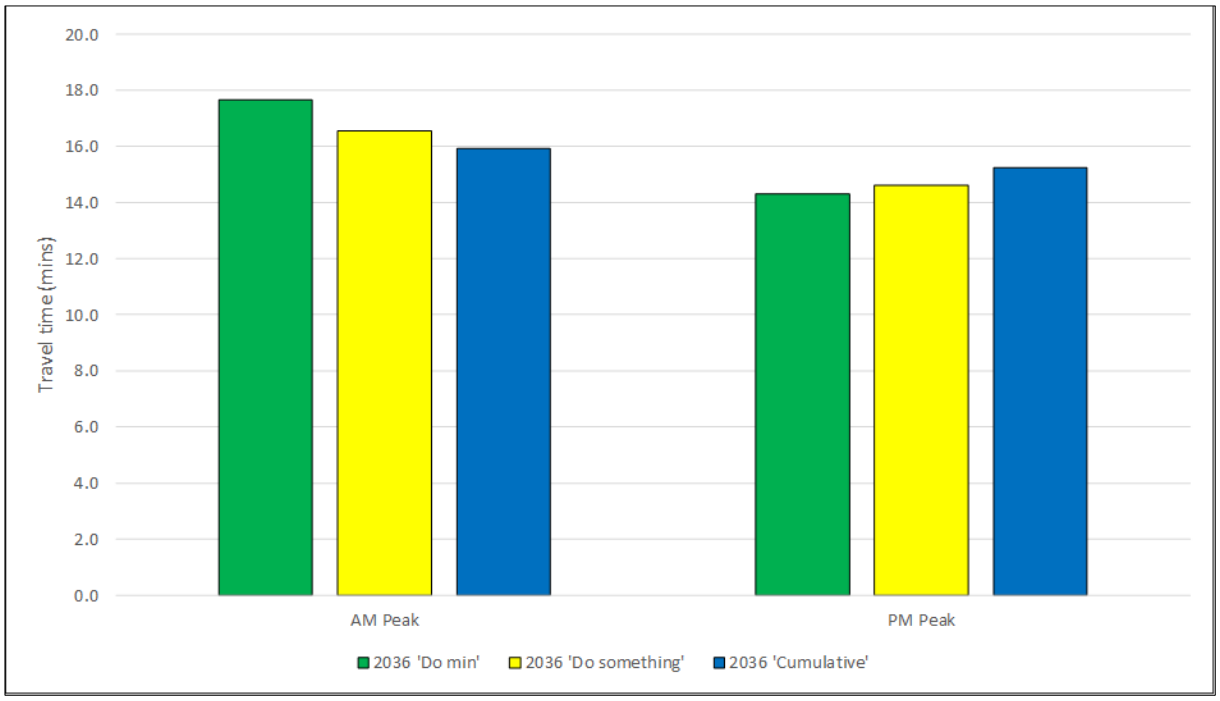


Figure 12-7 St Peters interchange: Average travel time for buses – 2036 'do minimum', 'do something' and 'cumulative' comparison

12.6 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.

13 Conclusion

Strategic and operational traffic modelling has assessed the project, on its own and as part of the broader planned motorway network development within the Sydney metropolitan area. Key outcomes of the traffic operational modelling include:

- Sections of the Sydney surface road network are currently approaching or exceeding capacity in the peak periods. The predicted peak period traffic volumes on the surface road network show significant growth by 2036 with or without the project. This forecast growth in traffic demand is consistent with the forecast growth in population in the Sydney Metropolitan Area and commensurate changes in land use and employment distribution. It is expected that, given the predicted growth in traffic volumes, the AM and PM peak periods would become longer, spreading congestion over longer periods of the day
- By 2036, the surface road network adjacent to the project is forecast to be at or close to capacity in peak periods without the project. The completion of the project is forecast to reduce vehicle distance travelled on non-motorway roads. In the 'do something' scenarios, overall network productivity is improved, with longer or more trips able to take place in less time. As the project is a comparatively short section of motorway in the context of the metropolitan road network, the impact is small.
- Reduced travel times are forecast between Kogarah and Mascot, Sydney CBD, North Sydney, Macquarie Park and Parramatta, and reduced traffic is forecast on sections of major arterial roads including sections of the Princes Highway, West Botany Street and General Holmes Drive
- Reduced heavy vehicle volumes on non-motorway links is also forecast, as heavy vehicles are forecast to divert to the project. Daily heavy vehicle volumes are forecast to fall by approximately 50 per cent on sections of Princes Highway and West Botany Street and by more than 20 per cent on sections of General Holmes Drive
- An implementation strategy to ensure appropriate network integration of the project is being developed. This strategy would include:
    - Working with Council to address potential impacts on O'Connell Street as a result of the project and on Civic Avenue as a result of the proposed access changes along President Avenue
    - Working with WestConnex to manage traffic in the St Peters, Alexandria and Mascot areas
    - A proposed Road Network Performance Review Plan to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. These reviews would be scheduled at 12 months and five years after the commencement of operation of the project and would examine potential management measures, following the collection of data that would facilitate a clearer understanding of actual project impacts.
    - Active traffic management measures both on the motorway and arterial networks.

Project objectives have been developed to address the key transport challenges faced by the Greater Sydney region and to align with objectives developed for the overall F6 Extension. These are:

- **Transport** - Improve journey times and reliability for all road users travelling to, from and through southern Sydney
- **Productivity** - Support future growth and productivity by providing better connections to the rest of Sydney
- **City Shaping** - Support improved land use and urban renewal around selected centres on the Princes Highway and The Grand Parade by reducing through traffic along these corridors that perform a key place function.

Based on the assessments undertaken, the project would contribute to fulfilling these objectives.

While construction traffic would impact on the operation of the road network surrounding the construction facilities, the analysis indicates that the intersection levels of service are forecast to generally not be significantly impacted, with the exception of the Marsh Street / M5 East ramps. This is due to the access to and from the M5 East Motorway being the key routes for construction traffic. However, the Marsh Street / M5 East ramps intersection is still forecast to operate at a LoS D in the 'with construction' scenario.

Impacts due to temporary lane closures and speed reductions, particularly during traffic staging, would also occur. A Construction Traffic and Access Management Plan (CTAMP) will be prepared and implemented, which will detail construction traffic management and mitigation measures that will assist in minimising disruption to road users.

Annexure A - Justification of modelled areas

Introduction

This appendix presents the scope of the road network impacted by the project to provide justification of the nominated boundaries of the operational model areas. Operational modelling was focused around the areas of largest local impact in the AM and PM peak hours, which are generally around the interface points between the project and the surface road network, namely the President Avenue intersection and the St Peters interchange.

Bandwidth plots illustrating the forecast change in AM and PM peak hour traffic volumes between the 2036 'do something' and the 'do minimum' scenarios were assessed. Roads expected to carry less traffic in the future 2036 'do something' scenario are shown in green and roads where volumes are predicted to increase in the future are shown in red. The line thickness is indicative of the magnitude of this change – the thicker the line, the more impact there is likely to be. Difference plots with the nominated modelling boundary overlaid for each motorway interchange are presented.

President Avenue intersection and surrounds

Annexure Figure 1 and **Annexure Figure 2** present the AM and PM peak hour volume difference plots between the 2036 'do something' and the 'do minimum' modelled scenarios in the vicinity of the President Avenue intersection, with the operational model boundary overlaid. The impact of the inclusion of the project is mainly focused on President Avenue, General Holmes Drive, Princes Highway, West Botany Street and, to a lesser extent, Bay Street and Bestic Street, which are captured within the boundary of the operational model reported on in **section 10.3**. The level of change due to the project along roads like Forest Road, outside of these boundaries, is forecast to be small with minimal impact on performance.

St Peters interchange and surrounds

Annexure Figure 3 and **Annexure Figure 4** present the AM and PM peak hour volume difference plots between the 2036 'do something' and the 'do minimum' modelled scenarios in the vicinity of the St Peters interchange, with the operational model boundary overlaid. The impact of the inclusion of the project is mainly focused on Princes Highway, Gardeners Road and, to a lesser extent, Euston Road south of Sydney Park Road, and Botany Street and O'Riordan Street south of Gardeners Road, which are captured within the boundary of the operational model reported on in **section 10.4**. The level of change due to the project along roads outside of these boundaries is forecast to be small with minimal impact on performance.

In addition to operational modelling, assessment of the wider network impacts outside of the two operational model boundaries was also undertaken through screenline analysis, Sydney metropolitan network plots and travel time analysis.

Annexure Figure 1 President Avenue intersection: comparison of 2036 AM peak hour volumes 'do something' and 'do minimum'

Source: SMPM v.1, February 2018

Annexure Figure 2 President Avenue intersection: comparison of 2036 PM peak hour volumes 'do something' and 'do minimum'

Source: SMPM v.1, February 2018

Annexure Figure 3 St Peters interchange: comparison of 2036 AM peak hour volumes 'do something' and 'do minimum'

Source: SMPM v.1, February 2018

Annexure Figure 4 St Peters interchange: comparison of 2036 PM peak hour volumes 'do something' and 'do minimum'

Source: SMPM v.1, February 2018

Annexure B - Heavy vehicle screenline analysis

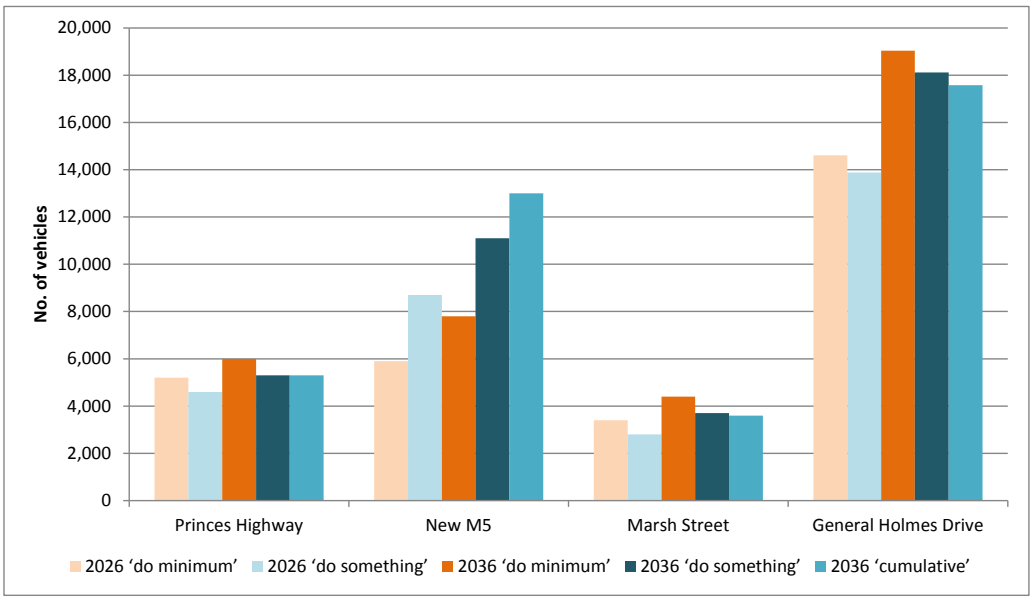
Introduction

Analysis has been carried out that looks at heavy vehicle volumes in isolation. The impacts of the project on heavy vehicles is important as it gives insight into how well the implementation of the project and other road network improvements will be in moving heavy vehicles away from more local roads and onto motorways. Heavy vehicle screenline analysis has been carried out for all three screenlines.

Cooks River screenline

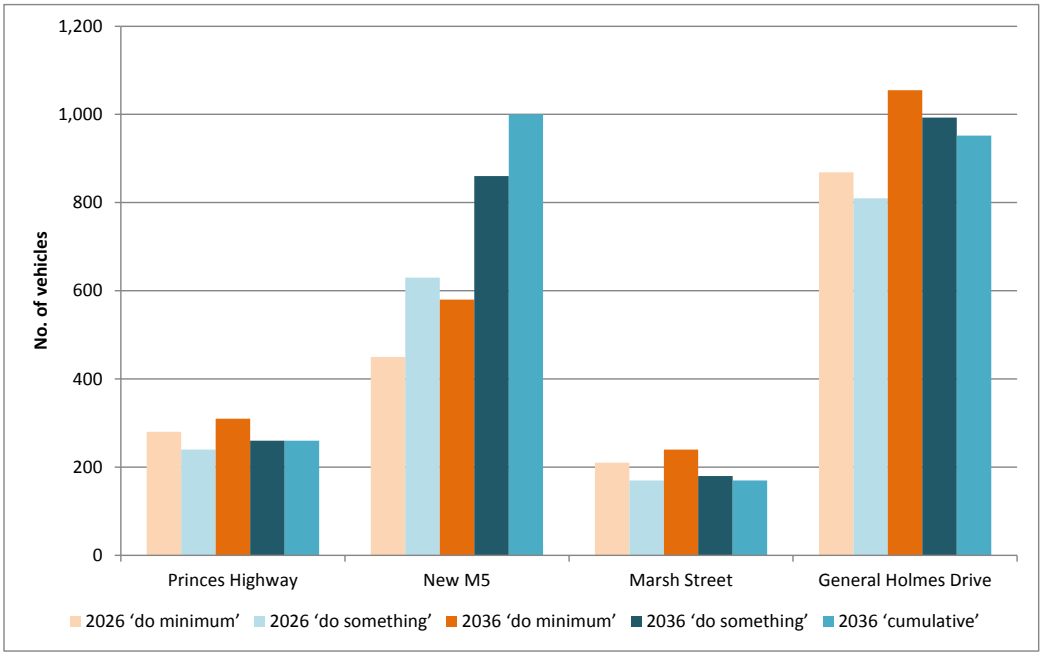
The forecast two-way AWT heavy vehicle volumes crossing the Cooks River screenline can be seen in **Annexure Figure 1**, while **Annexure Figure 2** and **Annexure Figure 3** illustrate the two-way peak hour heavy vehicle volumes crossing the screenline.

The patterns of change forecast for heavy vehicles crossing the Cooks River screenline are similar to those forecast for all vehicles, with the project forecast to cause a shift of vehicles away from existing roads crossing the Cooks River and onto the New M5 Motorway. However, forecasts indicate the project would have a greater impact on heavy vehicles, with a shift in heavy vehicles away from non-motorway roads onto this section of the New M5 Motorway of about 10 per cent, compared to a shift of about 5 per cent forecast for all vehicles.



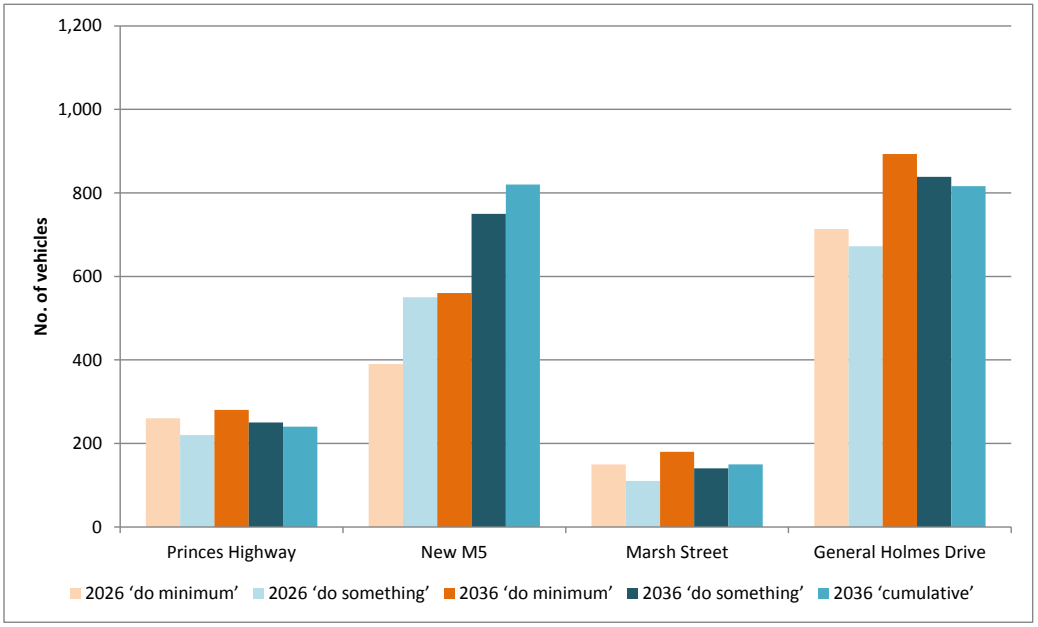
Annexure Figure 1 Cooks River screenline comparison of two-way AWT heavy vehicle volumes

Source: SMPM v.1, February 2018



Annexure Figure 2 Cooks River screenline comparison of two-way AM peak one-hour heavy vehicle volumes

Source: SMPM v.1, February 2018



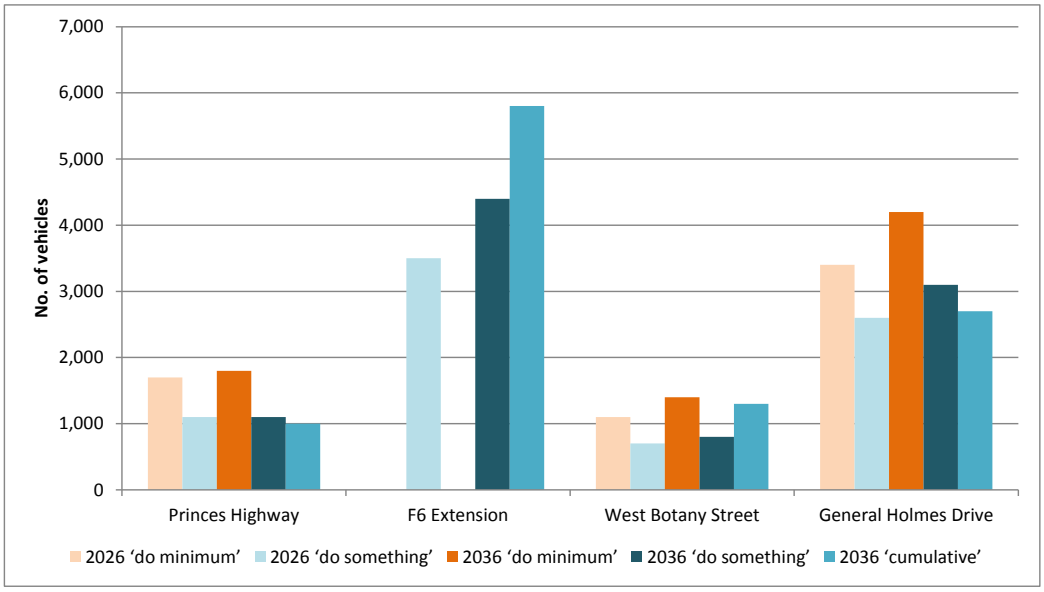
Annexure Figure 3 Cooks River screenline comparison of two-way PM peak one-hour heavy vehicle volumes

Source: SMPM v.1, February 2018

F6 Extension Stage 1 screenline

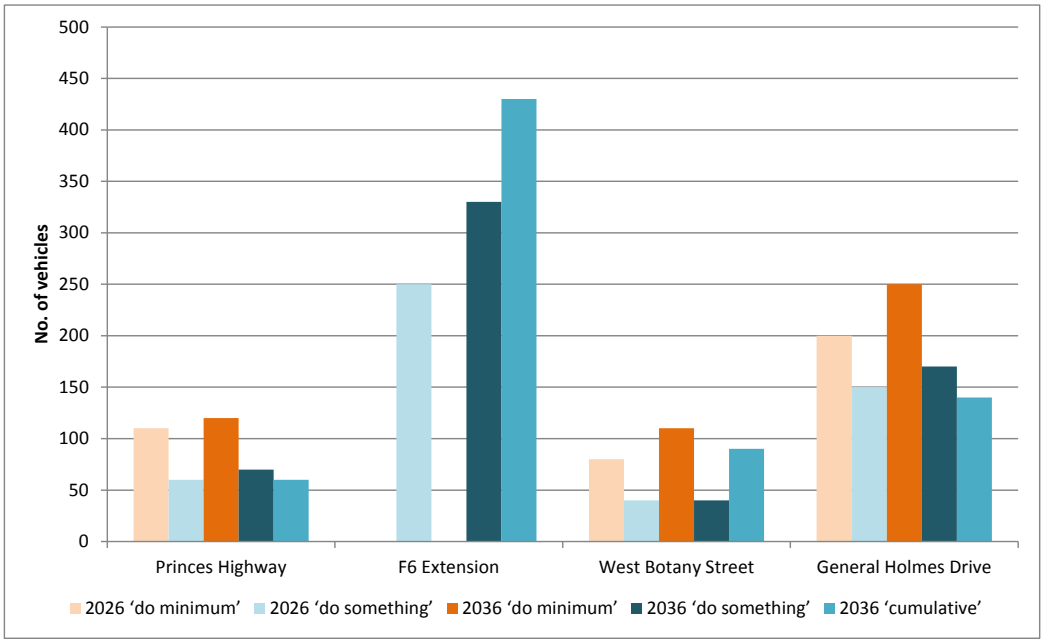
Annexure Figure 4 illustrates the forecast two-way AWT heavy vehicle volumes crossing the F6 Extension Stage 1 screenline, while **Annexure Figure 5** and **Annexure Figure 6** illustrate the two-way peak hour heavy vehicle volumes crossing the screenline.

The forecasts indicate that the project has the impact of significantly reducing heavy vehicle volumes on key arterial north-south road links between Arncliffe and Kogarah. While the patterns of reduction forecast for heavy vehicle traffic are similar to those forecast for all vehicles, the percentage reduction of heavy vehicles on surface roads contained in the screenline is much larger than for all vehicles. With the project, heavy vehicles volumes are forecast to fall by more than 40 per cent on the Princes Highway and by more than 30 per cent on General Holmes Drive.



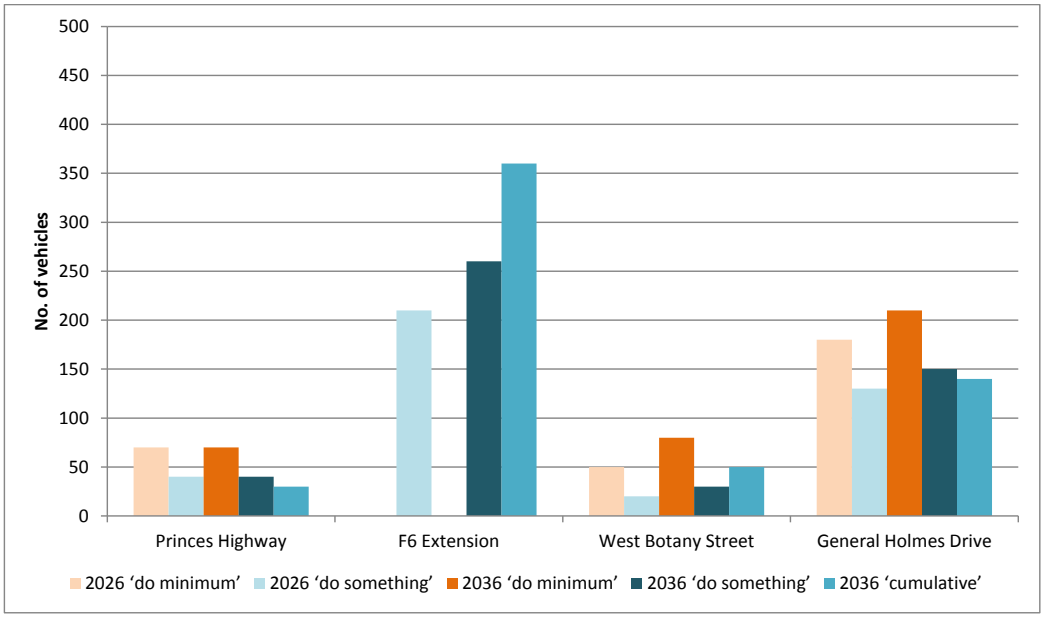
Annexure Figure 4 F6 Extension Stage 1 screenline comparison of two-way AWT heavy vehicle volumes

Source: SMPM v.1, February 2018



Annexure Figure 5 F6 Extension Stage 1 screenline comparison of two-way AM peak one-hour heavy vehicle volumes

Source: SMPM v.1, February 2018



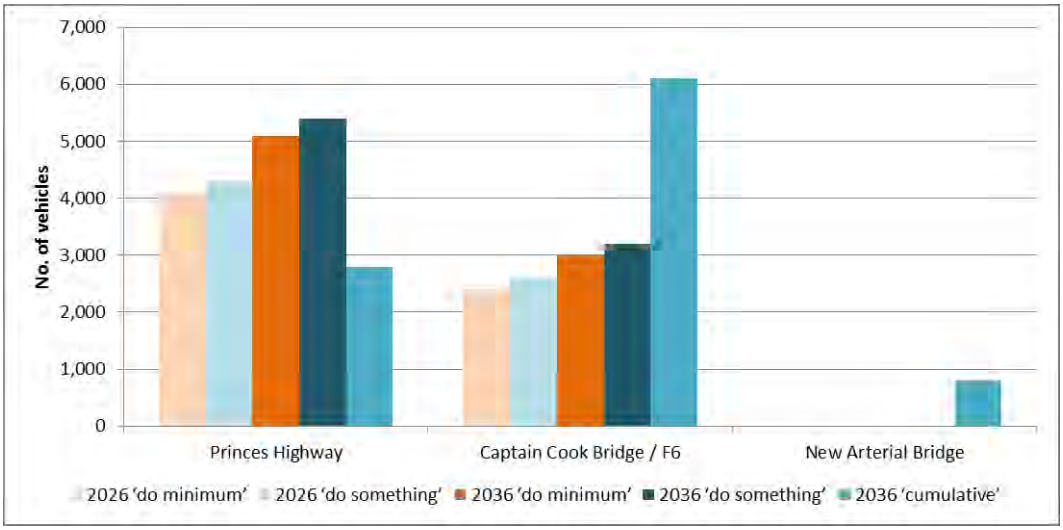
Annexure Figure 6 F6 Extension Stage 1 screenline comparison of two-way PM peak one-hour heavy vehicle volumes

Source: SMPM v.1, February 2018

Georges River screenline

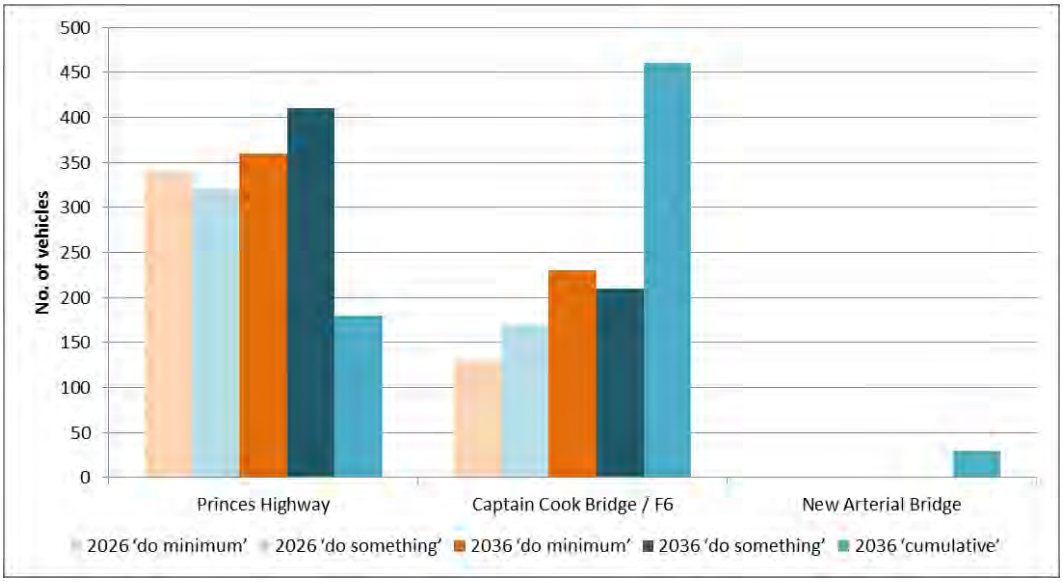
The forecast two-way AWT heavy vehicle volumes crossing the Georges River screenline are shown in **Annexure Figure 7**, while **Annexure Figure 8** and **Annexure Figure 9** illustrate the two-way peak hour heavy vehicle volumes crossing the screenline.

Similar to what was observed for all vehicles, the project is not forecast to have a significant impact on heavy vehicle travel patterns at the Georges River screenline. Comparing the 'do something' scenario with the 'do minimum' scenario, there is an increase of about 200 heavy vehicles in 2026 and about 300 vehicles in 2036 on Princes Highway and Captain Cook Bridge combined. However, comparing the 'cumulative' scenario, which includes further stages of the F6 Extension from Loftus to Kogarah, to the 'do minimum' scenario, significant changes in heavy vehicle volumes are forecast. A substantial increase in heavy vehicles crossing the screenline is forecast, with an increase of 8-14 per cent in the peak hours and a 20 per cent increase across the day. There is a significant shift off the Princes Highway, with some forecast to use the new arterial bridge crossing of the Georges River, which carries eight per cent of daily heavy vehicles crossing the screenline, but most of the increase is forecast on Captain Cook Bridge, which in the future becomes part of the F6 Extension motorway, where both peak hour and daily heavy vehicle traffic volumes are forecast to more than double.



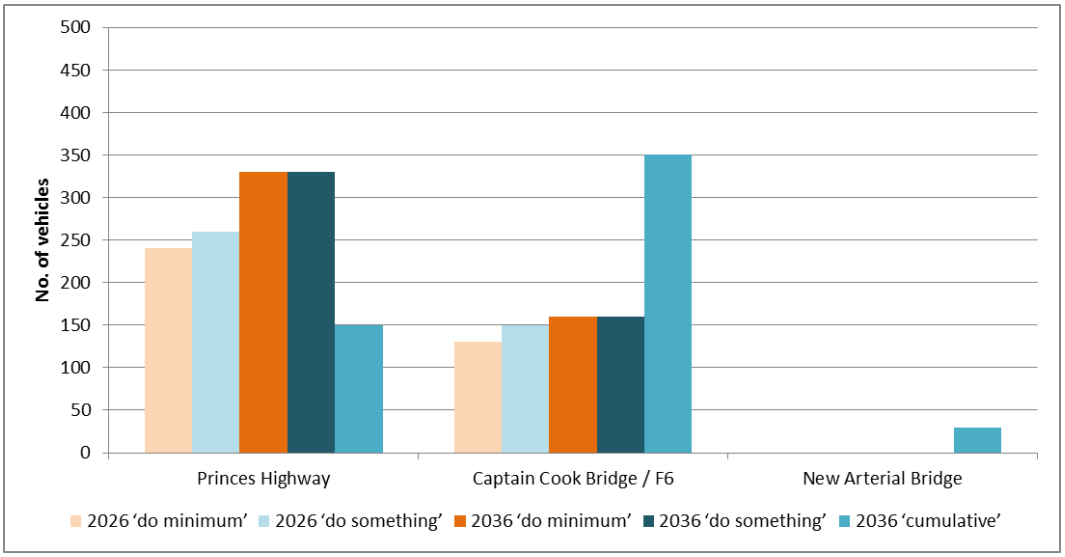
Annexure Figure 7 Georges River screenline comparison of two-way AWT heavy vehicle volumes

Source: SMPM v.1, February 2018



Annexure Figure 8 Georges River screenline comparison of two-way AM peak one-hour heavy vehicle volumes

Source: SMPM v.1, February 2018



Annexure Figure 9 Georges River screenline comparison of two-way PM peak one-hour heavy vehicle volumes

Source: SMPM v.1, February 2018

(blank page)