9 Traffic and transport

A technical working paper: Traffic and transport (**Appendix G**) has been prepared to assess potential traffic and transport impacts during construction and operation of the New M5 (the project). This section provides a summary of the technical working paper and details:

- The assessment methodology and approach used to undertake the traffic and transport assessment
- The existing traffic and transport environment within the traffic and transport study area
- Future traffic and transport conditions without the project
- Potential impacts of the project on the road network during construction and operation
- Recommended safeguards and management measures to avoid minimise and / or mitigate potential traffic and transport impacts.

Table 9-1 sets out the Secretary's Environmental Assessment Requirements (SEARs) as they relate to traffic and transport, and where in the environmental impact statement (EIS) these have been addressed.

Table 9-1 Secretary's Environmental Assessment Requirements – traffic and transport

Secretary's Environmental Assessment Requirement	Where addressed
Details of how the proposal meets the objectives of the overall WestConnex program.	The project objectives are detailed in **Section 3.5**. A summary of how the project meets the objectives is provided in **Table 31-2** (Project justification and conclusion).
Details of how the traffic and transport objectives of the proposal, and service and infrastructure responses, take into account: adjacent sensitive land uses; future housing and employment growth areas; existing town, employment and industrial centres; approved and proposed infrastructure proposals; and broader transport needs (including public transport, cyclist and pedestrian requirements and facilities); including with specific reference to: • The preferred alignment and design. • The proposed interchanges and connections to the surrounding road network. • Associated road and related transport infrastructure facilities.	The preferred alignment and design, including interchanges and connections to the local road network has considered how the project would provide connectivity to and support areas identified for future housing and employment growth. This is described in **Chapter 4** (Project development and alternatives). The design includes the provision of cyclist and pedestrian facilities, opportunities for bus infrastructure improvements, and maintains existing connectivity. Impacts of the project on public and active transport have been considered and are described throughout **Section 9.3**. Impacts to nearby sensitive land uses have been considered throughout the development of the project, and are discussed in **Chapter 15** (Social and economic).
An assessment and modelling of operational traffic and transport impacts on the local and regional road network (in consultation with affected councils), and the Sydney motorway network, including the consideration of planning proposals, major urban renewal and development, the potential cumulative impacts of Stage 3 – M4 South (Haberfield to St Peters), and the impacts of potential shifts of traffic movements to alternative routes outside the proposal area (including as a result of tolls);	Operational traffic modelling undertaken for the project considered impacts to the local and regional network, including the M5 East Motorway. Modelling of the future road network with the project was undertaken for three future scenarios; 2021 and 2031 with the project, and 2031 with the full WestConnex program of works and the future Southern extension. The full WestConnex program of works includes the future M4-M5 Link. Future year modelling scenarios included consideration of background traffic growth associated with urban and residential development. Potential shifts in traffic movements to alternative routes have also

Secretary's Environmental Assessment Requirement	Where addressed
	been assessed. The operational traffic impacts of the project are described in **Section 9.3.2**.
Induced traffic and operational implications for public transport (particularly with respect to strategic bus corridors and bus routes) and future public transport opportunities	Impacts of the project on existing and future public transport opportunities are described in **Section 9.3**.
Impacts on property and business access and on street parking provision, including permanent and temporary (construction) changes to access and parking, and traffic management measures such as clearways	Impacts to property access and on-street parking during construction and operation are provided in **Section 9.3**.
impacts on cyclists and pedestrian access and safety and consideration of opportunities to integrate cycleway and pedestrian elements with surrounding networks	Impacts on cyclists and pedestrian access and safety during construction and operation of the project are described in **Section 9.3.1**. Opportunities to integrate cycleway and pedestrian elements with the surrounding network are described in **Section 9.3.2**.
construction traffic and transport impacts of the proposal (including ancillary facilities) and associated management measures, in particular:	
• Impacts on the road network (including safety and level of service, parking, pedestrian and cyclist access, and disruption to public transport services and access to properties).	Impacts on the road network from construction traffic are described in **Section 9.3.1** and **Appendix G** (Technical working paper: Traffic and transport).
• Route identification and suitability for heavy vehicles, and scheduling of transport movements, particularly movements outside standard construction hours	Construction vehicle routes are discussed in **Section 9.3.1**. The construction traffic assessment has considered heavy vehicle movement during peak periods and off-peak periods, including outside standard construction hours.
• The number, frequency and size of construction related vehicles (both light and heavy vehicles).	Construction traffic volumes and patterns are described in **Section 9.3.1**. Construction vehicles are detailed in **Section 6.8** (plant and equipment).
• The nature of existing traffic on construction access routes (including consideration of peak traffic times).	The existing traffic environment within the traffic study area, which includes construction traffic vehicle routes is described in **Section 9.2**.
• The need to close, divert or otherwise reconfigure elements of the road network associated with construction of the proposal.	Temporary and permanent road closures, changes to property access, and modifications to pedestrian and cyclist pathways and infrastructure during construction of the project are described in **Section 9.3.1**.
• Having reference to the cumulative construction impacts of other infrastructure preparing for or commencing construction.	A description of potential cumulative construction traffic impacts is provided in **Section 9.3.1**. Additional detail regarding cumulative impacts is provided in **Chapter 27** (Cumulative impacts).

9.1 Assessment methodology

The Technical working paper: traffic and transport (**Appendix G**) has assessed the potential impacts of the project during construction and operation, including cumulative impacts associated with the WestConnex program of works and the future Southern extension. The existing traffic and transport environment, and the potential traffic and transport related impacts associated with the project have been described as two separate areas to reflect the key components of the project:

- The M5 East Motorway corridor (the M5 East Motorway, the main alignment tunnels between the two ends of the project and the St Peters interchange)
- The local roads around St Peters interchange and Sydney Park.

The traffic and transport impact assessment undertaken for the project consisted of three key components:

- Characterising the existing traffic and transport environment within the study area using a combination of data from the Bureau of Transport Statistics and Roads and Maritime, traffic counts and survey data, and traffic modelling applications
- The development and application of a regional strategic model; the WestConnex Road Traffic Model, to determine the anticipated future growth in traffic on the major road network and the effects of tolling on the road traffic demand
- Network modelling to determine the traffic and transport conditions within the western surface works, M5 East Motorway corridor and the local roads around St Peters interchange during construction of the project, and in future years with and without the project.

The study area for the traffic and transport assessment, as well as the methodology for undertaking these key traffic and transport assessment is discussed in **Section 9.1.1** to **Section 9.1.6**.

9.1.1 Study area

The study area for the traffic and transport assessment is shown on **Figure 9-1**. The study area encompasses the local and regional road network including the M5 East Motorway corridor and local roads around the St Peters interchange.

The extent of the traffic and transport study area was limited to roads which would potentially be affected as a result of construction and / or operation of the project, including roads which:

- Would be used as part of construction compound vehicle routes
- Would provide the main connections between the M5 East Motorway and the arterial road network during construction and operation
- Would provide the main connections between the New M5 and the arterial road network during operation.

The King Georges Road Interchange Upgrade Project is located near the western surface works. This project was approved in March 2015 and construction works have commenced. As part of the traffic and transport assessment for the project, operational traffic impacts along King Georges Road have not been re-evaluated from what was undertaken as part of the King Georges Road Interchange Upgrade project.

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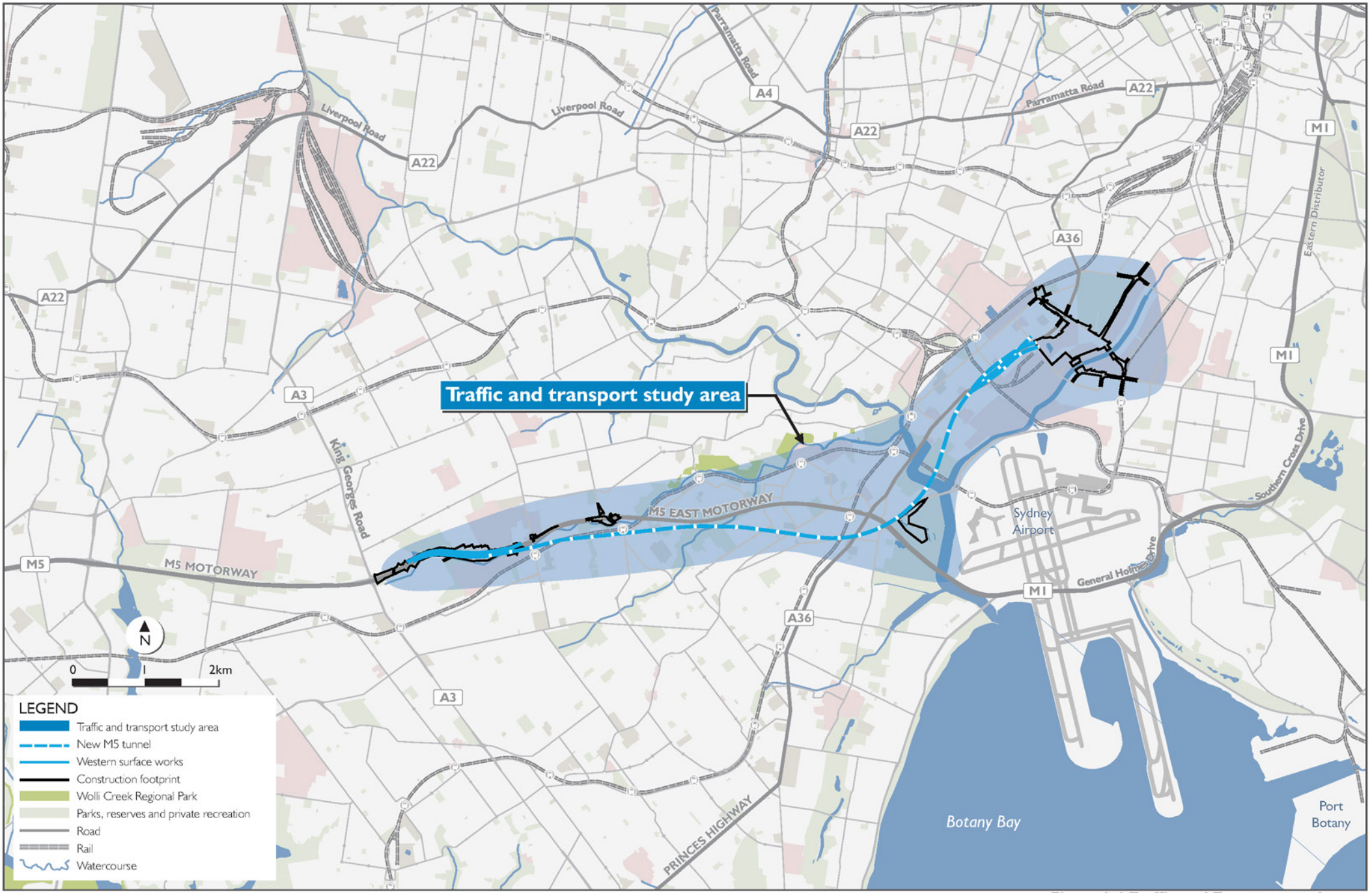

Figure 9-1 Traffic and Transport study area

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9.1.2 Characterising the existing traffic and transport environment

The existing traffic and transport environment across the study area was characterised through:

- Data collection and review to identify the transport mode share
- Deriving traffic patterns from traffic counts.

Data collection and review

Traffic and transport-related data was collected and analysed to determine the modes of travel across the study area. Key sources of data included:

- *Household Travel Survey Report: Sydney 2012 / 2013*, (Bureau of Transport Statistics (BTS) 2014b release)
- Train Statistics 2014: Everything you need to know about Sydney Trains and NSW TrainLink, 9th Edition (BTS, December 2014c)
- Traffic volume counts and road travel time surveys collected by Roads and Maritime. Traffic surveys used to characterise the existing environment included:
  - Automatic count surveys at 13 mid-block locations and 48 intersections
  - Bicycle counts at nine locations in 2014
- Roads and Maritime crash data between 2009 and 2013.

Deriving existing traffic patterns

Automatic mid-block traffic counts were carried out at 13 locations in the study area during 2014 (refer to **Figure 9-1**). A 'mid-block' is a section of road between two intersections. In addition, traffic counts were also conducted at 48 key intersections across the study area. Locations of mid-block and intersection traffic counts were selected to provide a good representation of existing traffic conditions on roads likely to be affected by the project.

The traffic count data was used to prepare average daily and weekly traffic profiles for the study area.

Percentages of heavy vehicles were also recorded at both mid-block and intersection counts, to characterise the current distribution of heavy and light vehicles using the road network around the project.

Data collected from mid-block and intersection counts, including AM and PM peak traffic volumes, daily traffic volumes and percentages of heavy vehicles are presented in **Section 9.2**.

The traffic count data collected has been used to assess the existing operational performance of the road network in areas likely to be affected by the project, including:

- Along the M5 East Motorway corridor
- Local roads around the St Peters interchange.

In assessing the existing performance of roads and intersections, the following performance indicators have been used:

- Road safety and incidence of traffic crashes (based on Roads and Maritime Crash Data between 2009 and 2013 and Transport for NSW Centre for Road Safety Data)
- Average travel speeds and travel times
- Mid-block and intersection level of service (LoS) (refer to **Section 9.1.6** for more detail about measures of network performance).

The assessment of existing traffic performance included comparing the collected AM and PM peak period traffic data with road and intersection design capacity. This comparison has allowed an assessment of whether a particular road or intersection is operating below, at or above its design capacity, indicating the level of congestion currently experienced. Existing intersection performance level of service and average delays at key intersections have also been determined.

9.1.3 Approach to traffic modelling

Overview of traffic modelling approach

Traffic modelling for the project aimed to make the best use of existing traffic counts and traffic models to:

- Determine the existing and future conditions in the study area and key surrounding roads with and without the project
- Assess the performance of the network / corridor during construction and operation, with and without the project.

An overview of the traffic modelling approach is presented in **Figure 9-2**.

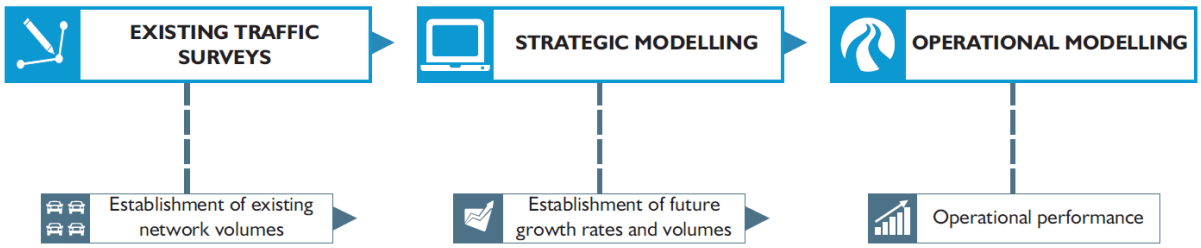

Figure 9-2 Overview of traffic modelling approach

Traffic models

Traffic modelling for the project included both regional and local scale modelling which enabled existing and future traffic and transport conditions and road network performance to be characterised, both with and without the project. This approach has been taken to include:

- Strategic modelling – changes to traffic which may occur at a regional or 'strategic' level, including as a result of the project, the broader WestConnex program of works and the future Southern extension, and factors such as major developments and changes in land use patterns
- Traffic network performance modelling – a more detailed, local analysis of changes to traffic which occur on individual roads and intersections.

These two types of models are described in more detail in **Section 9.1.4** and **Section 9.1.5** respectively.

Traffic modelling scenarios

Traffic modelling for the project assessed seven scenarios:

- Three scenarios without the project:
  - The existing road network (2012), which incorporates population and employment projections based on the September 2014 data release from the Bureau of Transport Statistics. This data has been projected from 2011 Census data and incorporates known major urban renewal and developments
  - The road network at the opening of the project (2021). While the NSW Government has committed to achieving completion of the New M5 Motorway by 2019, using 2021 allows for full ramp-up of traffic demand as travellers respond to the provision of the project.
  - The road network 10 years after opening the project (2031)

- A construction scenario (2016)
- Two scenarios with the project:
  - One at the year of opening of the New M5 (2021)
  - One 10 years after opening (2031)
- One cumulative scenario, 10 years after opening of the New M5 (2031), with all three stages of the WestConnex program of works and the future Southern extension operational.

The traffic modelling scenarios used to inform the assessment of the traffic and transport related impacts of the project are summarised in **Table 9-2**.

An additional scenario incorporating the project and the M4 East was strategically assessed to determine the potential impacts on traffic volumes and patterns within the study area (inclusive of the King Georges Road Interchange Upgrade and the M4 Widening projects). The results indicated no significant difference in volumes within the study area as a result of the M4 East. No further analysis was therefore undertaken.

Table 9-2 Traffic modelling scenarios

Model year	Without project	With project	Modelling Scenario	Description	Impact measured
2012	✓		Existing case	The existing road network with no new projects or upgrades.	NA
2016	✓		Construction	The current road network with no new projects or upgrades, with construction traffic movements for the project. This considers the worst case construction traffic generating scenario and includes traffic movements associated with spoil removal.	Construction impacts on the existing road network.
2021	✓		Base case without the project	The base case 'without project' assumes the King Georges Road Interchange upgrade and future M4 Widening projects are complete, but the remainder of the WestConnex program of works has not been built. This scenario assumes that on-going improvements will be made to the broader transport network including some new infrastructure and intersection improvements to improve capacity and to cater for traffic growth.	Consequence of not proceeding with the project on the existing network.
2021		✓	Base case with the project	The base case 'with project' assumes the New M5 is complete and open to traffic, without the future Sydney Gateway, M4 East (WestConnex Stage 1B) or the future M4-M5 Link (WestConnex Stage 3) components of the WestConnex program of works.	Operational impacts associated with the completion of the project as described in Chapter 5 (Project description).
2031	✓		Future case without the project	The future case 'without project' assumes the King Georges Road Interchange upgrade and M4 Widening projects are complete, but the remainder of the WestConnex program of works has not been built. This scenario assumes on-going improvements will be made to the broader transport network including some new infrastructure and intersection improvements to improve capacity and to cater for traffic growth.	Consequence of not proceeding with the project on the existing network
2031		✓	Future case with the project	The future case 'with project' assumes the New M5 is complete and open to traffic without the M4 East (WestConnex Stage 1) or the future M4-M5 Link components of the WestConnex program of works.	Operational impacts associated with the completion of the project as described in Chapter 5 (Project description).
2031		✓	Cumulative case (full WestConnex program of works and the future Southern extension)	All components of the WestConnex program of works and the future Southern extension completed. The full WestConnex program of works and the future Southern extension is considered to be a cumulative scenario.	Operational impacts associated with the operation of the three stages of the WestConnex program of works as well as the future Southern extension.

9.1.4 Strategic modelling

Strategic traffic modelling is typically undertaken for large areas and is best used for broad network evaluation and demand forecasting.

The Sydney Strategic Traffic Model

The key strategic transport model used in the Sydney greater metropolitan area is the Sydney Strategic Traffic Model (STM), managed by the Bureau of Transport Statistics. The STM provides the majority of strategic modelling for the Sydney greater metropolitan area and was developed to determine anticipated future growth in traffic on the major road network and the effect of tolling changes on this network.

The STM attempts to replicate people's travel choices and behaviour under a given scenario. It combines current understandings of travel behaviour with likely population and employment size and distribution, and likely road and public transport networks and services to estimate future travel patterns in Sydney under different strategic land use, transport and pricing scenarios. Inputs into the STM include:

- Household travel survey data
- Journey to work data
- Population and employment statistics (current and projected)
- Freight movement model data
- Parking survey data
- Road, rail, bus and ferry networks.

The WestConnex Road Traffic Model

The STM was used as the basis for developing a strategic traffic model specific to the project and the wider WestConnex program of works. The WestConnex Road Traffic Model (WRTM) was developed to determine anticipated future growth in traffic on the major road network. The model has been used to develop traffic forecasts and has been used as the basis for the traffic impact assessment for the project.

The information in the WRTM has been applied to existing traffic counts for the study area (2012) to estimate future traffic volumes as a basis for modelling and assessment of traffic impacts of the project during construction and operation.

The WRTM is not an operational model. Therefore, to assess detailed impacts of the project on the road network, further analysis using operational modelling software (traffic network performance modelling) was undertaken (refer to **Section 9.1.5** for additional detail).

The WRTM includes:

- A strategic model of the Sydney metropolitan area, including Sydney's motorway network and all major state roads in the network, taken from the STM
- Anticipated changes and upgrades to the road network up until 2031
- Anticipated future land uses as a basis for estimating future demand for travel for light and heavy vehicles
- Modelling of the effects of tolls on the road network and traffic volumes, including a toll on the New M5 and M5 East Motorways
- Accommodation of different motorist behaviours, including willingness to pay a toll to save travel time
- Induced traffic which is attracted to roads surrounding the New M5 or the main alignment tunnels from competing routes as a result of changed travel times.

Additional detail regarding induced demand and land use projections incorporated into the WRTM is provided in the following section.

Induced demand

Even with no growth in regional population and / or economic activity, a new or substantially upgraded road has the potential to induce changes in travel patterns, which appear as induced traffic. Traffic growth on new or upgraded roads is generally a result of:

- Regional growth in trips resulting from population growth and expanded economic activity
- Trips attracted from competing routes or modes as a result of improved travel times on the new or upgraded road
- Induced traffic as a result of improved travel times between homes and destinations, such as workplaces, shopping centres and education precincts, which stimulate changes to regional-wide trip patterns.

The WRTM includes changes in traffic associated with induced demand as a result of the three abovementioned sources of traffic growth.

Land use projections

Data from the STM has been extracted by the Bureau of Transport Statistics and used as a basis for developing the population and employment projections for the WRTM.

Population and employment data extracted and incorporated into the WRTM included trip generation, trip distribution and mode choice modules as well as demographic data related to land uses including population, employment and education enrolment projections.

9.1.5 Traffic network performance modelling

Traditional intersection assessment tools do not provide a whole-of-network assessment and tend to work best at evaluating individual, isolated intersections. To fully evaluate operational impacts of the project on the road network around the St Peters interchange and local road upgrades, a micro-simulation road network model using Paramics software was developed to assess localised road network effects. Modelling extents across the traffic and transport study area are shown in **Figure 9-3**.

Microsimulation or network models simulate the movement of individual vehicles within a defined area or network. Network modelling uses time-based algorithms related to vehicle-to-vehicle interactions on roads, including car-following, lane changing and gap acceptance. The vehicle-to-vehicle interactions accounted for in network modelling provide the basis for calculating delays within a defined area or network. Network modelling is used to provide a better representation of queueing, congestion and delays in at-capacity urban networks.

The major benefit of using network modelling is the ability to assess networks with closely spaced intersections, where intersection operation is likely to be influenced by adjacent intersections. This means the queue lengths and delays modelled at intersections within the modelled area reflect the impact of congestion and result in a more accurate representation in the model.

For the project's traffic and transport assessment, Paramics models were developed for the AM and PM peak periods to simulate the operation of the existing road network under present day traffic demands. The extent of the microsimulation model used for the traffic and transport impact assessment for local roads around the St Peters interchange is shown **Figure 9-4** and includes:

- A core network, comprising the intersections that would be modified as part of the local road upgrades (refer to **Section 5.7**)
- Additional intersections outside of the core modelled local road network.

Traffic data collected for the project between November 2012 and June 2014 was used to calibrate and validate the model.

Network performance modelling around the St Peters interchange and local road upgrades was undertaken to reflect the design of the project (refer to **Figure 5-29** to **Figure 5-36**). An additional two intersections were included in the network performance modelling which fall outside of the project; Sydney Park / Mitchell Road intersection and the Princes Highway / May Street intersection.

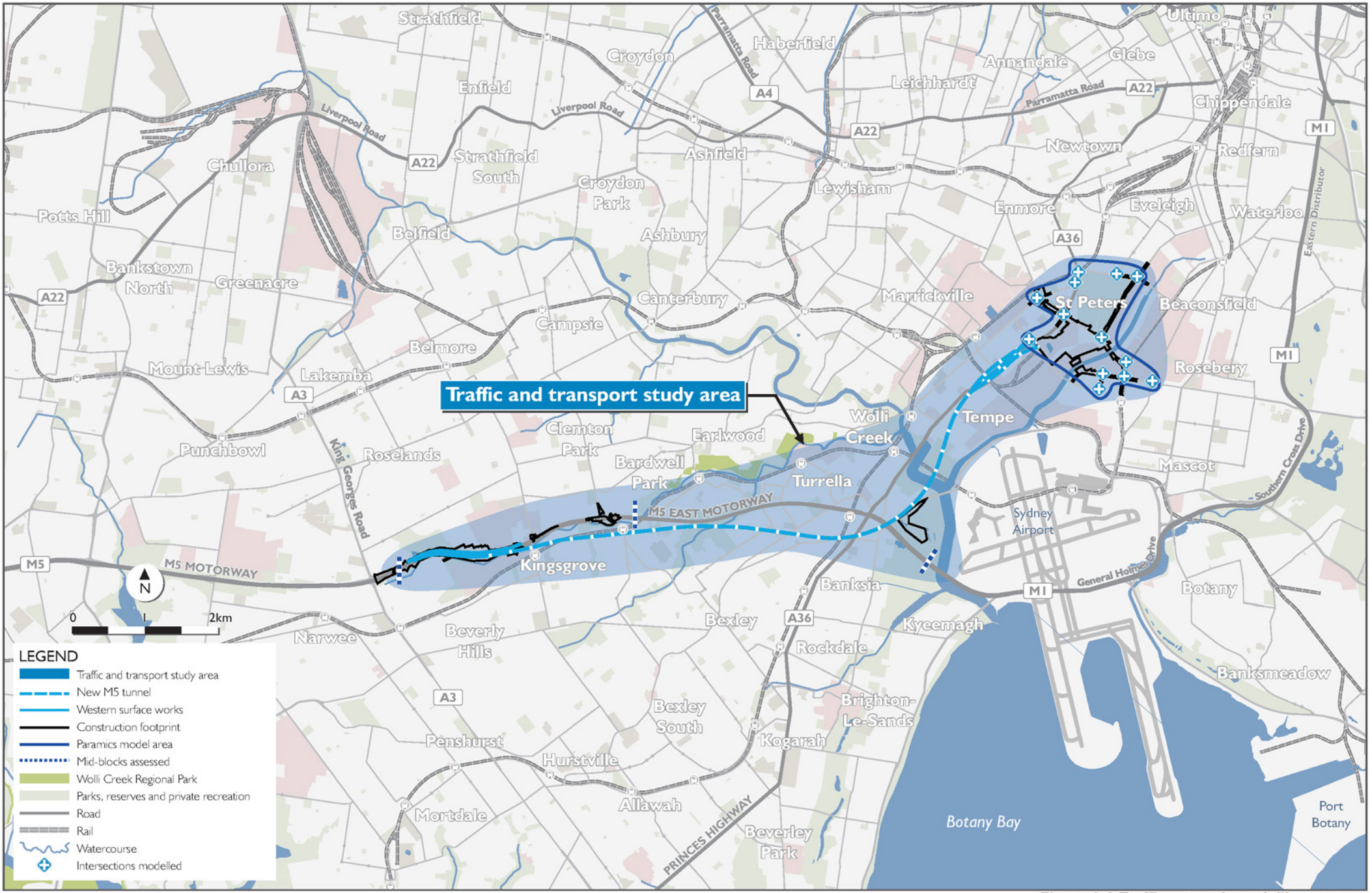

Figure 9-3 Traffic network modelling extents

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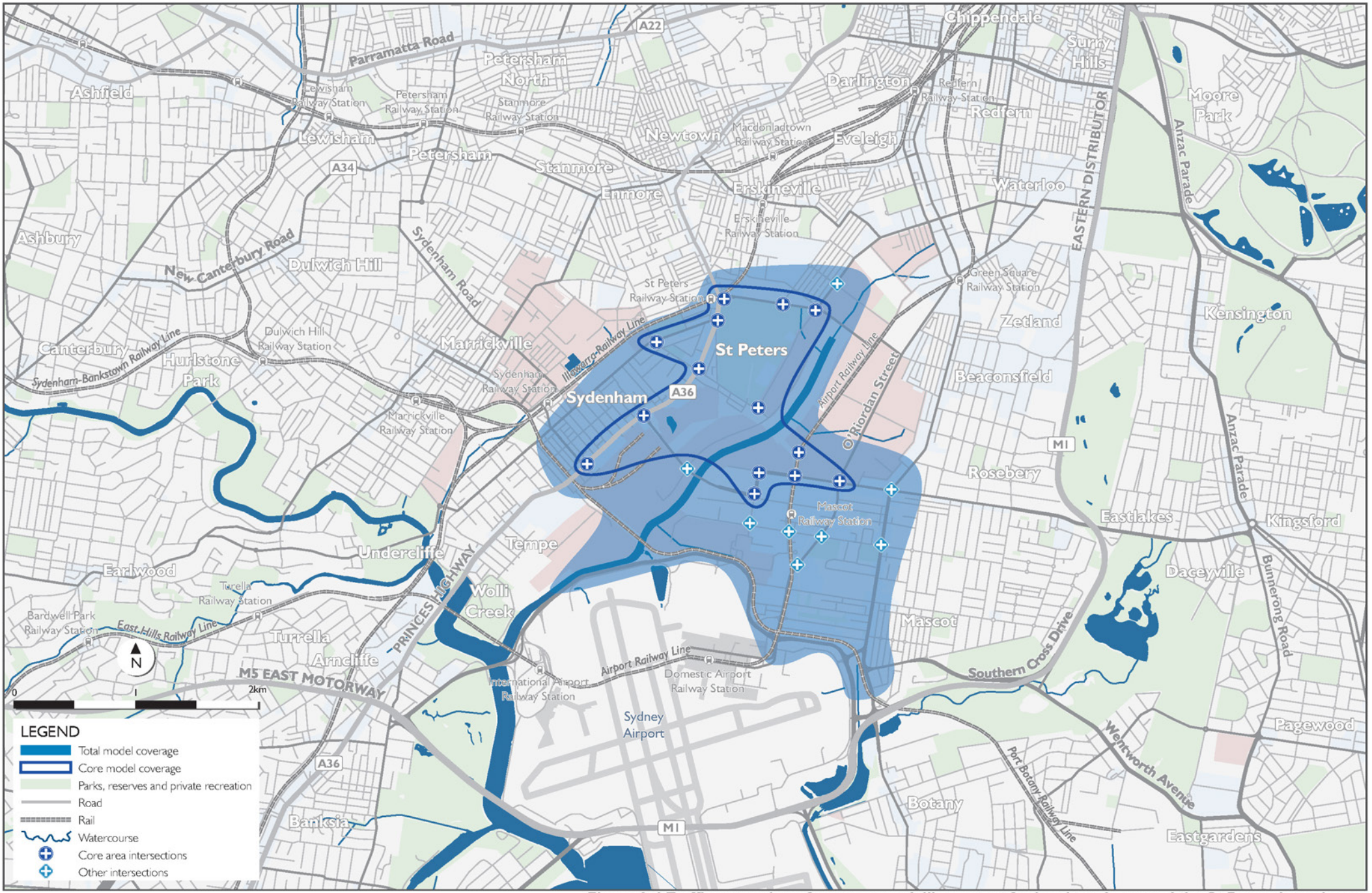

Figure 9-4 Traffic network performance modelling extent for local roads around the St Peters interchange

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9.1.6 Measures of network performance

Level of service (LoS) is a qualitative measure used to describe the operational conditions and efficiency of a road or intersection and to assess operational performance. As a measure of performance, level of service is generally described in terms of service measures such as:

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

There are six levels of service; level of service A to level of service F. A level of service A represents optimum operating conditions and a level of service F the poorest operating conditions. When the level of service of a road or intersection falls below a level of service D, investigations are generally initiated to provide suitable remediation. However, constraints in built up urban areas mean that level of service E and level of service F are regularly experienced by motorists on the Sydney road network. These conditions are generally experienced during traffic peak periods.

Intersection performance and level of service

Average delay is often used to assess the operational performance of intersections, with level of service used as an index. In other words, an intersection is first characterised based on its level of service 'band' with a more refined assessment of performance within that band carried out based on assessment of average delay times.

A description of the level of service scale for intersection performance is provided in **Table 9-3** .

Table 9-3 Level of service criteria for intersections

LoS	Average delay per vehicle (seconds)	Traffic signal / roundabouts	Give way and stop signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but crash study required
D	43 to 56	Operating near capacity	Near capacity and crash study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity; requires other control mode
F	More than 70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments (RTA, 2002)

Intersection performance and degree of saturation

Degree of saturation is a measure used to assess the capacity of an intersection which uses a ratio of intersection traffic volume to intersection traffic capacity (volume / capacity). In other words, the ratio of how much traffic passes through the intersection to how much traffic the intersection has been designed to accommodate.

The Degree of saturation of an intersection ranges between zero and one, with one representing the capacity of the intersection. Intersections are said to reach their practical capacity at a degree of saturation of 0.9. Beyond the practical capacity, any additional traffic would have an increasing impact on delays and the subsequent performance of the intersection.

Roadway performance and level of service

Mid-block volume / capacity (v/c) ratios provide an indication of the saturation level of a segment of road, based on the theoretical design capacity of the road. This measure for a road mid-block is equivalent to the concept of DoS for intersections described above.

Volume / capacity ratios can be used to provide a corresponding level of service for road operation, as detailed in *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads, 2013).

The range of mid-block volume / capacity ratios which correspond to each level of service vary with differing road conditions and road type classifications. The assessment of the mid-block levels of service for the M5 East Motorway and the New M5 use the volume / capacity ratios for freeways, and all other roads within the study area have been assessed using the volume / capacity ratios for multi-lane roads.

The definitions and criteria for the six levels of service for mid-blocks are provided in **Table 9-4**.

Table 9-4 Mid-block level of service definitions and criteria – multi-lane roads and freeways

LoS	Definition	Volume / capacity ratio criteria	
		Multi-lane roads[1]	Freeways[2]
A	A condition of free flowing traffic where 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.	V / C < = 0.26	V / C < = 0.28
B	Stable traffic 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.	0.26 < V / C < = 0.41	0.28 < V / C < = 0.44
C	Stable traffic flow; however, 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	0.41 < V / C < = 0.59	0.44 < V / C < = 0.64
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 will generally cause operational problems.	0.59 < V / C < = 0.81	0.64 < V / C < = 0.87
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 will cause breakdown.	0.81 < V / C < =1.00	0.26 < V / C < = 1.00
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 < V / C	1.00 < V / C

Source: Austroads Guide to Traffic Management – Part 3 Traffic Studies and Analysis, Second Edition, 2013 .

Notes [1]Where free flow speed is taken as 70 kilometres per hour. Multi-lane roads volume / capacity ratio criteria was adopted for all surveyed mid-blocks with the exception of the M5 East Motorway

[2]Where free flow speed is taken as 90 kilometres per hour. Freeway volume / capacity ratio criteria was adopted for mid-block surveys along the M5 East Motorway only.

9.2 Existing environment

The existing traffic and transport environment has been described in a regional and local context, in recognition of the key role of the M5 East Motorway as part of the State and national road freight network, as well as its role as part of the Sydney local and metropolitan road network.

The regional context of the road network within the study area has been discussed in **Section 9.2.1**, with specific focus on the role of the M5 East Motorway and the Sydney freight task.

The road network at a more local scale can be considered in two separate areas based on the local road environment and the key components of the project:

- The existing M5 East Motorway corridor
- The area around the St Peters interchange and local road upgrades.

The existing traffic and transport environment in these areas is described in the following sections with regard to:

- Modes of travel, including travel mode share, the public transport network and active transport infrastructure
- The current and future traffic conditions along the road network, including traffic volumes and patterns, travel times and speeds, network performance and road safety.

The existing environments along the M5 East Motorway corridor and around the St Peters interchange and local roads are outlined in **Section 9.2.2** and **Section 9.2.3** respectively.

9.2.1 Regional context

The role of the M5 East Motorway corridor

The M5 East Motorway corridor provides the main passenger, commercial and freight connection between South West Sydney and the Sydney CBD, Sydney Airport and Port Botany. It also connects to the Sydney orbital network and interstate transport routes. The corridor forms part of the AusLink National Land Transport Network (National Road Network) and the Sydney orbital network. The National Road Network in NSW and the Sydney orbital network are shown in **Figure 9-5** and **Figure 9-6**.

The National Road Network provides connections between all mainland states and territories of Australia. The network is based on national and inter-regional transport corridors including connections through urban areas, links to ports and airports, rail, road and intermodal connections, which together are of critical importance to national and regional economic growth, development and connectivity.

The primary objectives of the National Road Network are to facilitate overseas and interstate trade, to support regional development and to allow safe and reliable access to major population centres. The M5 East Motorway forms part of the urban roads component of the National Road Network, providing a connection between the Hume Motorway (M31) in the west and Sydney Airport and Port Botany in the east.

The Sydney orbital network comprises around 160 kilometres of motorways and other main roads which provide a ring or orbital around the Sydney metropolitan area. The network consists of nine motorways, linked with expressways, freeways and other main roads. The M5 East Motorway provides an east-west connection within the network between Port Botany and Sydney Airport in the east, and the Westlink M7 Motorway and the Hume Motorway (M31) in the west.

The Transport Master Plan identifies 46 strategic transport corridors in Sydney's greater metropolitan area. These corridors service travel demands between centres in metropolitan Sydney and are areas where high concentrations of travel demand occur during peak periods on all travel modes.

Patterns of economic and employment growth are expected to result in even greater demands along these corridors. The M5 East Motorway corridor is identified in the Transport Master Plan as a strategic transport corridor that is subject to high levels of congestion.

The M5 East Motorway corridor is very congested during peak periods with a volume / capacity ratio over 1.0 and average speeds reducing to below 40 kilometres per hour. Without any improvements to the capacity of the M5 East Motorway corridor, peak travel times between Liverpool and Sydney Airport are expected to increase by about 20 minutes to a total trip length of 90 minutes in 2031 (Infrastructure NSW, 2012).

The Transport Master Plan also notes arterial roads connecting to the M5 East Motorway, including King Georges Road, Canterbury Road, Stoney Creek Road, Princes Highway and General Holmes Drive are experiencing greater volumes of traffic than they were originally designed for, particularly heavy vehicle movements. The additional vehicles along these roads are causing underperformance of the M5 East Motorway by increasing congestion, travel time variability and a higher risk of crashes.

Freight

The NSW freight network comprises a system of railway lines, roads, ports, Sydney Airport, regional airports and intermodal terminals. Transport of freight through this system is critical to the State economy and the efficiency of the transport network contributes to the success and growth of NSW. Conversely, inefficiencies, friction and capacity constraints in the transport network add costs for manufacturers, producers and consumers (Transport for NSW, 2013e).

The M5 East Motorway forms part of the urban roads component of the National Road Network in Sydney. It is a key freight, commercial and passenger route which connects Port Botany and Sydney Airport with the Hume Motorway (M31). The Hume Motorway forms part of the National Land Transport Network; a defined national network of road and rail infrastructure links and their intermodal connections determined under the *National Land Transport Act 2014*.

The Freight and Ports Strategy states the NSW freight task is expected to almost double over the next 20 years. Capacity across the freight network varies; however, key parts of the network are already constrained. Across New South Wales in 2011:

- Of the 409 million tonnes moved on the NSW transport network in 2011, the road network carried around 256 million tonnes (63 per cent)
- About 33 per cent of the total freight task was carried by the rail network, dominated by the movement of coal in the Hunter Valley.
- Excluding the coal freight task, the road-share of the freight task was 90 per cent (Transport for NSW, 2013e).
- The road network also accounted for 92 per cent of the mode share for the total interstate freight task.

There is limited available freight capacity on the shared rail network in the metropolitan area, and priority for passenger trains in the rail timetables further constrains freight movements. A dedicated freight railway line exists to the north of the M5 East Motorway corridor and is used by freight trains travelling between the Illawarra / Port Botany and the Main Southern Railway. As described in **Chapter 4** (Project development and alternatives), improvements to the freight rail network, including shifting additional freight for transport from road to rail, would not satisfy future growth in transport demand and the diverse travel demands along the M5 East Motorway corridor.

The volumes of all commodities are expected to grow as population and economic activity increases. The increase in transport demand has implications for the capacity of the road network, including the M4, M5 and M7 motorways in the Sydney greater metropolitan area. Without additional motorway capacity, it is estimated the M5 East Motorway will not be able to accommodate the additional traffic by 2031 (Transport for NSW, 2012a).

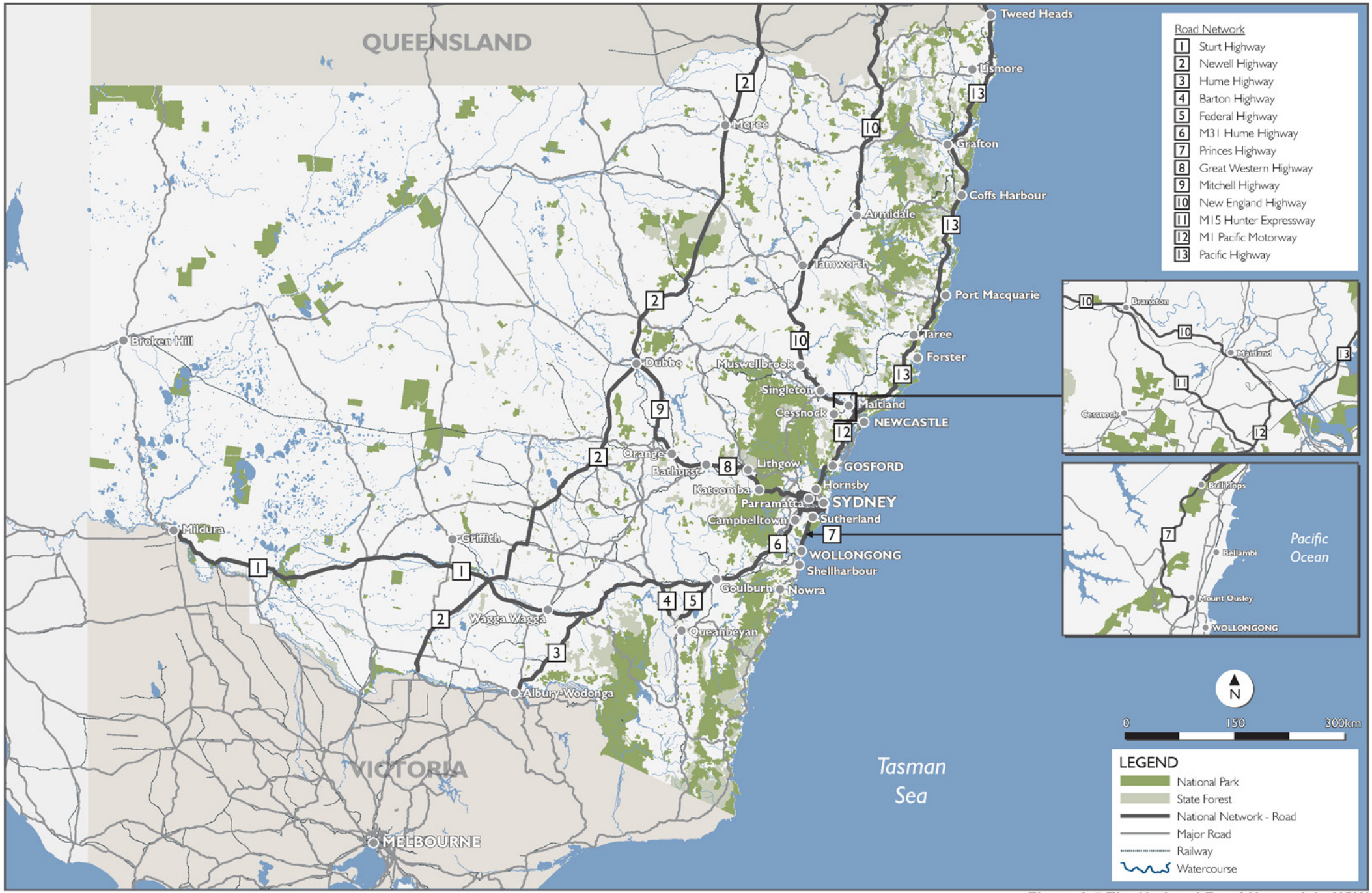

Figure 9-5 The National Road Network in NSW

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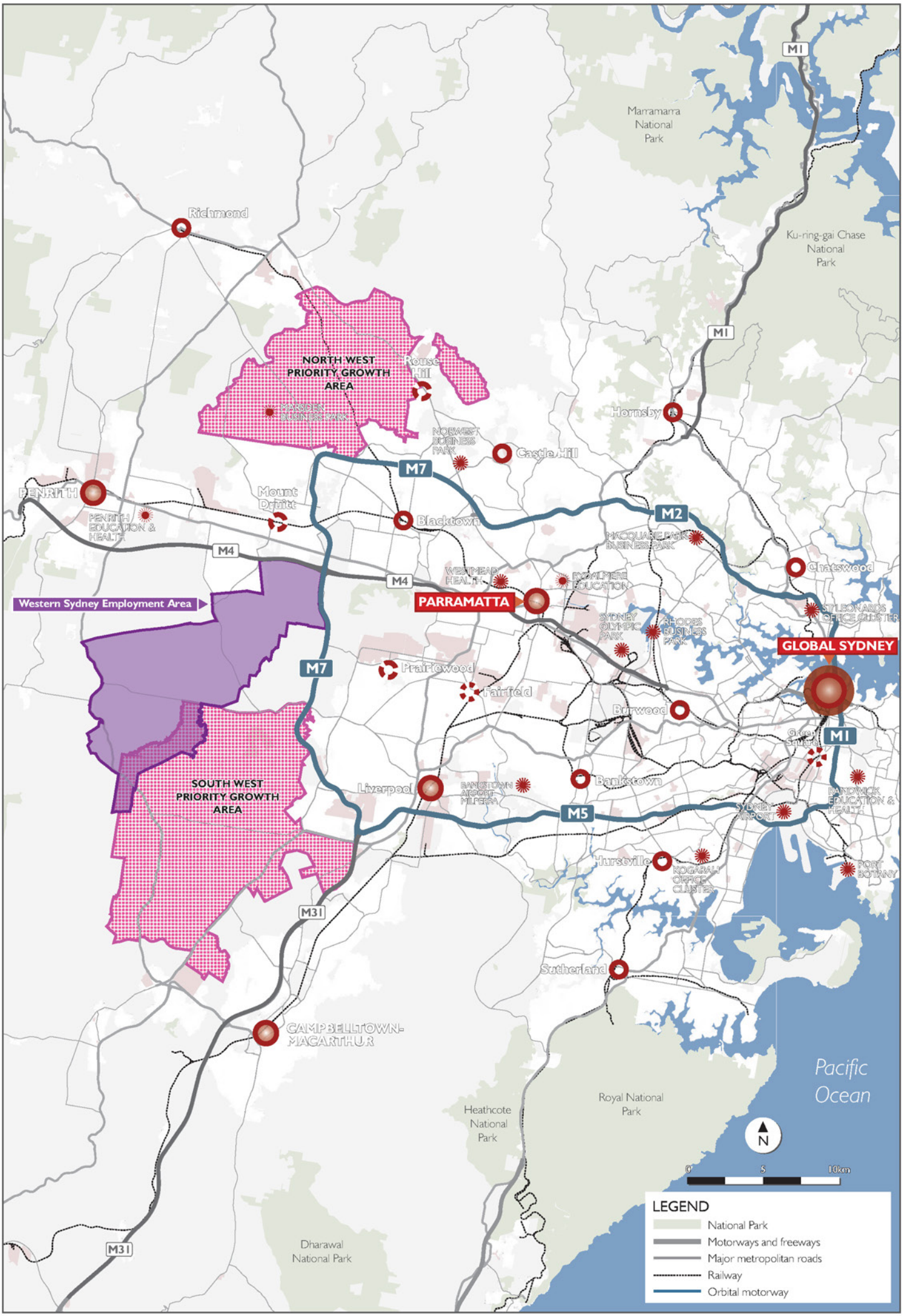

Figure 9-6 Sydney orbital network

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9.2.2 The M5 East Motorway corridor

The M5 East Motorway corridor provides a motorway connection between south-west Sydney in the west and the Sydney CBD, Sydney Airport and Port Botany in the east. It is the main east-west freight, commercial and passenger vehicle corridor in southern Sydney, and is of local and regional transport importance in terms of its function. The regional context of the M5 East Motorway corridor, including its role in wider road networks and the State and national freight network is provided in **Section 9.2.1**.

Overview of the existing traffic and transport environment

No pedestrians or regular bus services use the existing M5 East Motorway corridor. Cyclists are able to use the shoulder lane of the M5 East Motorway along the surface road sections. However, cyclist use of the corridor is limited, likely due to the off-street shared path facilities between King Georges Road and Bexley Road.

The AWDT traffic volumes along the corridor are similar for both the eastbound and westbound carriageways. A high percentage of heavy vehicles were recorded during traffic surveys, indicating the importance of the M5 East Motorway corridor as a key regional and local freight transport route.

The eastbound carriageway of the M5 East Motorway in the AM peak and the westbound direction in the PM peak are the most congested, with the longest recorded travel times, and slowest speeds. The speed limit of the motorway varies between 80 and 90 kilometres per hour along its length. However, average speeds along the M5 East Motorway corridor during peak periods vary between around 31 kilometres per hour and 68 kilometres per hour.

The motorway operates between a level of service B and C in both directions during the AM and PM peak, which is considered to be an acceptable level of service. However, it should be noted the surveyed demand could be representative of a suppressed demand due to congestion along the M5 East Motorway within the tunnels.

The total number of crashes, and the number of crashes which resulted in fatalities and injuries per million vehicle kilometres travelled (MVKT) along the M5 East Motorway is considerably lower than average records for the Sydney metropolitan area, likely due to the limited number of opposing turning movements along the motorway and separation of traffic travelling in opposing directions.

The traffic conditions along the M5 East Motorway under the 'without project' scenarios for 2021 and 2031 (refer to **Section 9.1.3** for additional detail on scenarios) would continue to deteriorate with additional growth in light and heavy vehicle movements along the road. This would result in a reduction in the performance of the motorway between King Georges Road and Foreshore Road. The motorway would approach capacity near the Cooks River along the westbound carriageway during the AM peak and along the eastbound carriageway during the PM peak.

Modes of travel

Travel mode share

The M5 East Motorway corridor traverses the Local Government Areas (LGAs) of Canterbury, Hurstville and, Botany Bay. The NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, November 2014 Release provides details of the mode share of average weekday travel demand made from each LGA in NSW.

A comparison of the average weekday travel mode shares of LGAs traversed by the M5 East Motorway in comparison with the Sydney Greater Metropolitan Area (GMA) is shown in **Table 9-5**.

Modes of travel within LGAs which traverse the M5 East Motorway are generally comparable to the Sydney greater metropolitan region, with the exception of trips made using the passenger railway network.

Private vehicles are the predominant mode of transport along the M5 East Motorway corridor. On a typical weekday, an average of about 70 per cent of trips are made by private vehicle across the Canterbury, Hurstville and Rockdale LGAs, which is comparable to the general trips made by all residents within the Sydney greater metropolitan area (about 69 per cent).

Table 9-5 Comparison of the average weekday travel mode shares of LGAs which are traversed by the M5 East Motorway with the Sydney Greater Metropolitan Area

Local government area	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Canterbury	46%	25%	71%	8%	5%	14%	1%
Hurstville	52%	22%	74%	9%	4%	12%	1%
Rockdale	44%	20%	64%	13%	5%	16%	2%
Sydney Greater Metropolitan Area	47%	22%	69%	5%	6%	18%	2%

Source: NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, Nov 2014 Release

Public transport

Intercity and regional bus services which depart from the Sydney CBD use the M5 East Motorway and the M5 South West Motorway; however there are no operational bus stops along the M5 East Motorway. There are a number of bus services which operate through the M5 East Motorway interchanges at King Georges Road, Kingsgrove Road, Bexley Road and Marsh Street (refer to **Section 9.3.1** for additional detail).

Active transport

No pedestrian facilities are provided along the M5 East Motorway due to road safety considerations.

Bicycle counts were conducted along the M5 East Motorway and Beverly Grove Park in 2014. The average daily bicycle count along the eastbound and westbound carriageways of the M5 East Motorway were five and nine per day respectively. The low number of cyclists using the M5 East Motorway is likely due to the availability of off-street shared path facilities within Beverly Grove Park between King Georges Road and Bexley Road. Bicycle trips recorded during the survey periods are summarised in **Table 9-6**.The existing cycle network around the M5 Motorway corridor is shown on **Figure 9-7**.

Table 9-6 Bicycle survey counts within Beverly Grove Park (12 May to 18 May 2014)

Location	AM peak period (three hours)	PM peak period (three hours)	Average weekday (24 hours)
King Georges Road / M5	6	8	32
South-west of Rosebank Ave	3	17	51
North of The Crescent	5	14	37
Tallawalla St entry / exit prior to split	7	20	52
North-east of Kirrang St	2	5	20
South-west of Elouera St	3	9	28
South of Shorter Ave (eastern side of Rd)	0	0	3
South-West of Allambee Crescent (north of M5)	1	2	7
West of Allambee Crescent (south of M5)	5	5	23
West of Rosetta Ln	1	2	9
West of Penshurst Rd (north of Windarra St, south of M5)	1	1	34

Source: Jacobs (2014), WestConnex M5 – King Georges Road Interchange Upgrade: Traffic and Transport Assessment

Shared paths are located adjacent to the M5 East Motorway within Beverly Grove Park, providing a continuous pedestrian and cyclist connection between King Georges Road and Bexley Road. Pedestrians and cyclists are able to cross the M5 East Motorway via:

- Four underpasses, located at Beverly Grove Park, Karingal Street, Arinya Street and Lundy Street
- Four at-grade signalised crossing points, located at King Georges Road, Cooloongatta Road, Kingsgrove Road and Bexley Road.

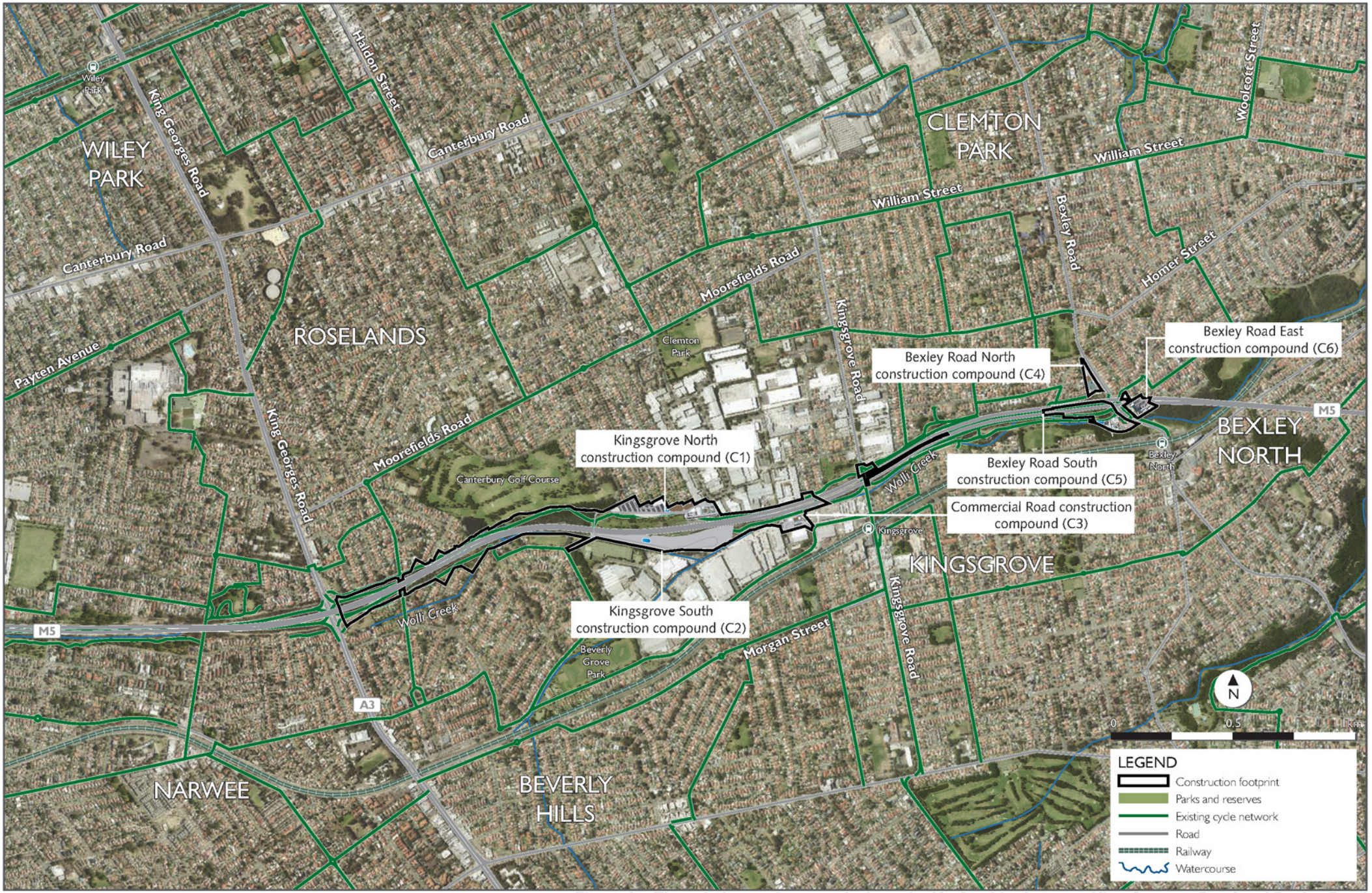

Figure 9-7 The existing cycle network along the M5 Corridor between King Georges Road and Bexley Road

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Current conditions (2014 / 2015)

Traffic volumes and patterns

Table 9-7 presents the results of traffic surveys carried out in late 2014 / early 2015 along the M5 East Motorway at three locations. These results include the percentage of average weekday daily traffic (AWDT) observed to be heavy vehicles.

The results of the survey show the AWDT volumes for the M5 East Motorway are similar for both the eastbound and westbound carriageways, with eastbound traffic generally having slightly higher flows. The percentage of heavy vehicles indicates the importance of the M5 East Motorway corridor as a key freight and commercial route between the Sydney CBD, Sydney Airport, Port Botany and south-western Sydney.

Table 9-7 Average mid-block counts on the M5 East Motorway

Location	Direction of traffic flow	Vehicles per hour		AWDT flow (vehicles/ day)	Percentage of heavy vehicles
		AM peak	PM peak		
M5 East Motorway east of King Georges Road	Eastbound	2380	3499	50,769	11%
	Westbound	3505	3564	57,359	10%
M5 East Motorway east of Bexley Road (in tunnel)	Eastbound	3539	3500	58,806	12%
	Westbound	2856	2937	50,327	13%
M5 East Motorway at the Cooks River	Eastbound	2773	2518	40,115	13%
	Westbound	2566	2439	38,946	13%

Traffic profile

The daily traffic flows along the M5 East Motorway at the three mid-block locations are shown on **Figure 9-8**. The daily traffic profile at this location demonstrates fairly consistent traffic flows between about 5am and 7pm along the eastbound and westbound carriageways. During the AM peak, the peak flow direction is westbound (away from the Sydney CBD, Sydney Airport and Port Botany) and during the PM peak, the peak flow direction is eastbound (towards the Sydney CBD, Sydney Airport and Port Botany).

During the AM peak, there is a drop in traffic flows along the eastbound and westbound carriageways. This is due to congestion along the M5 East Motorway, which restricts more traffic from entering the carriageways and reduces the average traffic speeds along the motorway.

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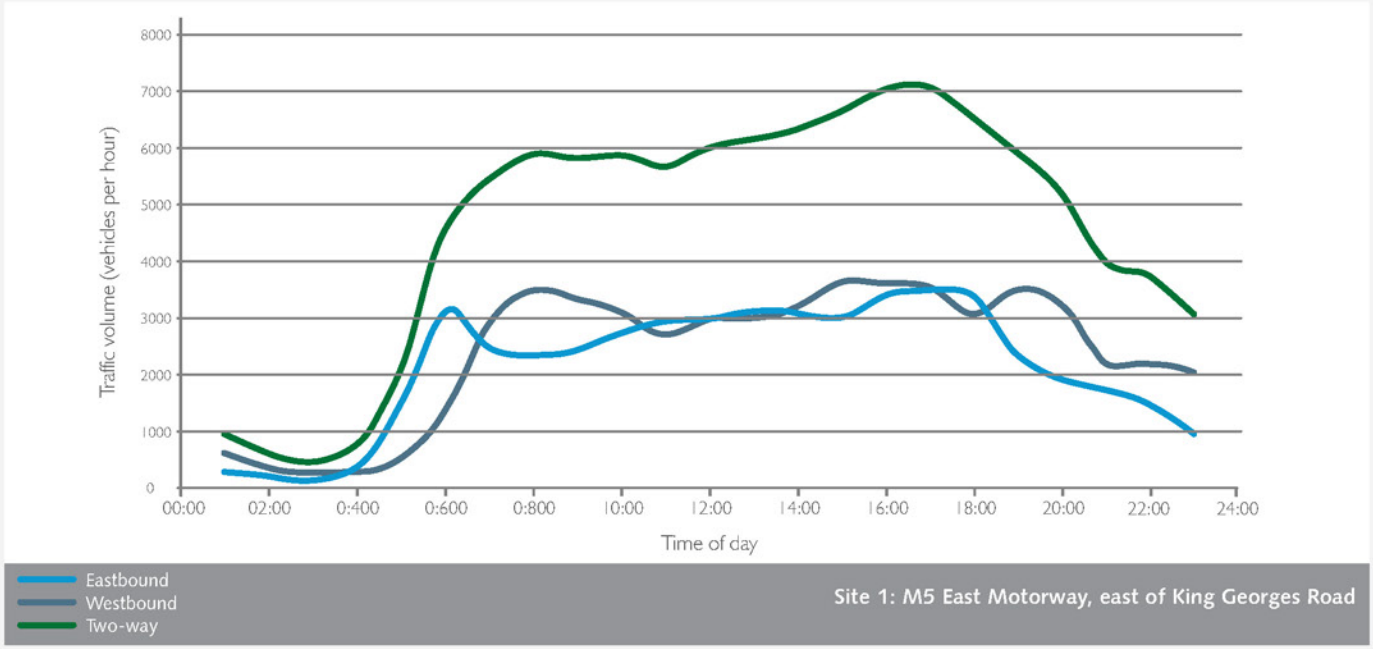

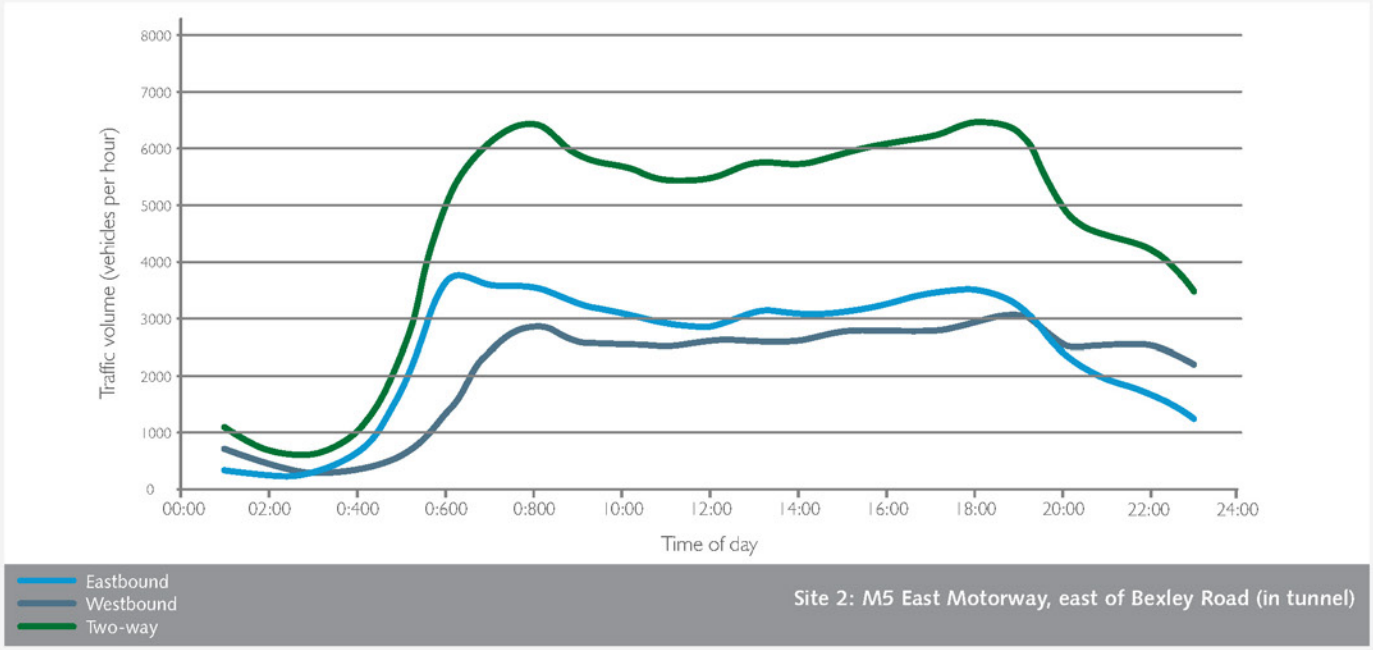

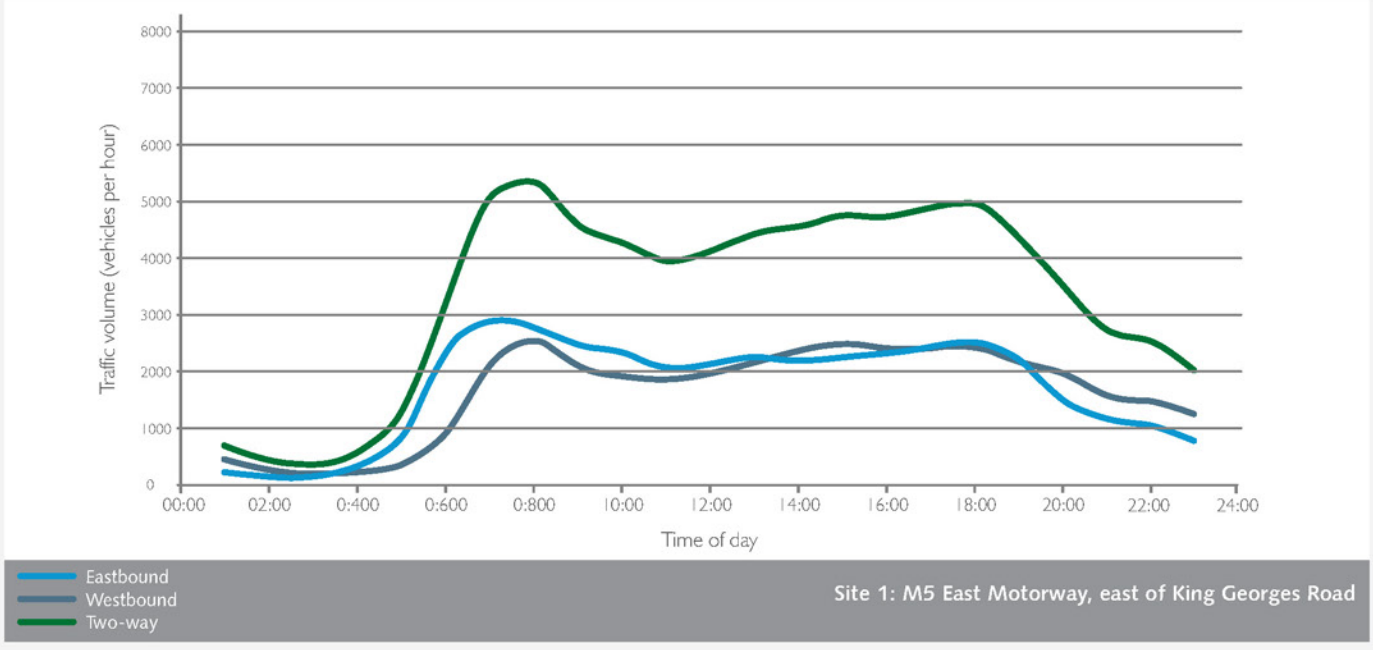

Figure 9-8 Average weekday traffic profiles along the M5 East Motorway (26/11/2014 - 11/02/2015)

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Travel times and speeds

Travel times and speeds along the M5 East Motorway between King Georges Road and Foreshore Road were surveyed in 2015. The M5 East Motorway has a posted speed limit of 90 kilometres per hour along the surface road section of the M5 East Motorway between King Georges Road and the motorway tunnels at Bexley, and 80 kilometres per hour along the remaining section of the motorway.

Average speeds along the M5 East Motorway corridor during peak periods varies between around 31 kilometres per hour and 68 kilometres per hour. The eastbound carriageway of the M5 East Motorway in the AM peak and the westbound direction in the PM peak are the most congested, with the longest recorded travel times, and slowest speeds. A summary of the travel times and speeds recorded along the M5 East Motorway are summarised in **Table 9-8**.

Table 9-8 Travel speed and travel time on the M5 East Motorway between King Georges Road and Foreshore Road (2015)

Direction	Distance (kilometres)	Average travel times (min:sec)	Range of surveyed travel times (min:sec)	Average speeds (kilometres per hour)
AM Peak period (5 am to 8 pm)				
Eastbound	10.8	15:20	09:31 – 18:55	42.4
Westbound	10.8	09:31	08:36 – 11:31	68.3
PM peak period (4 pm to 7 pm)				
Eastbound	10.8	11:52	09:37 – 16:32	54.8
Westbound	10.7	20:53	15:12 – 24:00	31.1

Source: AECOM (2015), based on Skyhigh survey data (2015)

Network performance

Mid-block volume / capacity ratios on the M5 East Motorway east of King Georges Road, within the existing M5 East Motorway tunnels, east of Bexley Road and at near the Cooks River under existing conditions in the AM and PM peak are provided in **Table 9-9**.

The volume / capacity ratios show the motorway operates at or close to capacity during the AM and PM peak. The level of service presented in **Table 9-9** represents the operational performance of the M5 East Motorway based on the surveyed demand. It is recognised that the actual level of service may be lower than the surveyed level of service, which could be supressed as a result of congestion at other sections of the M5 Motorway corridor, causing variations to travel times and speeds. The level of service and volume/ capacity rations should therefore be used as a comparison, or indication of change between scenarios, rather than absolute values.

Table 9-9 M5 East Motorway mid-block traffic and volumes and level of service (2014)

Location	Direction	Mid-block capacity*	Light vehicles	Heavy vehicles	v/c	LoS
AM peak						
M5 East Motorway, east of King Georges Road	Eastbound	4300	2979	333	0.86	D
	Westbound	4300	2972	335	0.86	D
M5 East Motorway, east of Bexley Road (in tunnel)	Eastbound	4300	3380	406	0.99	E
	Westbound	4300	2506	363	0.77	D
M5 East Motorway, at Cooks River	Eastbound	4300	2435	338	0.74	D
	Westbound	4300	2289	277	0.67	D
PM peak						
M5 East Motorway, east of King Georges Road	Eastbound	4300	3288	194	0.86	D
	Westbound	4300	3377	350	0.96	E
M5 East Motorway, east of Bexley Road (in tunnel)	Eastbound	4300	3316	192	0.87	D
	Westbound	4300	2824	241	0.78	D
M5 East Motorway, at Cooks River	Eastbound	4300	2365	137	0.62	C
	Westbound	4300	2242	232	0.64	C

Source: AECOM (2015)
*the mid-block capacity adopted for the M5 East Motorway is 2,250 PCU per hour per lane based on a freeway speed of 90 kilometres per hour (Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, second edition (2013).

Road safety

An analysis of crash statistics collected along the M5 East Motorway between King Georges Road and General Holmes Drive between 2009 and 2013 found a total of 478 crashes occurred from 2009 and 2013. Of these crashes, there were no fatalities and 188 crashes resulted in injuries.

The total number of crashes, and the number of crashes that resulted in fatalities and injuries per million vehicle kilometres travelled (MVKT) along the M5 East Motorway is considerably lower than averages for the Sydney metropolitan area, but higher than other Sydney motorway tunnels..

A summary of the crash statistics along the M5 East Motorway per MVKT between King Georges Road and General Holmes Drive in comparison to the Sydney greater metropolitan area and other Sydney motorway tunnels is provided in **Table 9-10**.

Between 2009 and 2013, crashes on the M5 East Motorway between King Georges Road and General Holmes Drive are estimated to have cost about $79.4 million (about $15.9 million per year), with the cost of crashes per 1000MVKT estimated to be about $5.9 million.

Table 9-10 Crash rates per 100 MVKT along the M5 East between King Georges Road and General Holmes Drive

Route / location	Crash severity index	Crash rate per 100 MVKT		
		Total	Fatal	Injury
M5 East Motorway between King Georges Road and General Holmes Drive	1.20	35.4	0	13.9
Existing Sydney motorway tunnels (Lane Cove, Eastern Distributor, Cross City and Sydney Harbour tunnels)	1.16	11.6	0	4.2
Total – Sydney metropolitan area	1.22	68.8	0.2	29.4

*Cost per MVKT has been calculated based on crash costs over the years 2009 to 2013.

Future conditions without the project (2021 and 2031)

The traffic conditions along the M5 East Motorway under the 'without project' scenarios for 2021 and 2031 would continue to deteriorate with additional growth in vehicle movements along the motorway.

This would result in a reduction in the performance of the motorway, with the road approaching capacity along the westbound carriageway during the AM peak and along the eastbound carriageway during the PM peak. The future condition of the M5 East Motorway corridor under the 2021 and 2031 'without project' scenarios in comparison to the current conditions is discussed in the following sections.

Modes of travel

As no regular bus services operate along the M5 East Motorway or the M5 South West Motorway, increases in travel times and speeds would not have a direct impact on the performance of bus services under the 2021 and 2031 without project scenarios.

Increases in congestion along roads which run perpendicular to the M5 Motorway corridor (ie north-south) and intersect the M5 East Motorway at grade separated interchanges (eg Kingsgrove Road, Bexley Road and Marsh Street) may cause delays to bus services operating on these roads.

Public transport services operate along other routes adjacent to the M5 Motorway corridor. *Sydney's Bus Future* (Transport for NSW, 2013) was developed to complement the Transport Master Plan by redesigning the city's bus network to meet current and future customer needs through identifying short and longer term priorities for bus services across Sydney.

Transport for NSW has identified a planned rapid bus route, which has target average speeds of 25 to 30 kilometres per hour between Hurstville and Macquarie Park via Burwood (current route M41). There is a commitment to deliver bus priority along the M5 Motorway corridor, including on Stoney Creek Road and Bexley Road (Transport for NSW, 2013a).

From the commencement of construction of the King Georges Road Interchange Upgrade project, cyclists would be diverted off the M5 East Motorway and onto parallel paths, namely the pedestrian and shared paths through Beverly Grove Park. It is expected that cyclist movements along the shared path within Beverly Grove Park would increase under the 2021 and 2031 without project scenarios.

Traffic volumes and patterns

Light and heavy vehicle AM and PM peak hour volumes along the M5 East Motorway have been forecast for 2021 and 2031 under 'without project' scenarios.

These volumes have been analysed and compared to existing (2014) volumes, in order to identify and assess relative changes in road network performance. A comparison of mid-block traffic counts on the M5 East Motorway between the existing case (2014) and 2021 and 2031 without the project is provided in **Table 9-11**.

Traffic volumes (vehicles per hour) would increase under the without project scenario between the existing case (2012) and 2021, and again between 2021 and 2031 (refer to **Table 9-11**). Between the existing case (2012) and 2021, the proportion of traffic using the M5 East Motorway comprising heavy vehicles would generally remain the same during the AM peak.

While the total number of heavy vehicles using the M5 East Motorway would increase during the PM peak in both directions, there would be a reduction in the proportion of heavy vehicles. This is expected to be a result of a larger increase in light vehicles.

Under the without project scenario, the proportion of heavy vehicles using the M5 East Motorway is expected to increase between 2021 and 2031 during the AM peak and reduce in the PM peak in both directions.

Table 9-11 Comparison of mid-block traffic counts on the M5 East Motorway between the existing case (2012) and 2021 and 2031 without the project (do minimum)

Location	Direction	2012 (existing case)		2021 (without project)*		2031 (without project)**	
		Vehicles per hour	Percentage heavy vehicles	Vehicles per hour	Percentage heavy vehicles	Vehicles per hour	Percentage heavy vehicles
AM peak							
M5 East Motorway, at King Georges Road	Eastbound	2380	11	3330	11	3190	15
	Westbound	3505	10	3750	10	3950	9
M5 East Motorway, east of Bexley Road (in tunnel)	Eastbound	3539	12	3810	11	3750	15
	Westbound	2856	13	3290	13	3390	14
M5 East Motorway, at Cooks River	Eastbound	2773	13	2890	13	2860	18
	Westbound	2566	13	3160	10	3440	13
PM peak							
M5 East Motorway, at King Georges Road	Eastbound	3499	11	3620	6	3830	5
	Westbound	3564	10	3850	12	3800	15
M5 East Motorway, east of Bexley Road (in tunnel)	Eastbound	3500	12	3670	7	3720	9
	Westbound	2937	13	3460	10	3410	13
M5 East Motorway, at Cooks River	Eastbound	2518	13	2900	6	3370	9
	Westbound	2439	13	2710	12	2770	16

*2021 without project assumes that the King Georges Road Interchange upgrade and M4 Widening projects are complete, but the remainder of the WestConnex program of works have not been built.

**2031 without project represents the future road network, assumed to include the King Georges Road Interchange upgrade and the M4 Widening projects as well as some upgrades to the broader transport network over time to improve capacity and cater for traffic growth.

Travel times and speeds

Surveyed travel times and speeds along the M5 East Motorway have been compared to the forecast average travel times and speeds for the 2021 and 2031 scenarios without the project. The forecast travel times have been provided from the WRTM and have been presented for comparison with the existing surveyed travel times and speeds in **Table 9-12**.

The WRTM results indicate that the M5 East Motorway will experience an increase in travel times and a reduction in speeds under the without project scenario in 2021 and 2031. Under the 2021 'without project' scenario, the average travel time would be the greatest during the AM peak in the eastbound direction and the westbound AM peak would experience the greatest reduction in average speed, slowing by about 16 kilometres per hour to 49 kilometres per hour. Under the 2031 without project scenario, traffic travelling westbound during the PM peak would experience the longest average travel time (27 minutes) and the slowest average speed (31 minutes).

Table 9-12 Comparison of average travel times along the M5 East Motorway between King Georges Road and Foreshore Road between the existing (2012) case and 2021 and 2031 under the without project scenario

Direction	Existing (2012)		2021 (without project)		2031 (without project)	
	Average travel time (minutes)	Average speed (kilometres per hour)	Average travel time (minutes)	Average speed (kilometres per hour)	Average travel time (minutes)	Average speed (kilometres per hour)
AM peak						
Eastbound	17	49	20	42	26	32
Westbound	13	65	17	49	23	37
PM peak						
Eastbound	12	70	18	47	26	32
Westbound	14	60	19	44	27	31

Source: WestConnex Delivery Authority Road Traffic Model, 2015

Network performance

Results of mid-block performance analysis as presented in **Table 9-13** demonstrates that under the without project scenarios for the years 2021 and 2031, growth in background traffic would result in decreased levels of mid-block performance in 2021. Under forecast 2031 without traffic volumes, the roadway performance of the M5 East Motorway is expected to further decrease.

Under the without project scenario in 2031, the M5 East Motorway at the Cooks River would operate at a level of service E in the westbound direction during the AM peak and in the eastbound direction during the PM peak. The Motorway at this location would be susceptible to decreases in performance with increases in demand if additional capacity is not provided.

Table 9-13 Comparison of M5 East Motorway mid-block traffic and volumes and level of service in 2012 (existing case) and without the project ('do minimum' scenario) in 2021 and 2031

Location	Direction	Mid-block capacity[1]	2012 (existing case)				2021 'without project'				2031 'without project'			
			LV[2]	HV[3]	v/c	LoS	LV	HV	v/c	LoS	LV	HV	v/c	LoS
AM peak														
M5 East Motorway, east of King Georges Road	Eastbound	4300	2979	333	0.86	D	2970	360	0.87	E	2710	480	0.87	E
	Westbound	4300	2972	335	0.86	D	3390	360	0.97	E	3560	350	1.01	F
M5 East Motorway, east of Bexley Road (in tunnel)	Eastbound	4300	3380	406	0.99	E	3370	440	1.01	F	3200	550	1.02	F
	Westbound	4300	2506	363	0.77	D	2860	430	0.88	E	2910	480	0.92	E
M5 East Motorway, at Cooks River	Eastbound	4300	2435	338	0.74	D	2510	380	0.78	D	2360	500	0.80	D
	Westbound	4300	2289	277	0.67	D	2830	330	0.82	D	3000	440	0.92	E
PM peak														
M5 East Motorway, east of King Georges Road	Eastbound	4300	3288	194	0.86	D	3390	230	0.90	E	3630	200	0.94	E
	Westbound	4300	3377	350	0.96	E	3390	460	1.02	F	3220	580	1.03	F
M5 East Motorway, east of Bexley Road (in tunnel)	Eastbound	4300	3316	192	0.87	D	3430	240	0.92	E	3390	330	0.95	E
	Westbound	4300	2824	241	0.78	D	3100	360	0.90	E	2950	460	0.91	E
M5 East Motorway, at Cooks River	Eastbound	4300	2365	137	0.62	C	2720	180	0.72	D	3060	310	0.87	D
	Westbound	4300	2242	232	0.64	C	2390	320	0.71	D	2340	430	0.76	D

[1] the mid-block capacity adopted for the M5 East Motorway is 2,250 PCU per hour per lane based on a freeway speed of 90 kilometres per hour (Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, second edition (2013).
[2] LV – Light vehicle
[3] HV – Heavy vehicle

Road safety

Forecast crash statistics along the M5 East Motorway under the 'without project' scenario in 2021 and 2031 have been prepared assuming the future frequency, type and severity of crashes on these roads would be consistent with historic trends.

It is expected the frequency of crashes on roads along the M5 East Motorway would increase in proportion to the forecast future traffic growth. The crash rate per vehicle kilometre under the 'without project' scenario in 2021 and 2031 would remain the same as the existing (2012) conditions.

By 2031, the growth in traffic volumes along the M5 East Motorway corridor is expected to result in:

- An increase in the number of crashes from an average of 96 per year to 117 per year
- An increase in the annual cost of crashed from $15.9 million to $19.5 million.

9.2.3 Area around the St Peters interchange and local road upgrades

The area around the St Peters interchange and local road upgrades spans the Sydney, Marrickville and Botany LGAs. The key roads at this location include the Princes Highway, Campbell Street, Campbell Road, Euston Road, Bourke Road and Gardeners Road. The St Peters interchange would provide a connection to the local road network at the intersection of Campbell Road and Euston Road, St Peters. Additional detail regarding the St Peters interchange and upgrades to the local road network are provided in **Section 5.6** and **Section 5.7**.

Overview of existing traffic and transport environment

The mode share in the Sydney and Marrickville LGAs is markedly different to the Sydney greater metropolitan area, given the proximity of these areas to the Sydney CBD (refer to **Table 9-14**). The extensive public transport network and diverse land use mix where residential development is located relatively close to employment areas reduces the need for travel by private vehicles. The Sydney and Marrickville LGAs are serviced by four railway lines, with the closest railway stations located at St Peters and Mascot. The St Peters and Mascot area also has a comprehensive bus network which provides access to the surrounding activity and employment centres as well as the Sydney CBD.

The Botany Bay LGA is situated further to the east and closer to industrial and commercial land uses, including Sydney Airport and Port Botany. Mode share within the Botany Bay LGA is similar to the Sydney greater metropolitan area, with the exception of travel by rail and bus (refer to **Table 9-14**). This is reflective of the lack of rail coverage within the area, with public transport instead provided by a relatively large bus network.

High traffic volumes around the St Peters interchange and local road upgrades generally flow eastbound and northbound towards the Sydney CBD and Sydney Airport / Port Botany in the AM peak and in the opposite direction during the PM peak.

Intersections along main roads in the area were recorded as having high traffic volumes, particularly along the Princes Highway, King Street, Canal Road, Botany Road and Gardeners Road. High percentages of heavy vehicles were recorded for intersections along Burrows Road and Coward Street which provide connections and access to the industrial areas east of Alexandra Canal.

The performance of roads surveyed is generally better during the PM peak than the AM peak, although congestion is experienced in both peak periods. Sections of Campbell Street, the Princes Highway and Ricketty Street operate at or near capacity during the AM and / or PM peak. Four intersections within the core modelled network operate at or near capacity during the AM and/ or PM peak. These intersections are susceptible to further decreases in performance with an increase in demand, if improvements to intersection layout or optimisation of signal timing are not undertaken.

The total number of crashes, and the number of crashes that resulted in fatalities and injuries per million vehicle kilometres travelled (MKVT) has historically been higher along all roads analysed around the St Peters interchange and local roads area when compared to the greater Sydney metropolitan area. Higher than average statistics in this area can be attributed to:

- High traffic volumes, comprising relatively high proportions of heavy vehicles
- High levels of congestion and poor network performance along key roads and at key intersections
- A large number of intersections with more opposing movements, resulting in a greater risk of crashes.

Modes of travel

Travel mode share

The mode share in the Sydney and Marrickville LGAs is markedly different to the Sydney greater metropolitan area and the Botany Bay LGA, given the proximity of these areas to the Sydney CBD. The extensive public transport network and better land use mix where residential development are located close to employment areas reduces the need for travel by private vehicles. The Sydney and Marrickville LGAs have a much lower mode share for private vehicles and a high mode share for walking compared to the Sydney greater metropolitan area. Travel by rail and bus in these two LGAs is also above the mode share for the Sydney greater metropolitan area.

The Botany Bay LGA is situated further to the east and closer to industrial and commercial land uses, including Sydney Airport and Port Botany. Mode share within the Botany Bay LGA is similar to the Sydney greater metropolitan area, with the exception of travel by rail and bus. Only two per cent of residents in the Botany Bay LGA travel using the passenger rail network, which is reflective of the lack of rail coverage at this location. There are additional bus services and routes within the Botany Bay LGA to provide connection to the rail network and Sydney CBD. This is reflected in the proportion of mode share by bus in this LGA being almost double the use across the Sydney greater metropolitan area.

The travel mode shares for the Sydney, Marrickville and Botany Bay LGAs in comparison with the Sydney greater metropolitan area are shown in **Table 9-14**.

Table 9-14 Average weekday travel mode share for LGAs around the St Peters interchange and local road upgrades

Area	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Sydney LGA	21%	9%	30%	8%	9%	49%	4%
Marrickville LGA	37%	12%	49%	10%	7%	30%	4%
Botany Bay LGA	46%	21%	67%	2%	11%	19%	1%
Sydney greater metropolitan area	47%	22%	69%	5%	6%	18%	2%

Source: NSW Bureau of Transport Statistics Household Travel Survey Report: Sydney 2012/2013

Public transport

The Sydney and Marrickville LGAs are serviced by four railway lines:

- T1 North Shore, Northern and Western Line
- T2 Airport, Inner West and South Line
- T3 Bankstown Line
- T4 Eastern Suburbs and Illawarra Line.

The Botany Bay LGA has limited rail coverage by the T4 Eastern Suburbs and Illawarra Line.

The closest railway stations to the St Peters interchange and the local road upgrades are the St Peters and Mascot railway stations. St Peters railway station is located on the T3 Bankstown Line, about 750 metres north of the St Peters interchange, and Mascot railway station is about one kilometre south of the St Peters interchange on the T2 Airport, Inner West and South Line.

From St Peters railway station there are 14 train services travelling towards the Sydney CBD during the AM peak (between 7 am and 9 am) at a frequency between six and 15 minutes. In the PM peak, there are 18 services from the Sydney CBD to St Peters, occurring at a frequency of between seven and 15 minutes.

From Mascot railway station there are 18 train services travelling towards the Sydney CBD during the AM peak at a frequency of between six and nine minutes. In the PM peak there are 16 train services from the Sydney CBD to Mascot railway station, occurring at a frequency of between six and nine minutes. Bureau of Travel Statistics NSW station entry and exit statistics (BTS, 2015) show Mascot railway station handles almost double the passenger throughput of St Peters railway station during peak periods.

The area around the St Peters interchange and local road upgrades has a comprehensive bus network providing access to surrounding activity and employment centres and the Sydney CBD. Key roads which provide for bus routes around the St Peters interchange include the Princes Highway, King Street, Canal Road, Ricketty Street, Kent Road, Gardeners Road, Euston Road, Bourke Road and Bourke Street. Three bus services provide access to the Sydney CBD at frequencies of between seven and 20 minutes during the AM and PM peak periods. Another six bus routes operate more local services around the St Peters interchange and local road upgrades, providing access to suburbs and centres, including Wolli Creek, Bondi Junction, Marrickville and Burwood. These services are less frequent than bus services to the Sydney CBD.

The public transport services along local roads around the St Peters interchange are summarised in **Table 9-15** below.

Table 9-15 Public transport services around St Peters interchange and local road upgrades

Railway station / bus route	AM Peak services	AM Peak frequency	PM Peak services	PM Peak frequency
Passenger rail				
St Peters (T3 Bankstown Line)	14	6-15 minutes	18	7-15 minutes
Mascot (T2 Airport, Inner West and South Line)	18	6-9 minutes	16	6-9 minutes
Bus services				
305 – Stamford Plaza Hotel to Railway Square	5	20 minutes	5	20 minutes
308 – Marrickville to City	8	20 minutes	4	30 minutes
310 / X10 Eastgardens to City	10	4 – 14 minutes	12	5 – 15 minutes
348 – Wolli Creek to Bondi Junction	4	30 minutes	4	30 minutes
352 – Marrickville to Bondi Junction	4	30 minutes	6	20 minutes
370 – Leichardt to Coogee	14	8-9 minutes	11	10-11 minutes
400 – Burwood to Bondi Junction	7	17-18 minutes	8	15 minutes
410 – Burwood to Bondi Junction	4	30 minutes	7	17-18 minutes
418 – Burwood to Bondi Junction	6	20 minutes	8	20 minutes
422 – Kogarah to City	9	13-14 minutes	9	13-14 minutes
M20 – Gore Hill to Botany Shops via City	12-17	7-10 minutes	12-17	7-10 minutes

Active transport

There is a network of cycle paths in the area, comprising a mixture of separated cycleways and on-road paths in areas of low to medium traffic. The major cycle path in the area is the Bourke Road cycleway, which provides a separated cycle path along Bourke Road between Gardeners Road and the Green Square railway station. Additional separated cycleways are located in Sydney Park, and these connect to on-road cycle paths on surrounding roads. The existing cycling network in the vicinity of St Peters and Mascot is shown in **Figure 9-9**.

A cyclist survey was undertaken in 2014 at eight locations around the St Peters interchange and local road upgrades area. The survey results indicated that the highest volumes of cyclists during peak periods (AM and PM) were located at the following intersections:

- Gardeners Road / Bourke Road
- Mitchell Road / Coulson Street
- King Street / Princes Highway / Concord Street / Lord Street
- Bourke Road / Maddox Street.

An analysis of historic bicycle count data from 2010 to 2014 indicates the number of bicycle trips around the area has increased at all surveyed locations except the intersection of Euston Road and Campbell Road. The average growth rate of cycling in the area at the surveyed locations over the five years between 2010 and 2014 is about nine per cent per annum. A summary of the bicycle trips recorded during the cyclist survey in 2014 and historical growth of bicycle trips in the St Peters and Mascot area is provided in **Table 9-16**.

Table 9-16 Bicycle counts around the St Peters and Mascot area during peak periods (2014)

Location	Bicycle count data (2014)		Historical bicycle count					growth per annum (per cent)
	AM peak	PM peak	2010	2011	2012	2013	2014	
Burrows Road / Canal Road / Ricketty Street*	40	39	-	-	-	-	-	-
Euston Road / Campbell Road	13	19	55	88	23	42	32	-13%
Gardeners Road / Bourke Road	219	253	272	339	320	420	472	15%
King Street / Princes Highway / May Street / Sydney Park pedestrian entrance	58	81	118	146	162	149	139	4%
Mitchell Road / Coulson Street	103	109	168	187	162	228	212	6%
O'Riordan Street / Doody Street	39	30	70	80	62	104	69	0%
King Street / Princes Highway / Concord Street / Lord Street	164	150	276	209	261	260	314	3%
Bourke Road / Maddox Street	205	225	244	277	338	490	430	15%
Total	841	906	1,203	1,326	1,328	1,693	1,668	9%

Source: City of Sydney (2015)
*No historical data

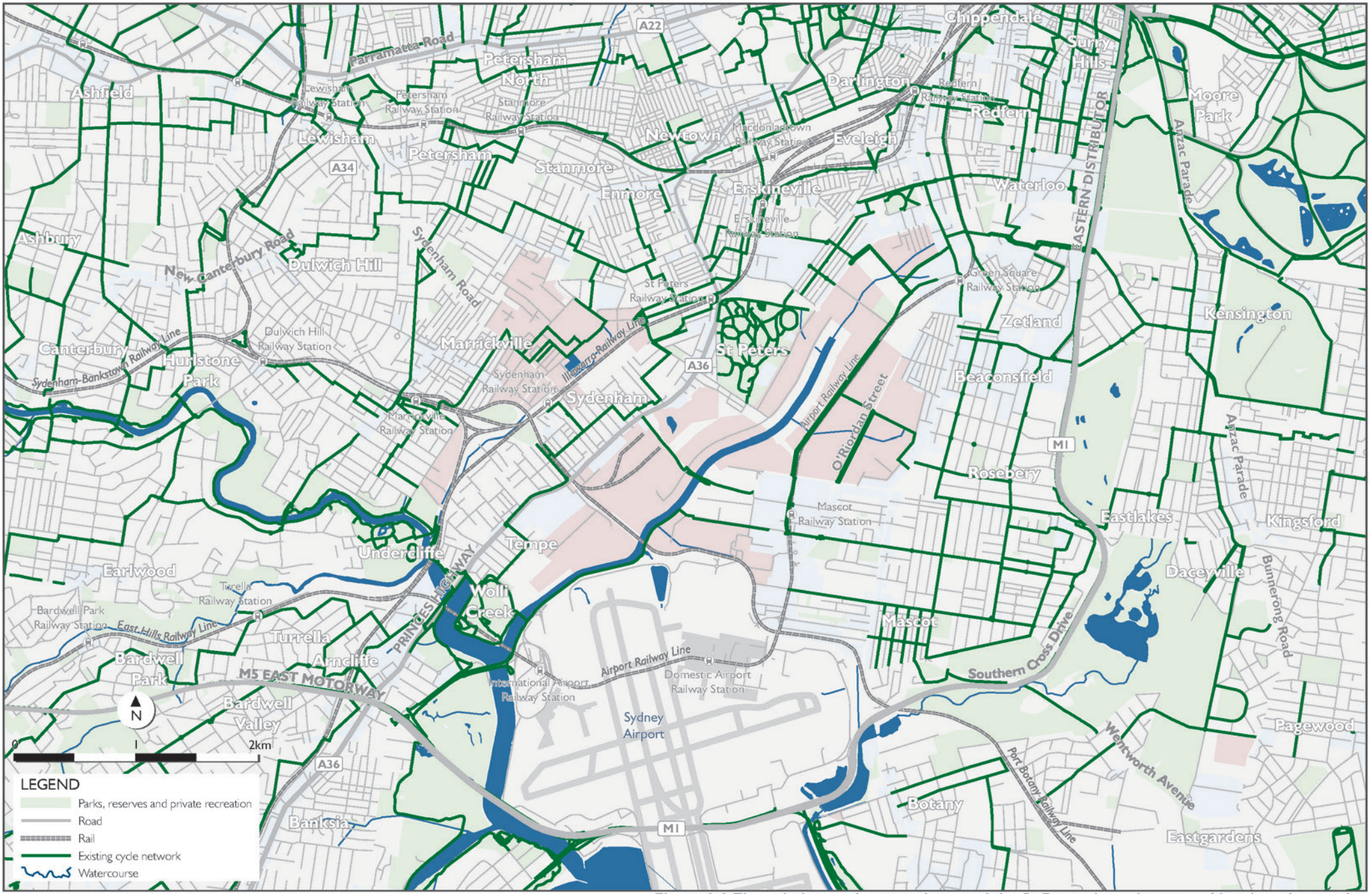

Figure 9-9 The existing cycle network around the St Peters interchange and local road upgrades

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Current conditions (2014 / 2015)

Traffic volumes and patterns

Table 9-17 presents results of traffic surveys that were carried out at various locations around the St Peters interchange and local road upgrades in 2014, including percentages of average weekday daily traffic (AWDT) observed to be heavy vehicles.

The results indicate that high AM peak traffic flows are generally in the eastbound and northbound directions along surveyed routes, towards the Sydney CBD and Sydney Airport / Port Botany areas. High percentages of heavy vehicles were recorded in some parts of at least one point along all roads surveyed.

Table 9-17 Mid-block traffic volumes on local roads around the St Peters interchange

Location	Direction of traffic flow	Vehicles per hour		AWDT flow (vehicles / day)	Percentage of heavy vehicles
		AM peak	PM peak		
King Street, south of Alice Street	Northbound	1019	953	-	-
	Southbound	781	941	-	-
Princes Highway, north of Campbell Street	Northbound	1661	981	18,818	6%
	Southbound	558	1601	17,371	7%
Princes Highway, south of Campbell Street	Northbound	1715	1043	19,681	9%
	Southbound	612	1553	17,798	10%
Railway Road, west of Princes Highway	Eastbound	626	638	-	-
	Westbound	389	550	-	-
Princes Highway, south of Railway Road	Northbound	3368	1595	26,902	15%
	Southbound	784	2607	25,443	17%
Euston Road, north of Campbell Road	Northbound	411	185	3117	13%
	Southbound	199	188	2559	16%
Euston Road, north of Sydney Park Road	Northbound	1220	597	-	-
	Southbound	503	1334	-	-
Campbell Road, west of Euston Road	Eastbound	864	407	7533	11%
	Westbound	161	320	3555	14%
Campbell Street, east of May Street	Eastbound	358	318	4988	8%
	Westbound	142	275	2994	12%
Edgeware Road, west of Edinburgh Road	Northbound	670	814	-	-
	Southbound	730	777	-	-
Ricketty Street	Eastbound	2285	1162	22,159	11%
	Westbound	963	1,830	20,614	12%
Gardeners Road, west of O'Riordan Street	Eastbound	1090	920	14,237	14%
	Westbound	1001	1121	15,235	11%

Network performance

Table 9-18 presents the performance of the modelled road network around the St Peters interchange and local road upgrades during the AM and PM peak periods.

The results of the network performance modelling show the AM and PM peak periods have similar levels of total traffic demand. During the AM peak travel times are longer with lower travel speeds and more stops, indicating there is more congestion during the AM peak when compared to the PM peak.

Table 9-18 Current network performance around the St Peters interchange and local road upgrades (2014)

Road network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (vehicles)	22,000	21,300
Total vehicle kilometres travelled in network (kilometres)	59,100	56,500
Total time travelled in network (hours)	2,310	2,070
Total number of stops	102,700	102,000
Average per vehicle		
Average vehicle kilometres travelled in network (kilometres)	2.7	2.7
Average time travelled in network (minutes)	6.3	5.8
Average number of stops	4.7	4.8
Average speed (kilometres per hour)	25.6	27.3
Unreleased vehicles		
Unreleased demand (vehicles)	0	0
Per cent of total traffic demand	0	0

Intersection counts were also obtained during 2014 from the area around the St Peters interchange and local road upgrades, and the performance of these intersections was modelled. The results of the intersection performance modelling are summarised in **Table 9-19**. The results indicate there are several intersections experiencing significant congestion during the AM and PM peak and are operating at a poor level of service. Any small increases to demand would further reduce the performance of intersections at this location without upgrades and improvements. Intersections which currently operate at or near capacity, ie a level of service E or level of service F include:

- Princes Highway / May Street during the AM peak
- Princes Highway / Canal Road during the AM and PM peak
- Princes Highway / Railway Road during the AM and PM peak
- Gardeners Road / O'Riordan Street during the AM peak.

Table 9-19 Overview of existing (2014) intersection performance around the St Peters interchange and local road upgrades during the AM and PM peak

Intersection	Level of service	
	AM peak	PM peak
Princes Highway / Sydney Park Road	C	D
Princes Highway / May Street	E	D
Princes Highway / Campbell Street	D	D
Princes Highway / Canal Road	E	F
Princes Highway / Railway Road	F	E
Sydney Park Road / Mitchell Road	C	D
Euston Road / Sydney Park Road / Huntley Street	A	D
Unwins Bridge Road / Campbell Street	C	C
Campbell Road / Euston Road	A	A
Gardeners Road / Bourke Road	C	C
Gardeners Road / O'Riordan Street	E	D

Road safety

An analysis of crash statistics collected between 2009 and 2013 showed 745 crashes occurred around the St Peters interchange and local road upgrades area. Of these crashes, three resulted in fatalities and 3337 resulted in injuries. The crash history of the area analysed is provided in **Table 9-20**.

Table 9-20 Crash statistics around the St Peters interchange and local road upgrades (2009-2013)

Road	Crashes			
	Total	Fatal	Injury	Tow-away
Princes Highway between Enmore Road and Gannon Street	407	2	189	216
Canal Road / Ricketty Street / Gardeners Road, between the Princes Highway and Botany Road	248	1	100	147
Euston Road between Sydney Park Road and Campbell Road	21	0	13	12
Bourke Road between Wyndham Street and Gardeners Road	69	0	35	34
Total	745	3	337	409

Source: Summarised from crash reports provided by Road and Maritime Services (2015)

The total number of crashes, and the number of crashes which resulted in fatalities and injuries per million vehicle kilometres travelled (MKVT) has historically been higher along all roads analysed when compared to the greater Sydney greater metropolitan area (refer to **Table 9-21**). Higher than average statistics in this area can be attributed to:

- High traffic volumes, comprising relatively high proportions of heavy vehicles
- High levels of congestion and poor network performance along key roads and at key intersections
- A large number of intersections, with more opposing movements, resulting in a greater risk of crashes.

Table 9-21 Crash rates per 100 MVKT (2014) on local roads around the St Peters interchange

Road / location	Crash severity index	Crash rate per 100 MVKT			Cost per 100 MVKT (AUD)
		Total	Fatal	Injury	
Princes Highway between Enmore Road and Gannon Street	1.24	115.1	0.6	53.5	$25,573,070
Canal Road / Ricketty Street / Gardeners Road, between the Princes Highway and Botany Road	1.21	143.0	0.6	57.7	$27,547,890
Euston Road between Sydney Park Road and Campbell Road	1.50	265.8	0	164.5	$68,702,630
Bourke Road between Wyndham Street and Gardeners Road	1.25	157.5	0	79.9	$33,391,030
Total – Sydney metropolitan area	1.22	68.8	0.2	29.4	-

Source: AECOM (2015), calculated based on the crash reports provided by Road and Maritime Services (2015)

Future conditions without the project (2021 and 2031)

Travel times and speeds

The average travel times and speeds for the Princes Highway near the St Peters interchange and local road upgrades during the AM and PM peak under existing conditions and under the 'without project' scenario in 2021 and 2031 are shown in **Table 9-22**. The results indicate that without the project, travel times would considerably increase, particularly between 2021 and 2031.

Table 9-22 Comparison of average peak travel times along the Princes Highway and the New M5 in 2021 with and without the project and in 2031 without the project and with the Full WestConnex program of works and Southern extension during the AM and PM peak

From	To	Average travel time (minutes)		
		Existing (2012)	2021 'without project'	2031 'without project'
AM peak				
Princes Highway (south of Railway Road)	North of Euston Rd	10:30	22:00	25:30
Princes Highway North (King St)	Sydney Airport Domestic Terminal	13:00	14:00	44:30
PM peak				
Princes Highway (south of Railway Road)	North of Euston Rd	8:00	14:00	38:00
Princes Highway North (King St)	Sydney Airport Domestic Terminal	15:30	17:30	45:00

*Taken from an equivalent distance to the Princes Highway (south of Railway Road)

Network performance

Road network performance

Modelling of the road network under the 'without project' scenario around the St Peters interchange and local road upgrades incorporated the following changes due to occur before 2021:

- As part of the Sydney Airport Master Plan 2033 (Sydney Airport Corporation Limited, 2014)
  - A new access and egress arrangement to Sydney Airport Domestic Terminal
  - A new one-way pairing arrangement for Robey Street, O'Riordan Street and Qantas Drive which would mean traffic would be able to travel northbound only along Robey Street between Qantas Drive and southbound only along O'Riordan Street between Robey Street and Qantas Drive
- The closure of General Holmes Drive between Joyce Drive and Botany Road.

A comparison of the road network performance for the existing case (2012) with 2021 and 2031 under the 'without project' scenario within the area around the St Peters interchange and local road upgrades is provided in **Table 9-23**.

By 2021, without construction of the project, about four per cent of vehicles in the AM peak and two per cent in the PM peak would be unable to enter the modelled road network around the St Peters interchange and local road upgrades as a result of high levels of congestion and queue lengths at intersections. This indicates that the road network does not have sufficient capacity to handle the forecast demand. The road network as a whole is restricted in 2021 under the 'without project' scenario, reflected in the increased travel times and reduced average speeds.

In 2031 under the 'without project' scenario, there would be a 13 per cent increase in traffic demand around the St Peters interchange and local road upgrades when compared to 2021. This would result in nine per cent of the total traffic demand in the AM peak and eight per cent in the PM peak being unable to enter the modelled road network due to congestion and queue lengths at intersections.

Table 9-23 Comparison of the road network performance for the existing case (2012) with 2021 and 2031 under the 'without project' scenarios within the area around the St Peters interchange and local road upgrades

Network measure	Existing (2012)	2021 (without project)	Per cent change (2012-2021)	2031 (without project)	Per cent change (2021-2031)
AM peak					
All vehicles					
Total traffic demand (vehicles)	22,000	23,800	+8	27,000	+13
Total vehicle kilometres travelled in network (kilometres)	59,100	66,400	+12	72,500	+9
Total time travelled in network (hours)	2,310	3,510	+52	3,840	+9
Total number of stops	102,700	170,600	+66	160,600	-6
Average per vehicle					
Average vehicle kilometres travelled in network (kilometres)	2.7	2.8	+4	2.7	-4
Average time travelled in network (minutes)	6.3	8.8	+40	8.5	-3
Average number of stops	4.7	7.2	+53	5.9	-18
Average speed (kilometres)	25.6	18.9	-26	18.9	0
Unreleased vehicles					
Unreleased demand (vehicles)	0	980	-	2,530	158
Per cent of total traffic demand	0	4	-	9	-
PM peak					
All vehicles					
Total traffic demand (vehicles)	21,300	24,800	+16	27,600	+11
Total vehicle kilometres travelled in network (kilometres)	56,500	67,000	+19	72,800	+9
Total time travelled in network (hours)	2,070	2,900	+40	4,470	+54
Total number of stops	102,000	124,100	+22	172,700	+39
Average per vehicle					
Average vehicle kilometres travelled in network (kilometres)	2.7	2.7	0	2.6	-4
Average time travelled in network (minutes)	5.8	7	+21	9.7	+39
Average number of stops	4.8	5	+4	6.3	+26
Average speed (kilometres per hour)	27.3	23.1	-15	16.3	-29
Unreleased vehicles					
Unreleased demand (vehicles)	0	520	-	2,200	323
Per cent of total traffic demand	0	2	-	8	-

Intersection performance

A comparison of intersection performance (level of service) for 2012 (the existing case) with forecasts for 2021 and 2031 under the 'without project' scenarios is summarised in **Table 9-24**.

Under the 'without project' scenario, a number of intersections would be close to or at capacity during the AM and PM peak in 2021 and 2031.

The number of intersection at or near capacity would continue to increase over time with the increase in traffic demand around the St Peters interchange and local road upgrades.

Intersections operating at a level of service F in 2012 and/ or 2021 would continue to deteriorate, with the average delay increasing.

The performance of some intersections in the modelled area around the St Peters interchange and local road upgrades area would improve between the existing (2012) and 2021 under the 'without project' scenario. This is likely a result of:

- A redistribution of green time at the Princes Highway / Railway Road intersection to accommodate the increased demand for southbound turning movements. As a result of this modification, the amount of time that the signal remains green for northbound movements along the Princes Highway at this intersection is reduced, thereby reducing the amount of traffic reaching the modelled road network around the St Peters interchange and local road upgrades. This leads to an improved level of service at intersections of Canal Road, Campbell Street, May Street and Sydney Park Road with the Princes Highway (refer to **Table 9-24**)
- Traffic that is unable to enter the modelled area around the St Peters interchange and local road upgrades from other traffic routes as a result of congestion.

Table 9-24 Summary of intersection level of service under existing (2012) traffic conditions and under the 'without project' scenario in 2021 and 2031

Intersection	Existing (2012)		2021 'without project'		2031 'without project'	
	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Princes Highway / Sydney Park Road	C	D	B	F	F	F
Princes Highway / May Street	E	D	B	D	C	D
Princes Highway / Campbell Street	D	D	C	C	D	F
Princes Highway / Canal Road	E	F	C	E	F	F
Princes Highway / Railway Road	F	E	F	F	F	F
Sydney Park Road / Mitchell Road	C	D	B	B	B	D
Euston Road / Sydney Park Road / Huntley Street	A	D	A	A	A	E
Unwins Bridge Road / Campbell Street	C	C	B	C	B	F
Campbell Road / Euston Road	A	A	A	A	A	F
Gardeners Road / Bourke Road	C	C	C	C	D	E
Gardeners Road / O'Riordan Street	E	D	F	D	F	F

Road safety

Forecast crash statistics on roads around the St Peters interchange and local road upgrades area under the 'without project' scenario in 2021 and 2031 have been prepared assuming that the future frequency, type and severity of crashes on these roads would be consistent with historic trends.

It is expected that the frequency of crashes on roads around area would increase in proportion to the forecast traffic growth. The crash rate per vehicle kilometre under the 'without project' scenario in 2021 and 2031 would remain the same as the existing (2012) conditions.

By 2031, the growth in traffic volumes would create a relative 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 81 to 112 per annum
  - The corresponding annual cost of crashes would rise from $18.1 million to $24.8 million per annum
- Canal Road / Ricketty Street / Gardeners Road (Princes Highway to Botany Road):
  - Crashes would be expected to increase from an average of 50 to 69 per annum
  - The corresponding annual cost of crashes would rise from $9.6 million to $13.3 million per annum
- Euston Road (Sydney Park Road to Campbell Road):
  - Crashes would be expected to increase from an average of four to six per annum
  - The corresponding annual cost of crashes would rise from $1.1 million to $1.6 million per annum
- Bourke Road (Wyndham Street to Gardeners Road):
  - Crashes would be expected to increase from an average of 14 to 21 per annum
  - The corresponding annual cost of crashes would rise from $2.9 million to $4.4 million per annum

9.3 Assessment of potential impacts

9.3.1 Construction

During construction, the project may affect the surrounding road network as a result of:

- The introduction of construction vehicles, especially heavy vehicles transporting spoil
- Surface road works, requiring temporary traffic cyclist and / or pedestrian diversions, road occupation and temporary road closures
- Changes to speed limits.

There would be 14 construction compounds used during construction of the project, as shown in **Figure 6-5** and in detail in **Figure 6-6** to **Figure 6-15**. The establishment and use of construction compounds may result in

- Impacts to local traffic
- Alterations to property access, pedestrian and cyclist movements
- Changes to the bus stop locations.

A detailed description of key traffic activities at each construction compound is provided in the Technical working paper: Traffic and transport (**Appendix G**).

Overview of construction traffic and vehicle routes

Construction of the project would result in the generation of additional heavy and light vehicle movements on the road network in three broad categories:

- Removal of spoil generated by construction activities
- Heavy vehicle deliveries and other heavy vehicles involved in construction activities
- Light vehicle movements associated with construction of the project.

Construction traffic routes for the project would use the existing motorway and arterial road network as much as possible, reducing traffic related impacts on local roads.

Spoil would be transported from construction compounds to spoil management locations, generally along the M5 East Motorway and M5 South West Motorway.

Western surface works, Kingsgrove Road surface works and Bexley Road surface works

Construction traffic volumes and patterns

Table 9-25 presents construction compound access points and construction traffic volumes around the western surface works, Kingsgrove Road surface works and the Bexley Road surface works.

The construction traffic volumes are the two-way volumes (inbound and outbound) associated with the peak construction period at each construction compound for each route.

Construction haulage routes for the Kingsgrove North (C1), Kingsgrove South (C2), Commercial Road (C3), Bexley Road North (C4), Bexley Road South (C5) and Bexley Road East (C6) construction compounds are shown in **Figure 9-10** to **Figure 9-12**.

Table 9-25 Construction compound access points and traffic volumes around the western surface works

Construction compound	Construction route number	Vehicle type	Access point	Daily vehicles^	AM peak (vehicles per hour)	PM peak (vehicles per hour)
Kingsgrove North (C1)*	Route 1	Light	Garema Circuit (left in, left out)	452	14	12
		Heavy		672	21	19
	Route 2	Light	Garema Circuit (left in, left out)	452	14	12
		Heavy		672	21	19
	Route 3	Light	M5 East Motorway (left in, left out)	86	3	2
		Heavy		631	20	18
	Total (Route 1, 2 and 3)	Light	Garema Circuit and M5 East Motorway	989	31	26
		Heavy		1975	62	56
Kingsgrove South (C2)	Route 3**	Light	M5 East Motorway (left in, left out)	24	1	1
		Heavy		72	3	3
Commercial Road (C3)	N/A	Light	Commercial Road (right in, left out)	133	7	7
		Heavy		192	8	8
Bexley Road North (C4)	N/A	Light	Bexley Road (left in, left out)	96	4	4
		Heavy		432	18	18
Bexley Road South (C5)	N/A	Light	Bexley Road (left in, left out)	96	4	4
		Heavy		432	18	18
Bexley Road East (C6)	N/A	Light	Wolli Avenue (left in, right and left out)	418	32	32
		Heavy		0	0	0
Total construction vehicles around the western surface works, Kingsgrove Road surface works and Bexley Road surface works		Light		1,756	79	74
		Heavy		3,103	109	103

*Construction traffic from the Kingsgrove North construction compound (C1) onto Garema Circuit (construction route 1 and route 2) comprises heavy and light vehicle movements from the Kingsgrove South construction compound (C2) which are not entering and exiting the construction compound directly via the M5 East Motorway (westbound).
**The Kingsgrove South construction compound (C2) construction routes 1 and 2 are included as part of the Kingsgrove North construction compound (C1) construction route 1 and 2. Construction traffic would travel to the Kingsgrove North construction compound (C1) via the Kindilan underpass.
^Daily vehicles accounts for traffic movements across a 24-hour period, including movements outside of standard construction hours

Construction vehicles would use the existing arterial road network to access construction compounds as much as practically possible. At locations where direct access to and from construction compounds via arterial roads is not feasible, or these roads cannot be used as a standalone access point for a construction compound, construction vehicles would use local roads. Impacts to the local road network from construction vehicle movements around the western surface works would be minimised where reasonable and feasible, in accordance with the Construction Traffic and Safety Management Plan.

Vehicle access to the Kingsgrove North (C1), Kingsgrove South (C2), Commercial Road (C3) and Bexley Road East (C6) construction compounds would require the use of some local roads.

The construction compound access requirements from local roads around the western surface works, Kingsgrove Road surface works and Bexley Road surface works are presented in **Table 9-26**.

Table 9-26 Construction compound access requirements from local roads around the western surface works, Kingsgrove Road surface works and Bexley Road surface works

Construction compound	Access point	Local road access requirements
Kingsgrove North (C1) Kingsgrove South (C2)	Primary access: Garema circuit (left in, left out) Secondary access: M5 East Motorway (left in, left out)	The roads used to travel to the principal construction compound access point would be Kingsgrove Road, Moorefields Avenue, Wirega Avenue and Garema Circuit. These roads are located adjacent to a mixture of mostly industrial and residential land uses. Construction of the project would generate around 40 vehicles per hour in both directions along Moorefields Avenue, Wirega Avenue and Garema Circuit.
Commercial Road (C3)	Commercial Road (right in, left out)	Commercial Road is a local road which travels through a light industrial precinct to the south of the M5 East Motorway. Construction of the project would generate around eight vehicles per hour in both directions along Commercial Road between the Commercial Road construction compound (C3) access point and Kingsgrove Road.
Bexley Road East (C6)	Wolli Avenue (left in, right and left out)	Wolli Avenue is a local road which passes through a primarily residential area. The Bexley Road East compound (C6) is located at the intersection of Wolli Avenue and Bexley Road and would generally not require heavy vehicles to travel along this road, apart from heavy vehicle movements required for site establishment and demobilisation. Construction of the project would generate around 16 additional light vehicle movements per hour in both directions on Wolli Avenue, Frost Street, Douglas Street and Homer Street.

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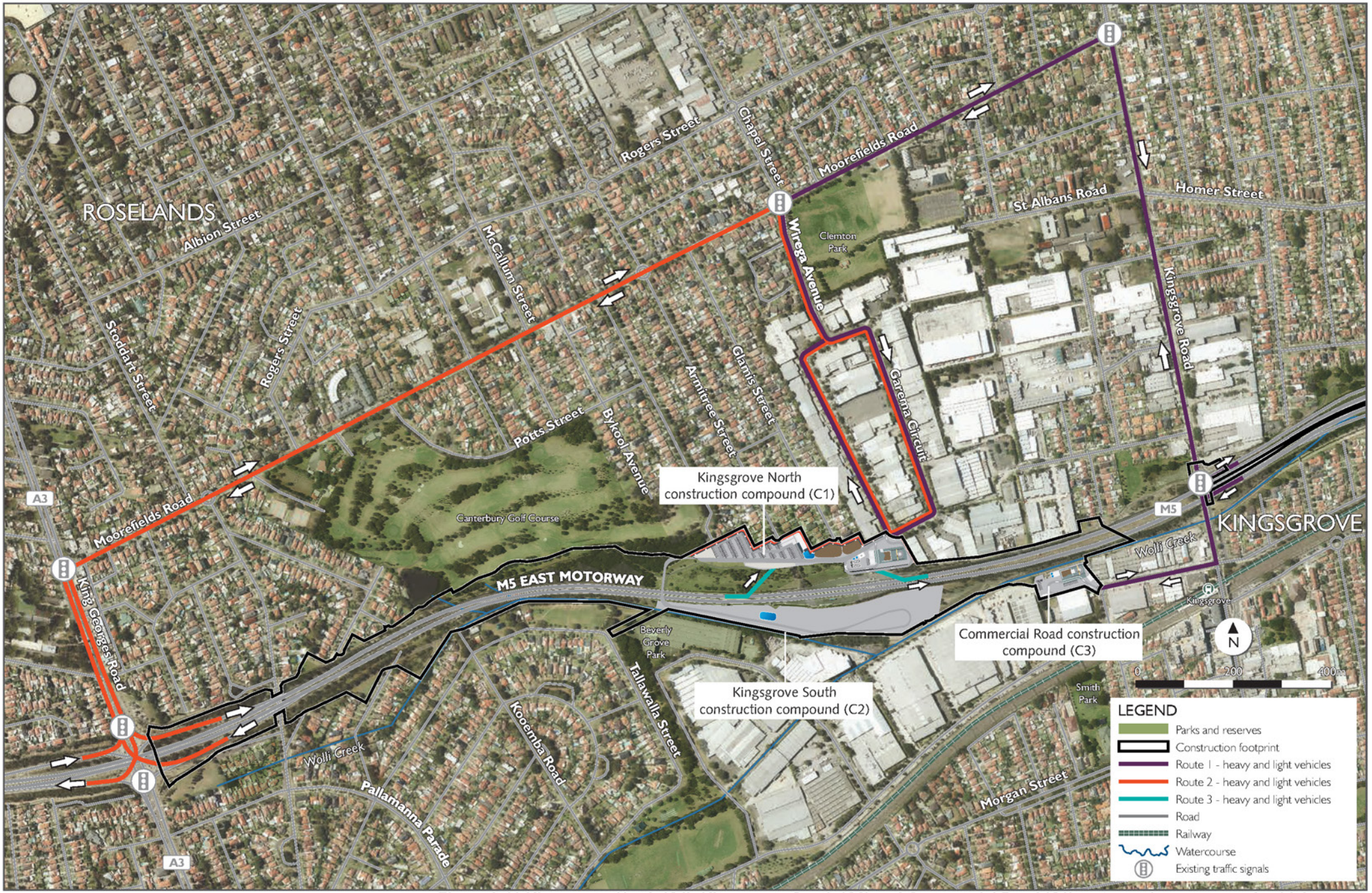

Figure 9-10 Kingsgrove North (C1), Kingsgrove South (C2) and Commercial Road (C3) construction compound vehicle routes

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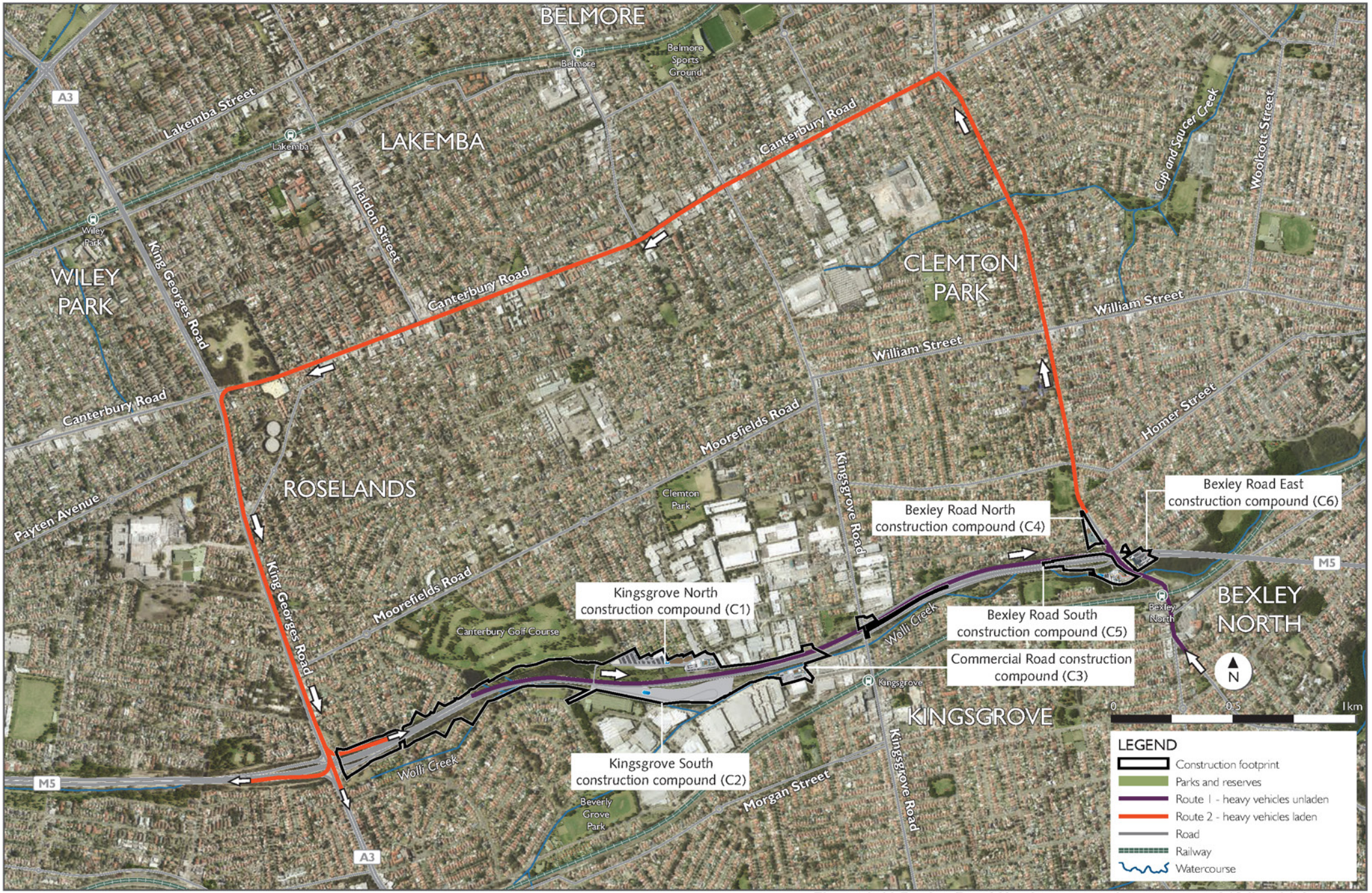

Figure 9-11 Bexley Road North construction compound (C4) vehicle routes

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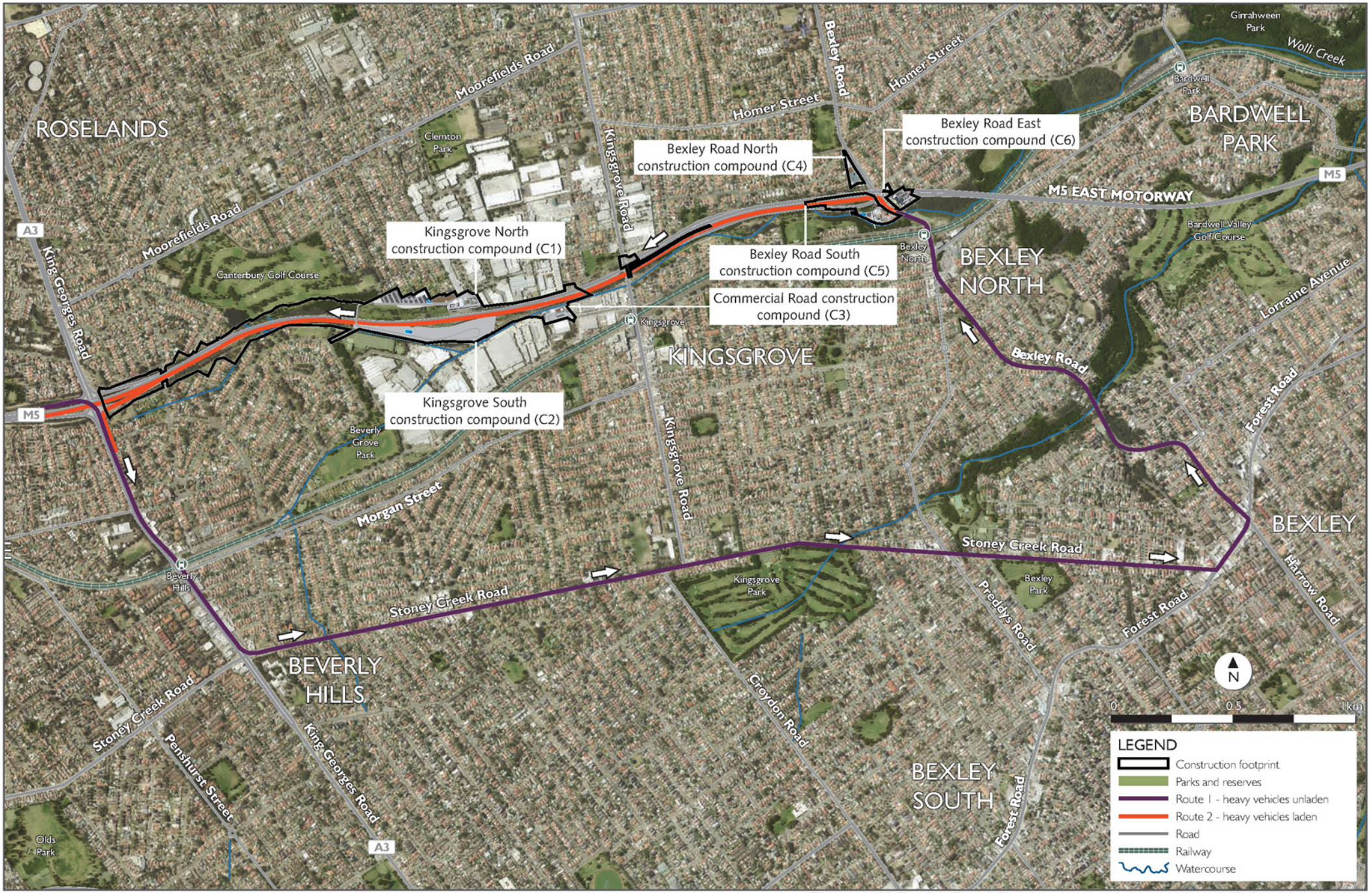

Figure 9-12 Bexley Road South construction compound (C5) vehicle routes

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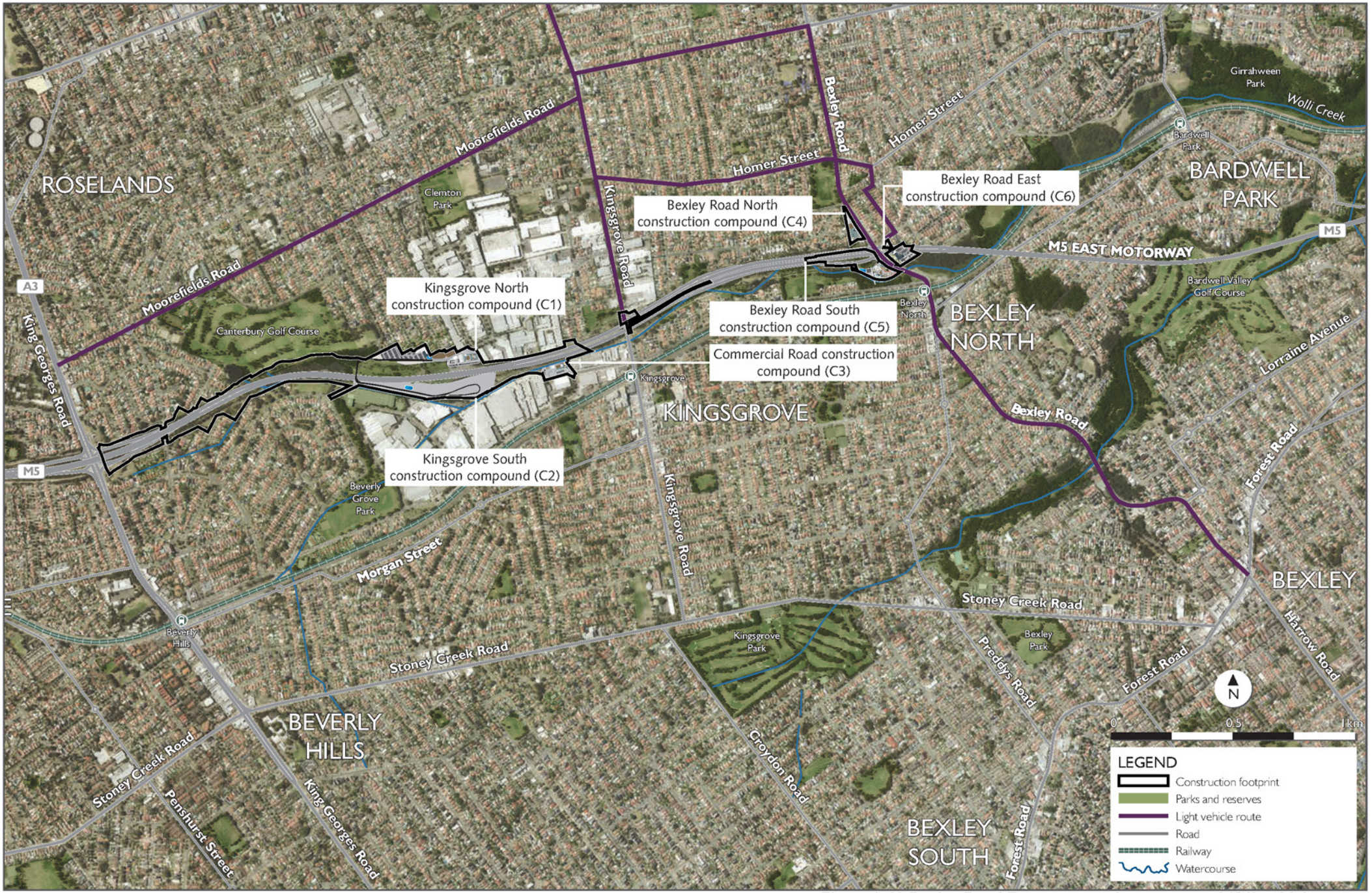

Figure 9-13 Bexley Road East construction compound (C6) vehicle routes

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Network performance

Mid-block traffic volumes and level of service

Mid-block volume / capacity ratios around the western surface works, Kingsgrove Road surface works and Bexley Road surface works in 2016 with and without construction of the project are presented in **Table 9-27**.

The volume / capacity ratios show the operation of the road network would be similar with and without construction of the project. This is mainly due to the small volume of total construction traffic relative to expected background traffic volumes in 2016.

During construction, road performance is generally expected to operate at a level of service D or better during the AM and PM peak periods, with the exception of the following roads which would operate at a level of service E during periods of peak construction:

- The M5 East Motorway (surface lanes) between King Georges Road and Bexley Road during the AM peak in both directions
- The M5 East Motorway tunnel (eastbound), east of Bexley Road during the AM peak
- King Georges Road (northbound) between the M5 East Motorway and Moorefields Road during the AM peak
- Moorefields Road (eastbound), east of Chapel Street during the AM and PM peak
- Moorefields Road (westbound), east of Chapel Street during the PM peak.

Only one road (the M5 East Motorway tunnel eastbound from Bexley Road) would deteriorate from a level of service E to a level of service F in 2016 (AM peak) with the addition of project construction traffic. This road is already anticipated to be very close to capacity in 2016, even without the addition of project construction traffic.

Total construction traffic during peak construction activities along major roads around the western surface works area, Kingsgrove Road surface works area and Bexley Road surface works area would be:

- Less than four per cent of the total existing traffic (2016) on the M5 East Motorway
- Less than three per cent of the total existing traffic (2016) on Kingsgrove Road
- Less than four per cent of the total existing traffic (2016) on Bexley Road.

As a result, construction of the project would have a minor, temporary impact on the mid-block performance of the road network around the western surface works area, Kingsgrove Road surface works area and the Bexley Road surface works area.

Table 9-27 Mid-block traffic and volumes and level of service (2016) with construction and without construction around the western surface works, Kingsgrove Road surface works and Bexley Road surface works

Location	Traffic direction	Mid-block capacity	2016 'without construction' LV	HV	v/c	LoS	2016 'with construction' LV	LV increase* (per cent)	HV	HV increase* (per cent)	v/c	LoS
AM peak												
M5 East Motorway, east of King Georges Road	East	4300	2979	333	0.86	D	2995	1%	372	12%	0.88	E
	West	4300	2972	335	0.86	D	2982	0.3%	356	6%	0.87	E
M5 East Motorway, east of Bexley Road (tunnel)	East	4300	3380	406	0.99	E	3404	1%	450	11%	1.02	F
	West	4300	2506	363	0.77	D	2527	1%	390	7%	0.78	D
Bexley Road, (M5 East Motorway-Kingsgrove Avenue)	North	2400	1674	58	0.75	D	1679	0.3%	67	15%	0.76	D
	South	2400	1196	46	0.54	C	1199	0.3%	46	0%	0.54	C
Kingsgrove Road, south of Homer Street	North	2400	1027	79	0.50	C	1037	1%	90	14%	0.51	C
	South	2400	1213	78	0.58	C	1223	1%	89	14%	0.59	D
Commercial Road, west of Kingsgrove Road	East	900	554	22	0.67	D	558	1%	26	18%	0.68	D
	West	900	423	21	0.52	C	427	1%	25	19%	0.53	C
King Georges Road (between the M5 East Motorway-and Moorefields Road)	North	3600	2,506	306	0.88	E	2513	0.3%	317	4%	0.89	E
	South	3600	1678	234	0.61	D	1687	1%	239	2%	0.61	D
Moorefields Road, east of Chapel Street	East	900	675	50	0.87	E	682	1%	61	22%	0.90	E
	West	900	553	45	0.72	D	560	1%	56	25%	0.76	D
Wirega Avenue, south of Moorefields Road	North	900	101	17	0.15	A	115	14%	39	129%	0.22	A
	South	900	252	18	0.32	B	266	6%	40	122%	0.39	B
PM peak												
M5 East Motorway, east of King Georges Road	East	4300	3288	194	0.86	D	3302	0.4%	231	19%	0.88	E
	West	4300	3377	350	0.96	E	3386	0.3%	370	6%	0.97	E
M5 East Motorway, east of Bexley Road (tunnel)	East	4300	3316	192	0.87	D	3338	1%	233	21%	0.89	E
	West	4300	2824	241	0.78	D	2843	1%	266	10%	0.79	D
Bexley Road, (M5 East Motorway-Kingsgrove Avenue)	North	2400	1492	33	0.65	D	1497	0.3%	42	27%	0.66	D
	South	2400	1499	47	0.67	D	1502	0.2%	47	0%	0.67	D

Location	Traffic direction	Mid-block capacity	2016 'without construction'				2016 'with construction'					
			LV	HV	v/c	LoS	LV	LV increase* (per cent)	HV	HV increase* (per cent)	v/c	LoS
Kingsgrove Road, south of Homer Street	North	2400	1089	43	0.49	C	1098	1%	53	23%	0.50	C
	South	2400	1341	59	0.61	D	1350	1%	69	17%	0.62	D
Commercial Road, west of Kingsgrove Road	East	900	498	14	0.59	C	502	1%	18	29%	0.60	D
	West	900	540	10	0.62	D	544	1%	14	39%	0.64	D
King Georges Road (between the M5 East Motorway-and Moorefields Road)	North	3600	2078	241	0.72	D	2084	0.3%	251	4%	0.73	D
	South	3600	2218	251	0.76	D	2226	0.4%	255	2%	0.77	D
Moorefields Road, east of Chapel Street	East	900	690	22	0.82	E	696	1%	32	45%	0.85	E
	West	900	815	23	0.96	E	821	1%	33	44%	0.99	E
Wirega Avenue, south of Moorefields Road	North	900	233	5	0.27	B	245	5%	25	400%	0.33	B
	South	900	106	4	0.13	A	118	11%	24	500%	0.19	A

*increase in number of vehicles between 2016 'without construction traffic' scenario and 2016 'with construction traffic' scenario
LV – light vehicles, HV – heavy vehicles and LOS – level of service

Intersection performance with and without construction of the project

Table 9-28 provides a summary of the intersection performance level of service at key locations along construction traffic routes around the western surface works area, Kingsgrove Road surface works area and Bexley Road surface works area in 2016 with and without construction of the project. The analysis provides the average intersection delays and level of service for the worst performing movement at each intersection.

During construction of the project, the performance of intersections along construction traffic routes are expected to generally operate at a level of service similar to the operation of these intersections without construction in 2016. Without construction of the project, all intersections would operate at a level of service D or better during the AM and PM peak, except:

- Moorefields Road / Wirega Avenue / Chapel Street, which would operate at a level of service E during the AM peak
- Kingsgrove Road / Homer Street, which would operate at a level of service F during the AM peak and level of service E during the PM peak
- Bexley Road / Homer Street, which would operate at a level of service F during the PM peak.

The Moorefields Road / Wirega Avenue / Chapel Street, Kingsgrove Road / Homer Street and Bexley Road / Homer Street intersections would continue to operate at a level of service E during construction; however, the average delay would increase. Construction of the project would result in a reduction in the performance of the Kingsgrove Road / Homer Street intersection during the PM peak from a level of service D to a level of service E.

Table 9-28 **Intersection performance (2016) with construction and without construction (including spoil disposal) around the western surface works, Kingsgrove Road surface works and Bexley Road surface works**

Intersection / Peak	2016 – without construction				2016 – with construction			
	Light vehicles (vehicles per hour)	Heavy vehicles (vehicles per hour)	Average delay (seconds)	Level of service	Light vehicles (vehicles per hour)	Heavy vehicles (vehicles per hour)	Average delay (seconds)	Level of service
Kingsgrove Road / Homer Street								
AM Peak	2789	191	>100	F	2815	213	>100	F
PM Peak	2993	522	52.2	D	3017	138	56.9	E
Kingsgrove Road / Moorefields Road								
AM Peak	3016	221	32.4	C	3036	243	31.3	C
PM Peak	3253	126	26.0	B	3271	146	30.0	C
Moorefields Road / Wirega Avenue / Chapel Street								
AM Peak	1652	128	56.8	E	1680	172	70.1	E
PM Peak	1925	52	34.9	C	1949	92	40.4	C
Kingsgrove Road / M5 East Motorway interchange								
AM Peak	3119	170	31.7	C	3147	200	37.9	C
PM Peak	3049	74	20.3	B	3075	102	21.1	B
Kingsgrove Road / Commercial Road / Kingsgrove Avenue								
AM Peak	2787	118	28.4	B	2795	126	29.4	C
PM Peak	3079	74	22.4	B	3087	82	22.9	B
Bexley Road / M5 East Motorway interchange								
AM Peak	3499	143	20.6	B	3515	161	21.2	B
PM Peak	4066	139	25.9	B	4082	157	26.0	B
Bexley Road / Kingsgrove Avenue								
AM Peak	3059	118	7.9	A	3067	127	7.8	A
PM Peak	3201	69	8.8	A	3209	78	8.8	A

Intersection / Peak	2016 – without construction				2016 – with construction			
	Light vehicles (vehicles per hour)	Heavy vehicles (vehicles per hour)	Average delay (seconds)	Level of service	Light vehicles (vehicles per hour)	Heavy vehicles (vehicles per hour)	Average delay (seconds)	Level of service
Bexley Road / Homer Street								
AM Peak	3430	135	46.2	D	3459	144	48.9	D
PM Peak	3485	92	77.5	F	3514	101	83.0	F

Temporary road closures and changes to property access and on-street parking provisions

Increases in traffic volumes around construction compounds and along construction traffic vehicle routes at the western surface works, Kingsgrove Road surface works and Bexley Road surface works would be relatively low when compared with background traffic volumes in 2016. The increase in traffic volumes due to construction traffic is not expected to affect the ability for road users to enter or exit properties along construction traffic routes; however, minor delays due to the increase in traffic volumes may be experienced in some areas.

The use of construction compounds would not require any temporary road closures during construction of the project. Some temporary road closures would be required along the M5 East Motorway at night to facilitate the installation, relocation and removal of traffic barriers, the installation of tolling infrastructure and for works associated with the M5 Motorway corridor integration works.

Light vehicle parking for about 200 vehicles would be provided at the Kingsgrove North construction compound (C1) and about 112 light vehicle parking spaces would be provided at the Bexley Road East construction compound (C6). Off-street parking within construction compounds would minimise impacts on the availability of on-street parking (refer to **Section 6.5.3**).

Construction works around the western surface works, Kingsgrove Road surface works and the Bexley Road surface works areas are not expected to impact property access and/ or existing on-street parking provisions.

Travel times and speeds

There may be some short-term periods during construction where the speed limits around the western surface works, Kingsgrove Road surface works and Bexley Road surface works are reduced to provide a safe road working environment. This would include:

- Lowering the speed limit on some local roads to 40 kilometres per hour
- Lowering the speed limit on sections of the M5 South West and M5 East Motorways to 80 kilometres per hour

Speed limits along local roads would be reduced where:

- There is a large volume of construction traffic, particularly heavy vehicles
- The relocation of pedestrian pathways requires a reduction in the speed limit
- Construction of the project generates additional opposing turning movements or conflict points on the local road network
- Construction of the project presents a risk to the safety of construction workers
- Construction of the project creates additional road hazards, such as uneven road surfaces.

A reduction in the speed limit along local roads would not significantly impact on travel times.

Any reductions to speed limits along local roads, the M5 South West Motorway and M5 East Motorway would be undertaken in accordance with a Construction Traffic Management and Safety Plan(s) which would be developed and implemented for the project.

Impacts to public and active transport facilities and infrastructure

Public transport

During construction, increases in traffic flows on the existing road network around the western surface works, Kingsgrove Road surface works and Bexley Road surface works areas, particularly increases in heavy vehicle movements would result in increased delays at intersections along the construction vehicle routes identified in **Table 9-25**.

Buses would experience the same delays as general traffic at these intersections, as well as delays as a result of reduced speed limits and manual traffic control. Bus services around the western surface works area, Kingsgrove Road surface works area and Bexley Road surface works area that would potentially experience some minor delays in line with that experienced by general traffic on the existing road network are shown in **Figure 9-14** and include:

- Route 400 (Bondi Junction to Burwood), which travels along Bexley Road every 10 to 20 minutes during the AM and PM peak
- Route 446 (St George Hospital to Roselands), which travels along Homer Street, Bexley Road and Moorefields Road every 30 minutes during the AM and PM peak
- Route 450 (Hurstville to Burwood) and Route 452 (Bankstown to Canterbury), which travel along King Georges Road every 20 minutes during the AM and PM peak
- Route 490 (Drummoyne to Hurstville) and Route 492 (Drummoyne to Roselands), which travel along Kingsgrove Road every 30 minutes during the AM and PM peak
- Route 491 (Five Dock to Hurstville), which travels along Bexley Road once an hour during the AM and PM peak
- Route 493 (Rockdale to Roselands), which travels along Bexley Road and Kingsgrove Road outside of the AM and PM peak once an hour
- Route 495 (Williams Landing to Point Cook South), which travels along Kingsgrove Road every 20 minutes during the AM and PM peak
- Route M41 (Hurstville to Macquarie Park), which travels along Bexley Road every ten minutes during the AM and PM peak
- Route 946 (Hurstville to Bankstown) and Route 942 (Lugarno to Campsie), which travel along King Georges Road every 30 minutes during the AM and PM peak.

School bus services operating on these roads would also be impacted.

Construction of the project would not impact on the operation of passenger rail services on the Sydney metropolitan rail network.

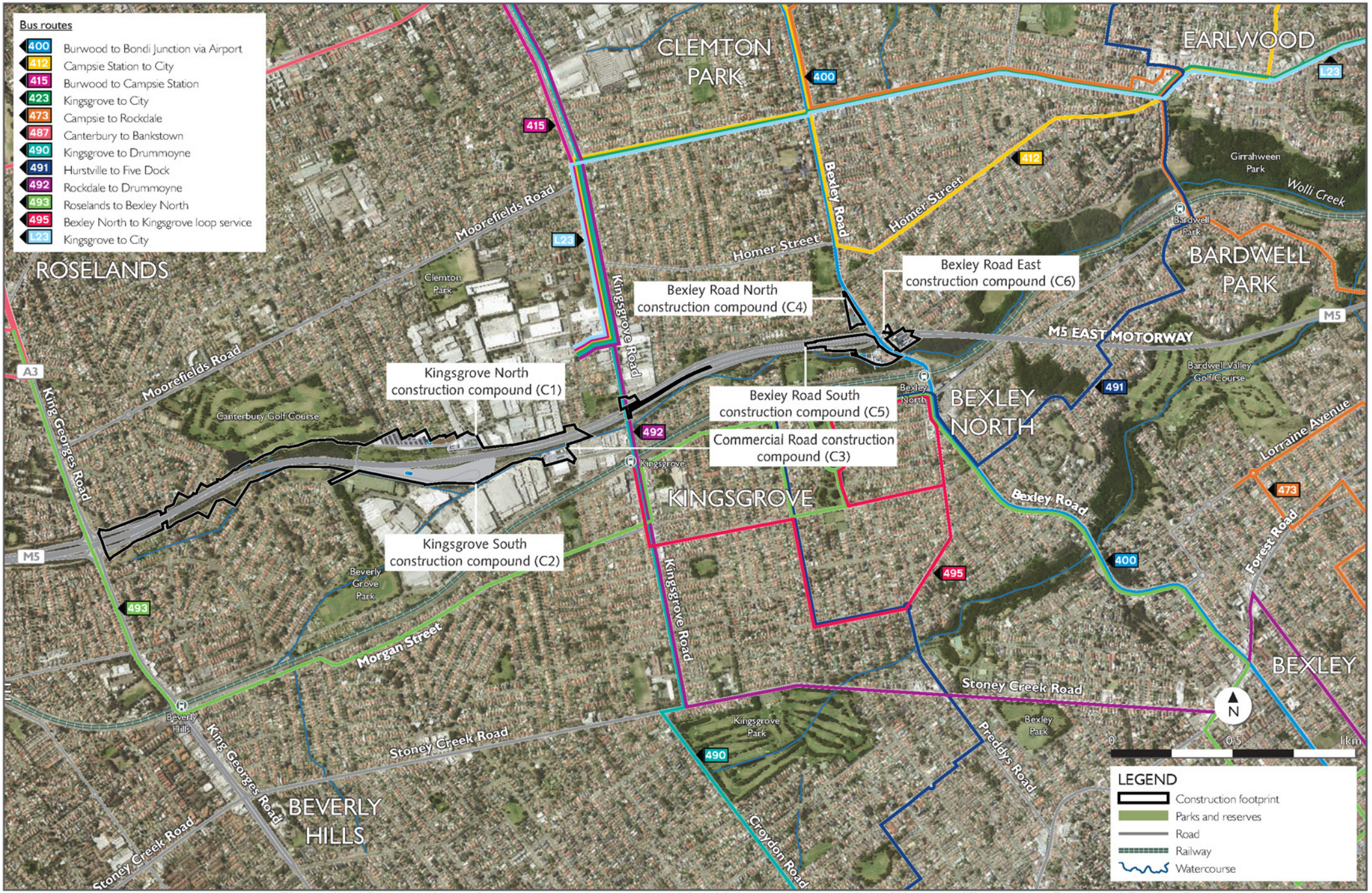

Figure 9-14 Bus services along construction compound vehicle routes around the Western, Kingsgrove Road and Bexley Road surface work areas

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Active transport

Construction of the project would require modifications to pedestrian and cycling facilities around the western surface works, Kingsgrove Road surface works and Bexley Road surface works. These modifications are shown in **Figure 9-15** and include:

- Realignment of the shared path within Beverly Grove Park, north of the M5 East Motorway. The shared path would be relocated outside of the Kingsgrove North (C1) construction compound so it would remain accessible during construction of the project. The path would be permanently realigned within Beverly Grove Park at the end of construction (refer to **Figure 5-1** to **Figure 5-3**)
- Temporary closure of the shared path within Beverly Grove Park, south of the M5 East Motorway between the Kindilan underpass and the Karingal Street underpass. Pedestrians and cyclists would be diverted onto the shared path within Beverly Grove Park on the northern side of the M5 East Motorway between these two underpasses. The path would be reinstated at the end of construction
- Permanent removal of cyclist provisions along the M5 East Motorway from the start of construction between King Georges Road and Bexley Road as part of the King Georges Road Interchange Upgrade project. Cyclists would be diverted onto the shared path within Beverly Grove Park and / or surrounding roads
- Changes to pedestrian and cyclist use of the Kindilan underpass. Kindilan underpass would be used for off-road vehicle access between the Kingsgrove North (C1) and Kingsgrove South (C2) construction compounds. Cyclists and pedestrian access would be temporarily separated from vehicles using the underpass with a hoarding to ensure safe access is maintained
- Temporary closure of the Kindilan underpass for four weeks during construction to facilitate the extension of the underpass as part of the western surface works (refer to **Section 5.4**). Additional intermittent closures may also be required during the construction period. In instances where the Kindilan underpass is closed, pedestrians and cyclists would be able to cross the M5 East Motorway via the underpasses at Karingal Street and/ or Coolangatta Road.

In addition, the pedestrian walkway along Bexley Road (northbound) adjacent to the Bexley Road South (C5) construction compound would be temporarily realigned to accommodate construction activities and maintain pedestrian accessibility. The path would be reinstated at the end of construction.

On-road cyclists may experience delays at intersections due to an increase in traffic volumes around the western surface works, Kingsgrove Road surface works and Bexley Road surface works areas. Additionally, journey times and distances for cyclists may be longer due to detours and changes in cycling routes.

A strategy for the maintenance of pedestrian and cyclist access during construction would be provided as part of the Construction Traffic Management and Safety Plan(s) for the project. The strategy would be prepared during the detailed design phase of the project and would incorporate management measures for pedestrian and cyclist access around the western surface works, Kingsgrove Road surface works and Bexley Road surface works.

Road safety

Construction traffic volumes are expected to be relatively low when compared with background traffic volumes in 2016 during peak construction activities along major roads around the western surface works, Kingsgrove Road surface works and Bexley Road surface works, making up:

- Less than four per cent of the total existing traffic on the M5 East Motorway
- Less than three per cent of the total existing traffic on Kingsgrove Road
- Less than four per cent of the total existing traffic on Bexley Road.

Increases in traffic along these roads due to construction of the project would be for the duration of construction only and are not expected to significantly impact on road safety around the western surface works area, Kingsgrove Road surface works area and / or Bexley Road surface works area.

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