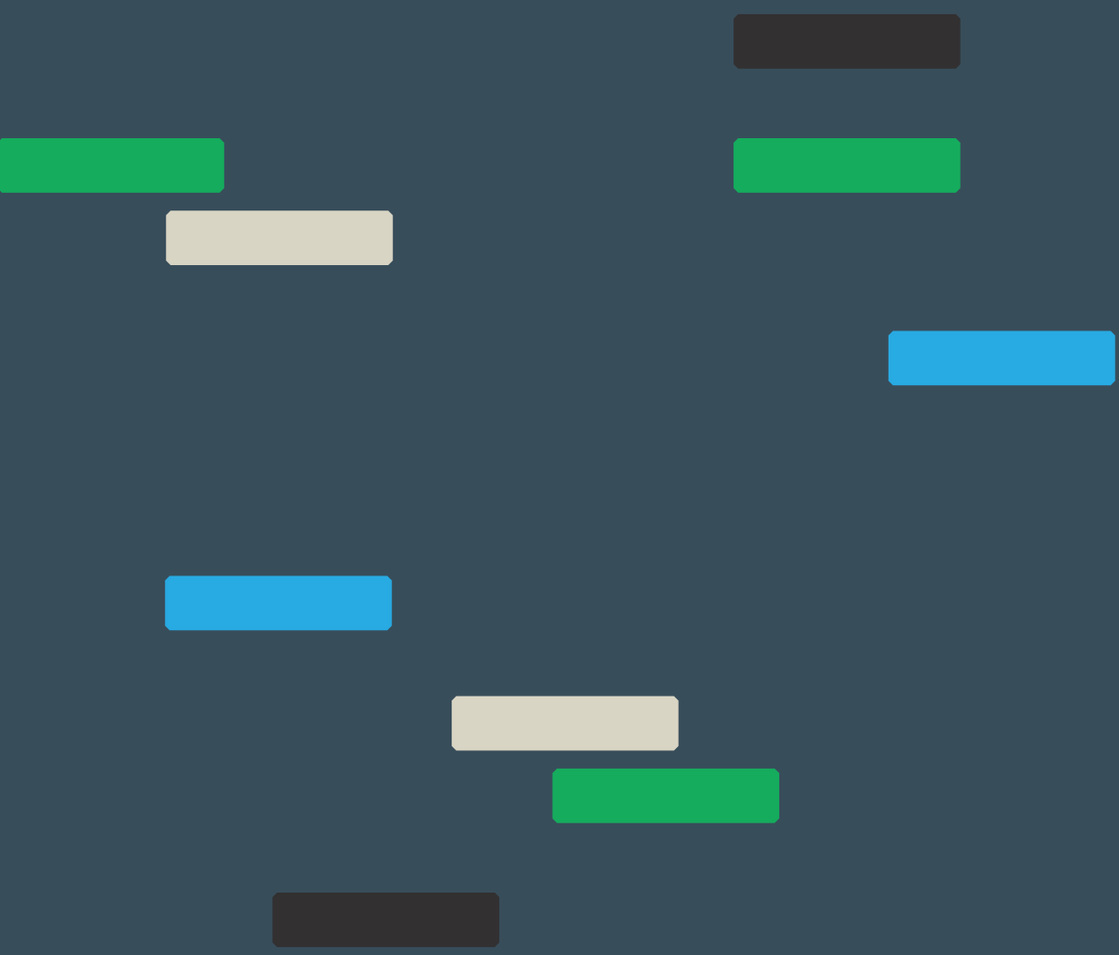
BOTANY RAIL DUPLICATION

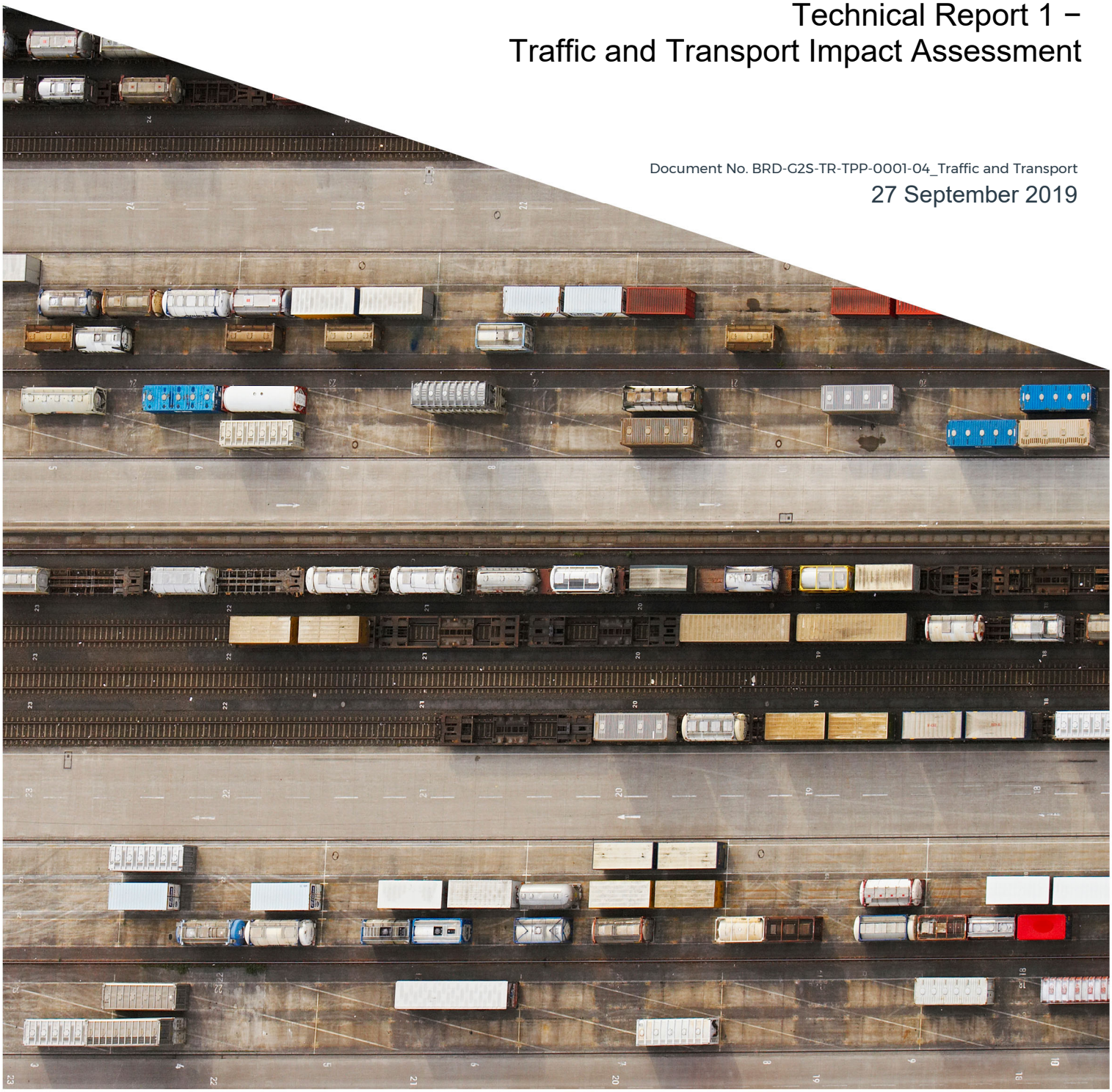
TECHNICAL REPORT



Technical Report 1 –
Traffic and Transport
Impact Assessment

Botany Rail Duplication – Environmental Impact Statement

Technical Report 1 – Traffic and Transport Impact Assessment



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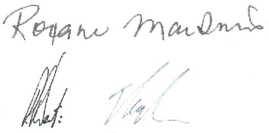
Reviewed by:	Roxane MacInnis; Richard West; Jarryd Barton	Date: 27/09/2019	Signature:	
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Glossary and abbreviations

Alignment	The geometric layout (e.g. of a road or railway) in plan (horizontal) and elevation (vertical)
AM peak hour	Unless otherwise stated, this refers to vehicle trips arriving at their destination during the average on-hour peak period between 7 am–9 am on a normal working weekday.
ARTC	Australian Rail Track Corporation (the proponent)
Botany Line	A dedicated 9 km freight rail line (operated by ARTC) that forms part of the Metropolitan Freight Network. The line extends from near Marrickville Station to Port Botany.
Bus lane	A traffic lane dedicated to buses, but which can be used by taxis, bicycle and motorcycles.
Capacity	The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a given time period under prevailing roadway conditions.
Carriageway	The portion of a roadway used by vehicles including shoulders and ancillary lanes.
Construction	Includes all physical work required to construct the project.
Construction ancillary facilities	Temporary facilities during construction that include, but are not limited to, construction work areas, sediment basins, temporary water treatment plants, pre-cast yards and material stockpiles, laydown areas, parking, maintenance workshops and offices, and construction compounds.
Construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities.
Council, the	Bayside Council
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessment on its own.
Detailed design	The stage of design where project elements are designed in detail, suitable for construction.
Detour	An alternative route, using existing roads, made available to traffic.
Deviation	An alteration to the alignment of a portion of a road.
Egress	Exit
EIS, the	Botany Rail Duplication environmental impact statement
Embankment	A raised area of earth or other materials used to carry a rail line in certain areas.
Existing rail corridor	The corridor within which the existing rail infrastructure is located. In the study area, the existing rail corridor is the Botany Line.
Gateway	A point where freight enters a territory and is interchanged between transportation lines.

Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two-axle truck) or larger, in accordance with the Austroads Vehicle Classification System.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Lane	A portion of the carriageway allotted for the use of a single line of vehicles.
Level of Service (LoS)	Defined by Austroads as a measure for ranking operating road and intersection conditions, based on factors such as speed, travel time, freedom to manoeuvre, interruptions, comfort and convenience.
Level crossing	Any crossing of a railway at grade, providing for both vehicular traffic and other road users including pedestrians.
LGA	local government area
M4 East	A component of the WestConnex program of works. Located from Homebush Bay Drive, Homebush to Parramatta Road and City West Link (Wattle Street) at Haberfield (under construction).
M4 Widening	A component of the WestConnex program of works. Located from Pitt Street, Parramatta to Homebush Bay Drive, Homebush (under construction).
M4–M5 Link	A component of the WestConnex program of works. A new inner western bypass of the Sydney central business district connecting the M4 and M5.
M5 East Motorway	Part of the M5 Motorway corridor. Located between Beverly Hills and Sydney Airport (General Holmes Drive).
M5 Motorway corridor	The M5 East Motorway and the M5 South West Motorway.
M5 South West Motorway	Part of the M5 Motorway corridor. Located between Prestons and Beverly Hills.
Metropolitan Freight Network	A network of dedicated railway lines for freight in Sydney, linking NSW's rural and interstate rail networks with Port Botany. The Metropolitan Freight Network is managed by ARTC.
New M5	A component of the WestConnex program of works. Located from Kingsgrove to St Peters (under construction).
OLS	Obstacle limitation surface
Overbridge	A bridge that conveys another road, rail or pedestrians over the described road.
PM peak hour	Unless otherwise stated, this refers to trips travelling on the network during the average one-hour peak period between 3 pm–6 pm on a weekday.
Possession	A period of time during which a rail line is closed to train operations to permit work to be carried out on or near the line.

Project site, the	The area that would be directly affected by construction (also known as the construction footprint). It includes the location of operational project infrastructure, the area that would be directly disturbed by the movement of construction plant and machinery, and the location of the storage areas/compounds etc, that would be used to construct that infrastructure.
Project, the	The construction and operation of the Botany Rail Duplication
Rail alignment	The exact positioning of the track, accurately defined both horizontally and vertically, along which the rail vehicles operate.
SA2	Statistical Area Level 2 These are medium-sized general-purpose areas built up from whole Statistical Areas Level 1. They represent a community that interacts together socially and economically.
Secretary's environmental assessment requirements (SEARs)	Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of Planning, Infrastructure and Environment under section 5.16 of the *Environmental Planning and Assessment Act 1979* (NSW).
SIDRA Intersection	SIDRA is a software package used to design and evaluate intersections and networks of intersections. It can be used to analyse a variety of signalised and unsignalised intersection types. Analysis output from SIDRA include intersection capacity, level of service and performance analysis.
St Peters interchange	A component of the New M5 project, located at the former Alexandria Landfill site at St Peters. In its ultimate configuration it would connect the New M5, the M4–M5 Link and the Sydney Gateway road project with Euston Road and Gardeners Road.
Staging	Refers to the division of the project into multiple contract packages for construction purposes, and/or the construction or operation of the overall project in discrete phases.
State significant infrastructure	Major transport and services infrastructure considered to have State significance as a result of size, economic value or potential impacts.
Study area, the	The study area is defined as the wider area including and surrounding the project site, with the potential to be directly or indirectly affected by the project (e.g. by noise and vibration, visual or traffic impacts). The actual size and extent of the study area varies according to the nature and requirements of each assessment and the relative potential for impacts, but which is sufficient to allow for a complete assessment of the proposed project impacts to be undertaken.
Sydney Gateway	A NSW Government initiative to respond to the forecast growth of Sydney Airport and Port Botany. Sydney Gateway comprises a road and rail component, consisting of: ▪ road connections to Sydney Airport's domestic and international airport terminals from the Sydney motorway network at St Peters interchange (being delivered by Transport for NSW) ▪ duplication of a three-kilometre long section of the Botany Line (being delivered by ARTC).

Terminal 1	Sydney Airport's international terminal
Terminal 2	One of Sydney Airport's two domestic terminals, used by a number of domestic and regional airlines including Virgin Australia, Jetstar and Rex.
Terminal 3	Qantas's domestic terminal.
Terminals 2/3	Sydney Airport's domestic terminals.
TEU	Twenty-foot equivalent units This is a measure of volume in units of twenty-foot containers.
TfNSW	Transport for New South Wales
WestConnex	WestConnex is a 33-kilometre long, predominantly underground motorway currently under construction in Sydney. The WestConnex program of works includes widening and extension of M4 Western Motorway (the M4 widening project); construction of two tunnels connecting Homebush Bay Drive with Wattle Street and Parramatta Road at Haberfield (M4 East); a new section of the M5 South Western Motorway including a new interchange at St Peters (the New M5 project); and a new inner western by-pass of the Sydney central business district connecting the M4 and M5 (the M4–M5 Link project).
Work area	Individual areas within the project site that are subject to construction at any one time.

Executive summary

The Australian Rail and Track Corporation (ARTC) proposes to construct and operate a new three-kilometre second rail track within the existing Botany Line rail corridor, between Mascot and Botany. The Botany Rail Duplication ('the project') would increase freight rail capacity in and out of Port Botany. The project would involve track duplication, track realignment and upgrading, new crossovers, bridge works, and new embankments/ retaining structures. No permanent modification to the road network is proposed in this project. Construction is planned to commence at the end of 2020 and be completed by late 2023.

This report addresses the Secretary's environmental assessment requirements (SEARs) by assessing the potential traffic and transport impacts resulting from construction of the project. The report also makes recommendations for measures to mitigate identified impacts as required.

The key construction activities that are likely to impact the transport network are as follows:

- temporary closure of Robey Street and O'Riordan Street at the rail line bridge locations. This would be for a weekend period of 54-hours and will take place on 10 occasions over the three-year construction period
- temporary road and lane closure of Southern Cross Drive between 11 pm and 5 am weekday and weekend Six major closures are anticipated during the Project's construction period. The assessment considers the movement of heavy vehicles for material transportation as well as the movement of light vehicles for the movement of construction staff
- localised temporary lane closures to facilitate day-to-day construction activities and associated vehicle movements.

To assess the project's construction impacts, the following was carried out:

- modelled and analysed the performance of eight key intersections and affected routes with the forecasted traffic volumes in year 2022, to consider the background traffic growth that may occur during the construction periods. The project's impacts were measured by comparing the metrics (level of service and travel time delays on key routes) which were assessed with and without the proposed 54-hour road closures on Robey Street and O'Riordan Street
- assessed six intersections and affected routes with the detoured traffic volumes due to the proposed Southern Cross Drive closure during the weekday and weekend night time periods
- qualitatively assess the proposed gate locations and the associated construction vehicle movements to determine their potential impacts to the surrounding road network and adjacent intersections.

The assessment determined that during construction there would be inevitable delays in the road network within the project area. However, it is possible to reduce the impacts through mitigation measures. A Construction Transport, Traffic and Access Management Plan (CTTAMP), as part of the Construction Environmental Management Plan would be developed to manage most of the impacts and minimise delays within the study area. The CTTAMP, would:

- consider safe routes for pedestrians and cyclists during construction
- develop staging strategies in consultation with the relevant roads authority and stakeholders to minimise, where possible, the need for road occupancy and the number of changes to road users' travel paths (detours)
- develop a strategy to communicate changes in traffic conditions to all affected stakeholders
- work to minimise the impacts of construction related traffic and access disruptions in the public road network.

Further mitigation measures would include deceleration lanes, restricting heavy vehicle movements to non-peak periods and employing approved temporary traffic controls.

The project would have no impact on the road network upon completion. The project would improve the efficiency of the rail network and may have a secondary impact on the reduction of trucks travelling to and from Port Botany.

1. Introduction

1.1 Overview

1.1.1 Background

Australian Rail Track Corporation (ARTC) proposes to construct and operate a new second rail track typically within the existing Botany Line rail corridor between Mascot and Botany, in the Bayside local government area (LGA). The Botany Rail Duplication ('the Project') would increase freight rail capacity as it would allow a two-way inbound and outbound movements from Port Botany. The location of the project is shown in Figure 1.1.

The project is defined as State significant infrastructure in accordance with Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As State significant infrastructure, the project needs approval from the NSW Minister for Planning and Public Spaces.

This report has been prepared to accompany the environmental impact statement (EIS) to support the application for approval of the project and address the Secretary environmental assessment requirements (SEARs) issued by the Department of Planning, Industry and Environment on 21 December 2018.

1.1.2 Overview of the Project

In summary, the project would involve (more detailed information on the project is provided in the EIS):

- Track duplication – constructing a new track within the rail corridor over a distance of approximately three kilometres.
- Track realignment (slewing) and upgrading – moving some sections of track sideways (slewing) and upgrading some sections of track to improve the alignment of both tracks and minimise impacts to adjoining land uses.
- New crossovers – constructing new rail crossovers at two locations to maintain and improve access (totalling four new crossovers).
- Bridge works – constructing new bridge structures at Mill Stream, Southern Cross Drive, O'Riordan Street and Robey Street (adjacent to the existing bridges), and re-constructing the existing bridge structures at Robey Street and O'Riordan Street.
- Embankment/retaining structures – construction of a new embankment and retaining structures adjacent to Qantas Drive between Robey and O'Riordan streets and a new embankment between the Mill Stream and Botany Road bridges.

Ancillary work would include bi-directional signalling upgrades, drainage work and protecting/relocating utilities.

Subject to approval of the project, construction is planned to start at the end of 2020, and is expected to take about three years. Construction is expected to be completed in 2023, while Project commissioning is anticipated in late 2024.

It is expected that some features of the project would be constructed while the existing rail line continues to operate. Other features of the project would need to be constructed during programmed weekend rail possession periods when rail services along the line cease to operate.

The project would form part of the existing Botany Line and would continue to be managed by ARTC. ARTC is not responsible for the operation of rolling stock. Train services are currently, and would continue to be, provided by a variety of operators. Following the completion of works, the existing functionality of surrounding infrastructure would be restored.

Key features of the project are shown on Figure 1.2.

Figure 1.1 Botany Rail Duplication location

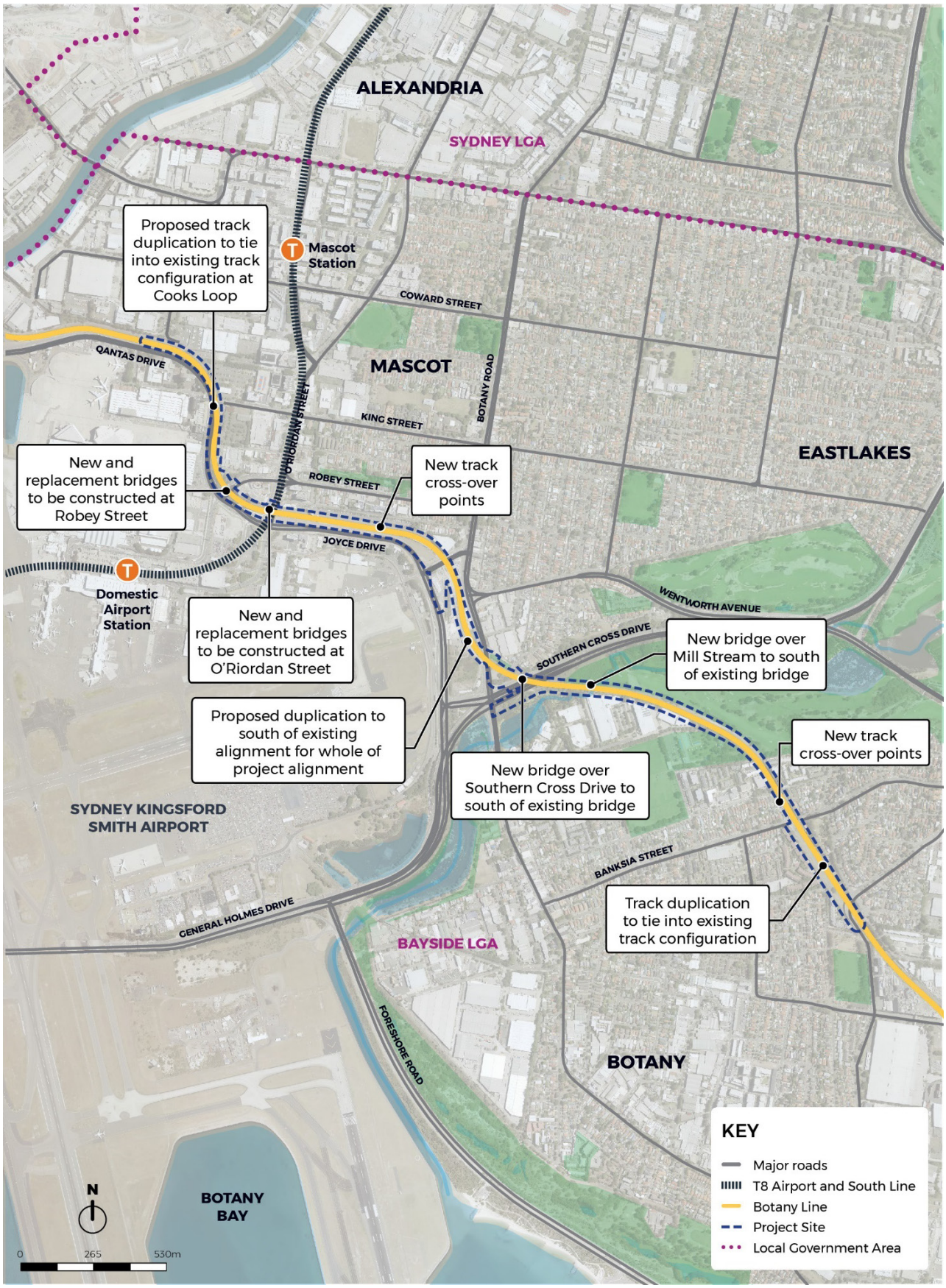

Figure 1.2 Botany Rail Duplication project overview

1.2 Purpose and scope of this report

The purpose of this report is to assess the potential traffic and transport impacts from the construction and operation of the project. This traffic and transport assessment addresses the relevant SEARs for the EIS, as outlined in Table 2.1.

The report:

- describes the existing conditions for all modes of transport in the study area, such as heavy and light vehicles, public transport, pedestrians and cyclists. The review considers both infrastructure and operations for each of the modes
- describes the existing environment with respect to the rail and road activities in the study area that will be affected by the construction and operation of the project
- assesses the impacts of constructing and operating the project on the surrounding road network and the potential impacts of construction-related vehicle movements and construction activities on the traffic and transport networks
- assesses the impacts of closing Robey Street and O'Riordan Street during 54-hour possessions, including the currently proposed detour routes
- recommends mitigation measures to manage identified traffic and transport construction impacts of the project
- assesses the impacts of constructing the proposal on the road network, particularly the streets which have been identified as construction traffic and haulage routes as depicted in Appendix B1
- assess the cumulative impacts of other planned infrastructure programs programmed during both the construction and operational phases of the project.

The methodology that was used for the assessment of the traffic impacts during construction is described in Section 3.

1.3 Structure of this report

The structure of the report is outlined below.

- Section 1 Introduction – provides an introduction to the report.
- Section 2 Legislative and policy context – describes the legislative and policy context for the assessment, and relevant guidelines.
- Section 3 Methodology – describes the methodology for the assessment.
- Section 4 Existing environment – describes the existing environment as relevant to the assessment.
- Section 5 Impact assessment – describes the assessment of the impacts of the project, primarily the impacts during construction.
- Section 6 Management of impacts – describes the management of the impacts from construction through mitigation measures.
- Section 7 Conclusion – provides the conclusions of the assessment.

2. Legislative and policy context

This section is provided in response to the SEARs section on Assessment of Key Issues, (Requirement 2b) to 'describe the legislative and policy context, as far as it is relevant to the issue.'

Port Botany is of strategic and economic importance to the region, state and country. The project sits within a broader legislative and planning framework which provides regulatory, spatial, policy and economic strategic direction for Sydney's international gateways and associated transport and freight infrastructure. There are numerous legislative and strategic documents that outline important principles, objectives and targets which the project aims to align. Section 2.1 provides an overview of these strategic documents.

2.1 Relevant legislation, policies and guidelines

The assessment was undertaken with reference to the following:

- *NSW Environment Planning and Assessment Act 1979*
- NSW Future Transport 2056 Strategy
- NSW Freight and Ports Plan 2018–2023
- NSW State Infrastructure Strategy 2018–2038
- 2015–2024 Sydney Metropolitan Freight Strategy.
- Guide to Traffic Management – Part 3 Studies and Analysis (Austroads 2007)
- Guide to Traffic Generating Developments, version 2.2 (RTA 2002)
- Cycling Aspects of Austroads Guides (Austroads 2014)
- NSW Bicycle Guidelines, V1.2 (RTA 2005)
- Planning Guidelines for Walking and Cycling (DIPNR 2004)
- NSW Sustainable Design Guidelines Version 3.0 (TfNSW 2013).

2.1.1 State legislation

Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* is administered by the NSW Department of Planning, Infrastructure and Environment and includes provisions for the assessment of Environmental Impact Statements (EIS), including for State Significant Infrastructure.

The project has been declared State significant infrastructure and must receive ministerial approval under Division 5.2 of the Act. The Act requires that an EIS must be prepared according to the SEARs. The Secretary would then prepare an Environmental Assessment Report for the purposes of the Minister's consideration of approval for the project. This traffic and transport technical report is one of a number of specialist reports which have been prepared to support the preparation of the EIS for the project and in so doing, also address relevant SEARs (refer to Section 2.2).

2.1.2 Policies

Future Transport 2056 Strategy

The *Future Transport 2056 Strategy* was released in 2017 as an update of the *NSW Long Term Transport Master Plan*. *Future Transport 2056* is a customer focused 40-year strategy that outlines a vision, strategic directions and customer outcomes for the state's transport system. It is supported by the *Services and Infrastructure Plans* and additional plans to underpin the delivery of the strategy across the state.

The Strategy's vision is built on six outcomes, one of which is 'Growing the Economy'. This recognises that the state's transport network drives a $1.3 trillion economy and must maintain effective connections to Sydney's global gateways. The strategy also recognises the importance of transport infrastructure to freight customers, highlighting key constraints to the freight industry which include network inefficiency, inconsistent regulation and poor planning decisions around trade gateways and freight lands.

The *Greater Sydney Services and Infrastructure Plan* builds upon the state-wide outcomes set out in *Future Transport 2056* to establish specific outcomes for the Greater Sydney area. The plan defines the Greater Sydney Strategic Freight Network which consists of the most significant road and rail corridors that support freight movement across Greater Sydney, connecting trade gateways, freight precincts and strategic centres. A key objective of the plan is to improve connections between Sydney's ports in the east and the manufacturing and distribution facilities which are primarily based in Western Sydney. The project would assist in improving freight rail capacity and efficiency to Port Botany thereby achieving this key objective.

NSW Freight and Ports Plan 2018–2023

The *NSW Freight and Ports Plan 2018–2033* is a supporting plan to Future Transport 2056 and aligns with other key documents, including the *State Infrastructure Strategy 2018–2038*, *Greater Sydney Services and Infrastructure Plan* and the Greater Sydney Commission's District Plans. The Plan identifies key issues that NSW Government agencies, the Australian Government and local councils must consider and incorporate into land use and infrastructure planning over the next five years.

The plan identifies that the largest growth in freight volumes in NSW (50 per cent by 2036) is expected to occur in Greater Sydney. This growth will be driven by population and economic growth, and global commodity demand. The plan outlines five objectives:

- **Economic Growth** – providing confidence and certainty that encourages continued investment in the freight industry to support economic growth.
- **Efficiency, connectivity and access** – improving the efficiency of existing infrastructure and ensuring greater connectivity and access along key freight routes.
- **Capacity** – maximising infrastructure investment and increasing infrastructure and land use capacity to accommodate growth.
- **Safety** – creating a safe freight supply chain, involving safe networks, safe transport, safe speeds and safe people.
- **Sustainability** – developing a sustainable supply chain that delivers benefits to our environment and continued operations into the future.

The project would involve the construction of a new second track predominantly within the existing ARTC rail corridor between Mascot and Botany. The project would be consistent with the five objectives outlined above as it would:

- provide the infrastructure to support continued economic growth within the region
- increase efficiency and capacity for freight activity through the duplication of the remaining three kilometres of corridor
- ensure continued freight activities via rail to and from the port through the construction of the parallel track
- facilitate a safer environment by increasing the capacity of the rail corridor and potentially reducing the demand for the movement of freight by road.

State Infrastructure Strategy 2018-2038

Infrastructure NSW is an independent statutory body established under the *Infrastructure NSW Act 2011* to provide a source of independent expert advice for infrastructure policy. Infrastructure NSW is required to prepare a 20-year *State Infrastructure Strategy* every five years to assess the current state of infrastructure within NSW. *Building Momentum: State Infrastructure Strategy 2018–2038* is the most recent version of this strategy and outlines 122 recommendations for infrastructure.

Recommendation 60 – Infrastructure NSW recommends that TfNSW finalise business cases by the end of 2018 to fund investment in Sydney Gateway, Botany Rail Duplication and Foreshore Road/Botany Road, as well as the Moorebank Intermodal Terminal Road Access Strategy.

This recommendation aims to ensure and improve NSW's global competitiveness. Therefore, the State Infrastructure Strategy identifies that strategically important freight gateways such as Port Botany, and key corridors must be protected to facilitate the movement of freight in NSW.

2015–2024 Sydney Metropolitan Freight Strategy

The Australian Rail Track Corporation (ARTC) released this strategy in 2015 to identify expected growth in freight volumes in Sydney. The ARTC operates the Metropolitan Freight Network under a lease agreement with Sydney Trains and constructed the Southern Sydney Freight Line.

The strategy states that the Botany yard has sufficient capacity until 2030 under ideal conditions; however, the yard already suffers congestion at peak times due to port activities. To overcome these constraints, ARTC recommended a range of infrastructure upgrades within the Port Botany Rail Yard itself, along with the duplication of the single-track section of the line by 2023. The strategy includes options to maximise rail freight and protect the efficiency of the freight network.

NSW Ports' 30-year Master Plan

Navigating the Future: NSW Ports' 30 Year Master Plan outlines NSW Ports' priorities and objectives for Port Botany over the next 30 years. It recognises that Port Botany would continue to have a vital role as Australia's premier port. The five objectives outlined in the plan are to:

- provide efficient road connections to the ports and intermodal terminals
- grow rail transport of containers
- use land and infrastructure efficiently
- grow port capacity
- protect the ports and intermodal terminals from urban encroachment.

The project supports many of these objectives by providing high-quality rail connections between Port Botany and Sydney's strategic rail freight networks. By 2045, three million twenty-foot equivalent containers (TEUs) are anticipated to be transported by rail.

Guide to Traffic Management – Part 3 Studies and Analysis (Austroads 2007)

Part 3 of Austroads' *Guide to Traffic Management* outlines the importance of traffic data and its analysis for the purpose of traffic management and traffic control within a network. It serves as a means to ensure some degree of consistency in conducting traffic studies and surveys. It provides guidance on the different types of traffic studies and surveys that can be undertaken, their use and application, and methods for traffic data collection and analysis.

The traffic assessment that was completed for the project was conducted as per the recommendations set out in this report.

NSW *Sustainable Design Guidelines* Version 3.0 (TfNSW 2013)

The *Sustainable Design Guidelines* seek to incorporate sustainable development practices into the design and construction of transport infrastructure projects. These guidelines form part of the Transport Projects Sustainability Framework. Key aims of the guidelines are to:

- ensure development, expansion and management of the transport network is sustainable and resilient to climate change
- minimise impacts of transport on the environment, encompassing transport operations, infrastructure delivery and maintenance and corporate activities
- enhance quality of life for transport customers by procuring, delivering and promoting sustainable transport options.

The guidelines dictate that EISs' must critically consider the *Sustainable Design Guidelines* and facilitate their implementation in later stages of a project. An indicative compliance goal must be obtained and provided to the design team/contractor.

Guide to Traffic Generating Developments, Version 2.2

The *Guide to Traffic Generating Developments* outlines the purpose for, and the process to complete traffic impact studies. It includes the traffic generation rates for various land uses and their impacts, as well as parking requirements, design and access.

As this guide is designed to assess the impacts of a development and the impacts it will have on the road network, it was not used in the assessment of the construction impacts in the immediate road network surrounding the project.

Cycling Aspects of Austroads Guide

This guide incorporates relevant sections of other Austroads guides and expands on how to plan and develop cycling networks and end of trip facilities such as bicycle parking, showers and locker rooms. The guide includes:

- planning for bicycle networks
- types of facilities
- local traffic characteristics
- design and construction of facilities.

While cycling is an important part of the transport system, the planning, design and construction of a bicycle corridor has not been included in the project. There are a number of impracticalities associated with the inclusion of cycling infrastructure within the existing rail corridor. These include the narrowness of the corridor and existence of numerous underbridges. The need to be able to undertake routine maintenance and ensure corridor access for any emergency response event precludes the ability to provide cycling facilities in this narrow rail corridor. Provision of cycling facilities is also not the role of ARTC and is considered to be outside the scope of the objectives of the project. However, it is worth noting that in the vicinity of the Botany Rail Duplication, other projects such as Gateway and Airport North have active transport corridors in their designs.

NSW Bicycle Guidelines (RTA)

The *NSW Bicycle Guidelines* provides information on the overarching principals for developing bicycle facilities and networks, including:

- types of bicycle facilities
- location of various facility types within and outside the road reserve
- treatments at intersections, including roundabouts
- signage, mapping and wayfinding
- maintenance and provision for cycling at worksites
- bicycle parking.

These guidelines were not applied to the traffic impact assessment associated with the project. As stated above, the objectives of the project did not include the creation of a cycling corridor. The potential for impacts on existing cycling infrastructure were examined. The result was that there would be no impact on bicycle facilities as they are located beyond the study area.

Planning Guidelines for Walking and Cycling

This is a practitioner's guide to incorporating walking and cycling into projects, policies and documents. The guidelines can be used at the city level, in neighbourhoods and for individual developments.

As the project is the duplication of a three-kilometre section of the Botany Line, these guidelines were not considered to be applicable during the assessment of the traffic impacts.

2.2 Secretary's environmental assessment requirements

The SEARs and agency recommendations relevant to the construction impacts on traffic and transport, together with a reference to where they are addressed in this report, are outlined in Table 2.1.

Table 2.1 SEARs relevant to this assessment

Requirements		Where addressed in this report
3. Assessment of Key Issues* (2) For each key issue the Proponent must:		
a)	describe the biophysical and socio-economic environment, as far as it is relevant to that issue;	Section 4
b)	describe the legislative and policy context, as far as it is relevant to the issue;	Section 2.1
c)	identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts;	Sections 5.2, 5.3 and 5.4
d)	demonstrate how options within the project potentially affect the impacts relevant to the issue;	Sections 5.2, 5.3 and 5.4
e)	demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	Sections 6.2, 6.3, 6.4, 6.5, 6.7 and 6.8
f)	detail how likely impacts that have not been avoided through design would be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant); and	Section 6.6
g)	detail how any residual impacts would be managed or offset, and the approach and effectiveness of these measures.	Sections 6.6 and 6.8
Transport and Traffic 2.1.1 The Proponent must assess construction transport and traffic (vehicle (including freight, port and airport traffic), pedestrian and cyclists) impacts, including, but not necessarily limited to:		
a)	a considered approach to route identification and scheduling or transport movements, particularly outside standard construction hours;	Sections 5.1.4, 5.1.5 and 5.2.1
b)	the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements and track machines);	Sections 5.1.4 and 5.2.1
c)	construction worker parking;	Section 5.1.3
d)	the nature of existing traffic (types and number of movements – rail and road) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements) and impacts on these routes;	Section 4.3
e)	access constraints and impacts on public transport, pedestrians and cyclists; and	Section 5.2.1
f)	the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project and measures to minimise any impacts and delays.	Sections 5.2.2, 5.2.3, 6.2.2 and 6.2.3
2.1.2 The proponent must assess the operational transport impacts of the project for both Road and Rail		Section 5.3

3. Methodology

This section outlines the methodology followed to assess the traffic and transport related impacts of the project in support of the SEARs. The assessment considers both the operational and construction related impacts by comparing the existing traffic and transport environment to the future traffic and transport environment, with and without the project, using objective assessment criteria for the relevant performance measures.

3.1 Study area

The project is generally located within a section of the rail corridor for the Botany Line, about eight kilometres south of the Sydney central business district, in the suburbs of Mascot, Botany and Pagewood, as shown in Figure 1.1. The north-western extent of the project site is located in the vicinity of Qantas Drive and south of Coward Street in Mascot. The south-eastern extent of the project site is located just to the north of the Stephen Road bridge in Botany. The rail corridor is owned by the NSW Government (RailCorp) and leased to ARTC. Some additional areas outside of the rail corridor that would be used as compound sites are also included in the project site.

The duplication of the rail line would not have operational impacts on the road network, but construction activities would have the potential to cause impacts due to increased traffic on roads, heavy vehicle movements and over-sized equipment and material deliveries through suburban areas. For most part, the construction activities will occur within the Project's site boundary to minimise disruption to the road network. However, to ensure public safety and to enable the provision of sufficient work area during the proposed bridge works at O'Riordan Street and Robey Street, up to ten road closures are anticipated across these two locations (approximately five closures each site) over the three years' construction period. Similarly, the bridge works on Southern Cross Drive will require road closures to be undertaken with road occupancy approval to be sought from Transport for NSW's Transport Management Centre (TMC). ARTC anticipates six major closures of Southern Cross Drive.

These closures will have a network wide impact within the vicinity of the Project's site. Therefore, a wider study area (as shown in Figure 3.1) has been identified to assess the traffic and transport impact. The study area typically includes an area around one kilometre from the project site (with the exception of the Sydney Airport site).

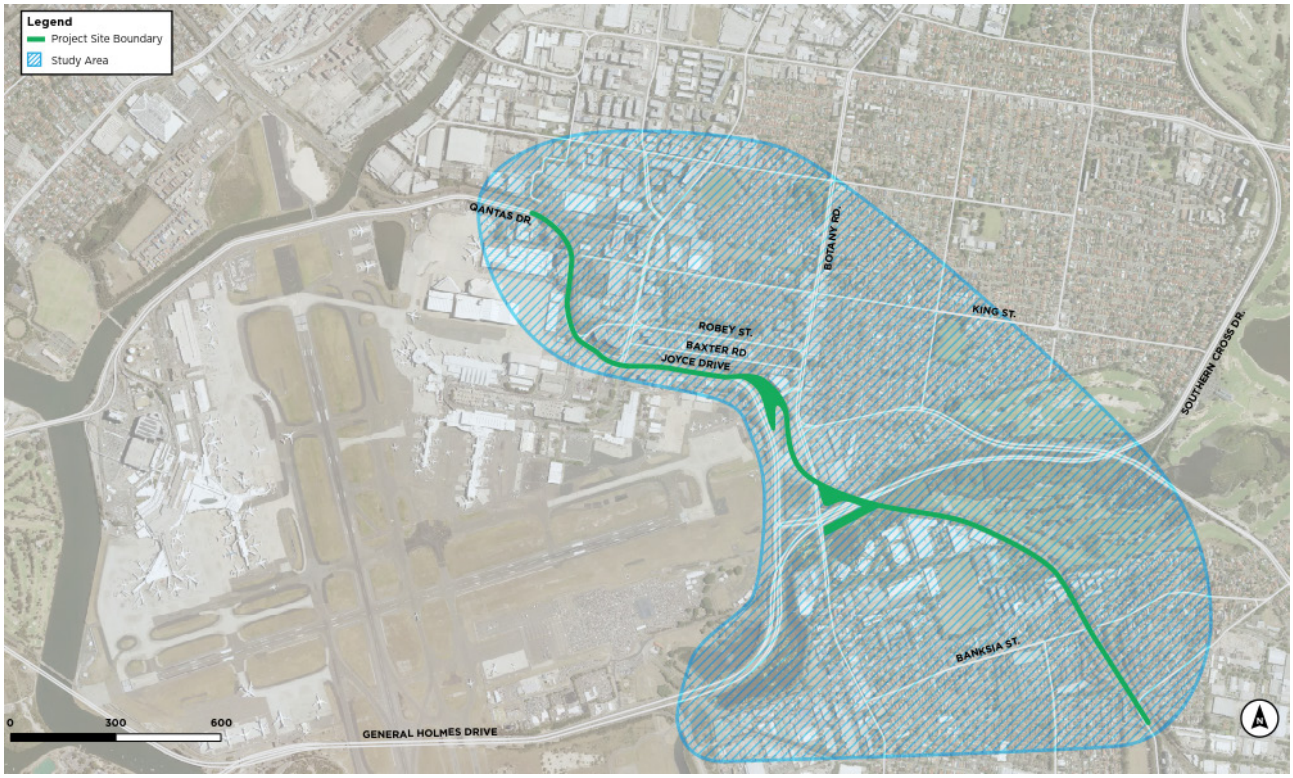

Figure 3.1 Botany rail duplication study area

3.2 Overall approach

For the purpose of this assessment the construction activities which may affect the road network are defined as:

- **'Typical'** construction includes day-to-day construction activities that would occur throughout the duration of the project (haulage of materials, transport of construction workforce, rail line duplication activities), and within the approved working hours. The primary activity which would impact the road network is the generation of construction related vehicles and site access arrangements. It is anticipated that there will be no road or lane closure required during the typical construction period. The increase in construction traffic on the nominated construction vehicle routes and at the existing access gates may lead to intermittent disruptions to pedestrian and cyclist movements along the existing adjacent footpaths and intersection crossing points. However, impacts on existing pedestrian and cyclist infrastructure is considered minimal during this stage.
- **'Temporary road or lane closure'** construction stages refer to the occasional period when road or lane closures are required to support the construction of the Robey Street, O'Riordan Street and Southern Cross Drive rail bridges. The primary activity which would impact the road network are road diversions. Robey Street and O'Riordan Street bridge construction works include 54-hour weekend road closures that will occur 10 times over the three-year construction program. Southern Cross Drive closures will be in accordance with Transport Management Centre (TMC) approvals. This could be weekend or weekdays and will occur approximately six times over the three-year construction program. There will be no concurrent closures of Robey Street, O'Riordan Street and Southern Cross Drive.

This report includes an assessment of the project's construction impacts on the road network as follows:

- A **qualitative** assessment of 'typical' construction stages. Construction vehicle activity during these periods would be low and therefore a qualitative assessment is considered to be appropriate to assess the potential impacts. These activities would occur over an extended duration of time (2021 to 2023). The overall number of construction vehicles in typical weekday peak periods would be approximately between 20 and 150 at key intersections. As the anticipated construction traffic volume is low compared to existing traffic volumes, the effects of the temporary traffic increase won't be significant in the project area.
- A **quantitative** assessment of 'temporary road or lane closure' construction stages. These activities have been comprehensively quantified and assessed using detailed traffic modelling. It is to be noted that the main construction works for Botany Rail Duplication project will commence in year 2021 and construction works will be carried out in different phases. However, for the purpose of this assessment a conservative approach has been adopted by assuming that all construction works will start at the same time. The year 2022 was selected as the assessment year. The tested scenario represents a future 2022 road network including any planned network upgrades (i.e. Airport North and Airport East Upgrade projects) completed up until that year.

3.3 Key tasks

3.3.1 Qualitative assessment of impacts of additional construction vehicles

The assessment used the proposed construction plan (which is subject to further development as the project progresses) to determine the number of construction vehicles. To identify the impact of the day-to-day construction traffic on the road network, the construction vehicle volumes were distributed across the road network based on the following assumptions:

- Construction vehicles will be accessing the work sites during the peak periods using the major motorway and arterial road network within the study area. These include Botany Road, O'Riordan Street, Robey Street, Qantas Drive/Airport Drive, Joyce Drive, General Holmes Drive and Southern Cross Drive. The traffic distribution assumptions are listed as follows, and depicted in Figure 3.2 and Appendix B1:
  - construction trips from/to south-west of the Project's site were grouped together as 'Zone 1', via General Holmes Drive
  - construction trips from/to east of the Project's site were grouped into 'Zone 2', via Southern Cross Drive
  - construction trips from/to north of the Project's site were grouped into 'Zone 3', via Botany Road
  - construction trips from/to from north-east of the Project's site were grouped into 'Zone 4', via Airport Drive
  - the construction site access gates are grouped alphabetically from Zone 'A' to 'E'. These locations are further detailed in Section 5.1.1.
- The Airport North Upgrade project and the Airport East Upgrade project have been completed prior to the commencement of construction of the Botany Duplication project. General Homes Drive would no longer provide a connection between Joyce Drive and Botany Road during the construction period. Instead, Wentworth Avenue has been extended to provide a connection between General Homes Drive and Botany Road. Airport North Upgrade and Airport East Upgrade are further detailed in Section 4.3.2.

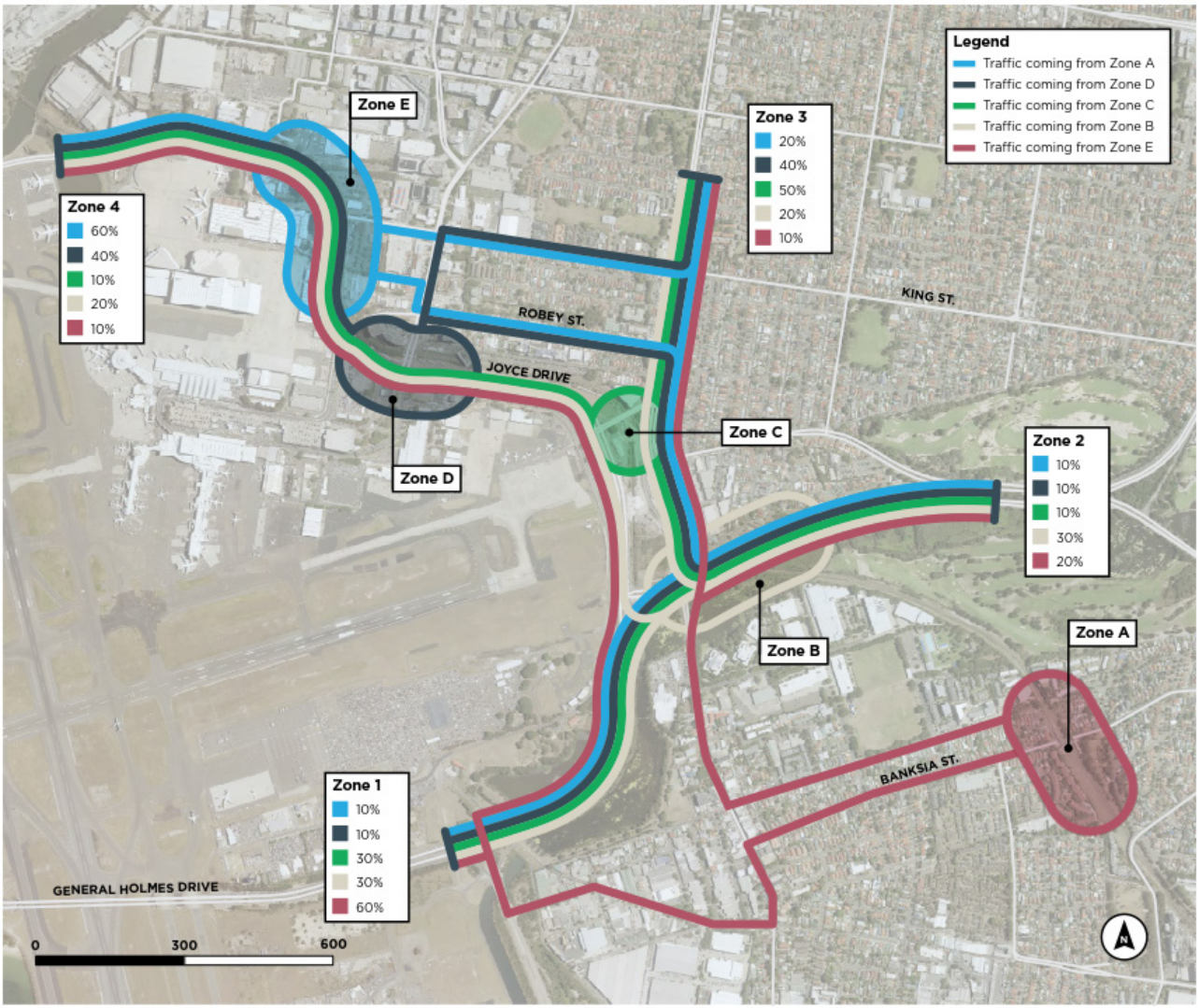

Figure 3.2 Construction traffic distribution

A qualitative assessment of the additional construction vehicle volumes during the typical weekday peak periods on the adjacent roads and intersections in proximity to each construction access gate was based on the following criteria:

- distance of the construction access gates from the adjacent intersections
- traffic volume on the adjacent roads during the AM and PM peak hours
- intersection geometry and lane configuration.

The impact of construction traffic entering and exiting each construction access gate was assessed using the above criteria and categorised as follows:

- High impact – the operation of the adjacent roads and intersections may deteriorate, and mitigation measures would likely be required.
- Medium impact – the operation of adjacent road and intersections may be affected, and mitigation measures may be required.
- Low impact – the operation of adjacent roads and intersection would not be impacted.

3.3.2 Quantitative assessment of Robey Street and O'Riordan Street road closures

Full road closures of Robey Street and O'Riordan Street would be required for certain periods throughout the construction period for activities such as construction of new bridges, demolition of existing bridges and utilities relocations. The final extent of closures would be confirmed during detailed design and construction planning in consultation with the final construction methodology developed by the construction contractor. It is expected that road closures would be proposed during weekends to minimise impact of traffic flows to and from the airport, city and Port Botany.

A quantitative assessment of eight intersections that would be impacted as a result of the temporary closure of Robey Street and O'Riordan Street was completed using SIDRA network modelling. These intersections were selected as they capture the impacted traffic routes. The intersections that were modelled are:

- Qantas Drive–Seventh Street–Robey Street
- Robey Street–O'Riordan Street
- O'Riordan Street–Sir Reginald Ansett Drive–Joyce Drive
- Ross Smith Avenue–General Holmes Drive–Joyce Drive
- General Holmes Drive–Wentworth Avenue
- Botany Road–Wentworth Drive
- Botany Road–General Holmes Drive
- Botany Road–Robey Street.

The modelling of the rail duplication construction impacts was limited to an assessment of the proposed temporary closure of Robey Street and O'Riordan Street to support the raising of the new rail bridge structures. The following assumptions have been made for the 2022 baseline SIDRA network models:

- That both the Airport North Upgrade project and the Airport East Upgrade project have been completed prior to the commencement of construction of the Botany Duplication project. These projects made a number of changes to the circulation around the Kingsford Smith Sydney Airport. These projects' scope of works is further detailed in Section 4.3.
- Robey Street and O'Riordan Street would not be closed at the same time.
- The proposed road closures would occur during the weekend to avoid impacts to the road network during the weekday peak periods.
- There will be no additional traffic generated by other major development in the surrounding area during the temporary road closure periods.
- The closures would take place up to four times per year, with two for each road closure.
- The modelled scenarios reflect a 'worst case'.

The existing routes for each closure were compared to the proposed detour routes. This allowed for an understanding of the impact of the temporary detours on the road network, including travel time delays and reductions in level of service.

3.3.3 Quantitative assessment of Southern Cross Drive road closure

Road closures on Southern Cross Drive would also be required to accommodate the proposed bridge works on the Botany Line. The final extent of closures would be confirmed during detailed design and construction planning in consultation with the final construction methodology to be developed by the construction contractor.

To minimise impact to the surrounding road network and align with the Airport curfew, it is expected that road closures would take place between 11 pm to 5 am when traffic volumes are lowest, on both weekdays and weekends.

A microsimulation model developed in AIMSUN was used to quantitatively assess the intersections affected by the proposed Southern Cross Drive closure. These intersection locations as listed below and depicted in Figure 3.3 were selected, as these capture the existing impacted traffic routes and the likely detour route due to the proposed closures.

1. General Holmes Drive–Wentworth Avenue
2. General Holmes Drive–Mill Pond Drive
3. Mill Pond Drive–Botany Road
4. Wentworth Avenue–Botany Road
5. Wentworth Avenue–Southern Cross Drive on-ramp
6. Wentworth Avenue–Southern Cross Drive off-ramp.

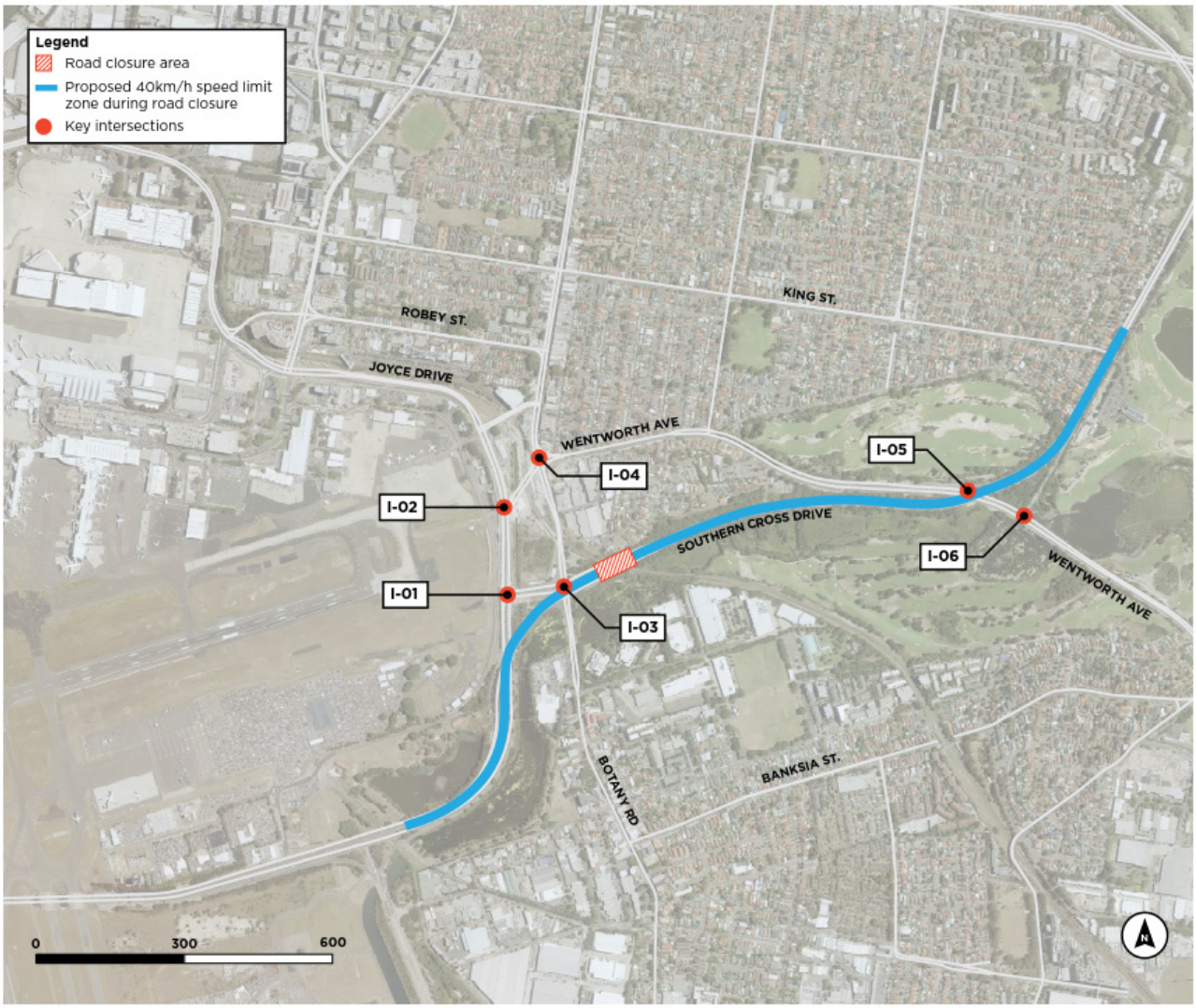

Figure 3.3 Intersections assessed as part of Southern Cross Drive closure analysis

The following assumptions have been made to assess the performance of the above intersections:

- That both the Airport North Upgrade project and the Airport East Upgrade project have been completed prior to the commencement of construction of the Botany Duplication project. These projects made a number of changes to the circulation around the Kingsford Smith Sydney Airport. These projects' scope of works is further detailed in Section 4.3.2.
- To model the worst-case scenario, modelling was undertaken using the critical hour demand (11 pm to midnight), determined as the peak hour between 11 pm to 5 am on a weekend, as it was found that the traffic volumes on the weekends were higher than weekdays.

- The second peak hour (midnight-1 am) during this period was also modelled to provide indicative performance of the network in this condition. A plot of the traffic flow hourly profile (see Figure 3.4), also found that the typical peak weekday night (between 11 pm–mid-night) traffic volumes is within the threshold of the second peak hour (midnight–1 am) on a weekend.
- Additional modelling was undertaken to assess the impacts of Southern Cross Drive closure during weekday night time period. The critical weekday time period was found to occur on Thursday between 11 pm and midnight. Although a higher bidirectional volume was observed between 4 am and 5 am on Wednesday, modelling has indicated that the westbound closure has a far more significant impact on network performance. As a consequence, Thursday peak hour (11 pm to midnight) was identified as the critical volume for the weekday night time closure period due to the higher traffic flow in the westbound direction.
- The traffic model was developed with the forecasted 2022 traffic volumes to take into account the changes in road network within the vicinity of the study area.
- The closures would take place with road occupancy approval from Transport for NSW's Transport Management Centre (TMC). Six major closures are anticipated during the Project's construction period.

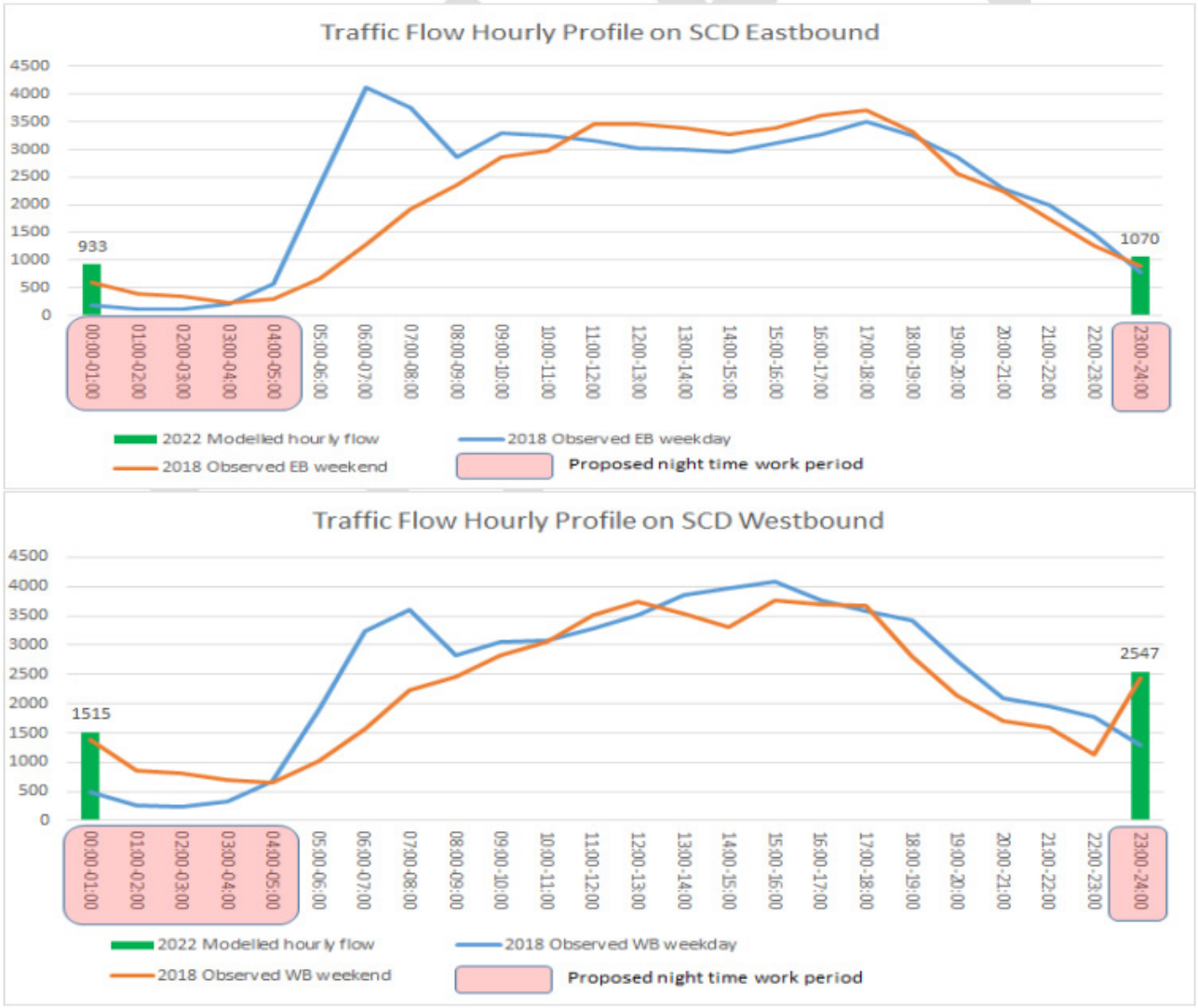

Figure 3.4 Southern Cross Drive – Traffic flow hourly profile for weekday and weekend (ARTC, 2019)

The existing routes for each closure were compared to the proposed detour routes. This allowed for an understanding of the impact of the temporary detours on the road network, including travel time delays and reductions in level of service.

4. Existing environment

4.1 Introduction

This section outlines the existing conditions related to the rail and road networks, parking, public transport, travel behaviour and active transport. The information presented in this section represents the base case (or existing environment) for the transport network in the study area. It supports the requirements found in the SEARs, specifically 2.1.1 (d), 'the nature of existing traffic (types and number of movements – rail and road) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements) and impacts on these routes'.

4.2 Rail and road freight network

4.2.1 Overview

The movement of freight within the Greater Sydney region requires a focus on efficiency to ensure its important contribution to the NSW economy. The importance of freight to the daily lives of residents is undisputed, from the large-scale movements (at the Port) to small scale household deliveries. The role of the freight network in NSW is an important contributor to the economy.

The freight network in NSW consists of the following components, which provide a comprehensive approach to the delivery of goods:

- ports and shipping channels
- airports and prescribed airspace
- roads
- rail lines
- pipelines, and
- intermodal terminals and freight-related precincts.

4.2.2 Rail freight network

Rail freight

Rail freight in Sydney is serviced by a network of dedicated and shared (with passenger rail) corridors across the metropolitan area. The rail network is used to transport raw construction materials, household waste, interstate and regional cargo, and import and export containers to and from Port Botany. The Metropolitan Freight Network is shown in Figure 4.1 and includes the following corridors:

- Southern Sydney Freight Line
- Metro Freight Network
- Botany Line
- Northern line
- Illawarra line
- Western line
- Main South line.

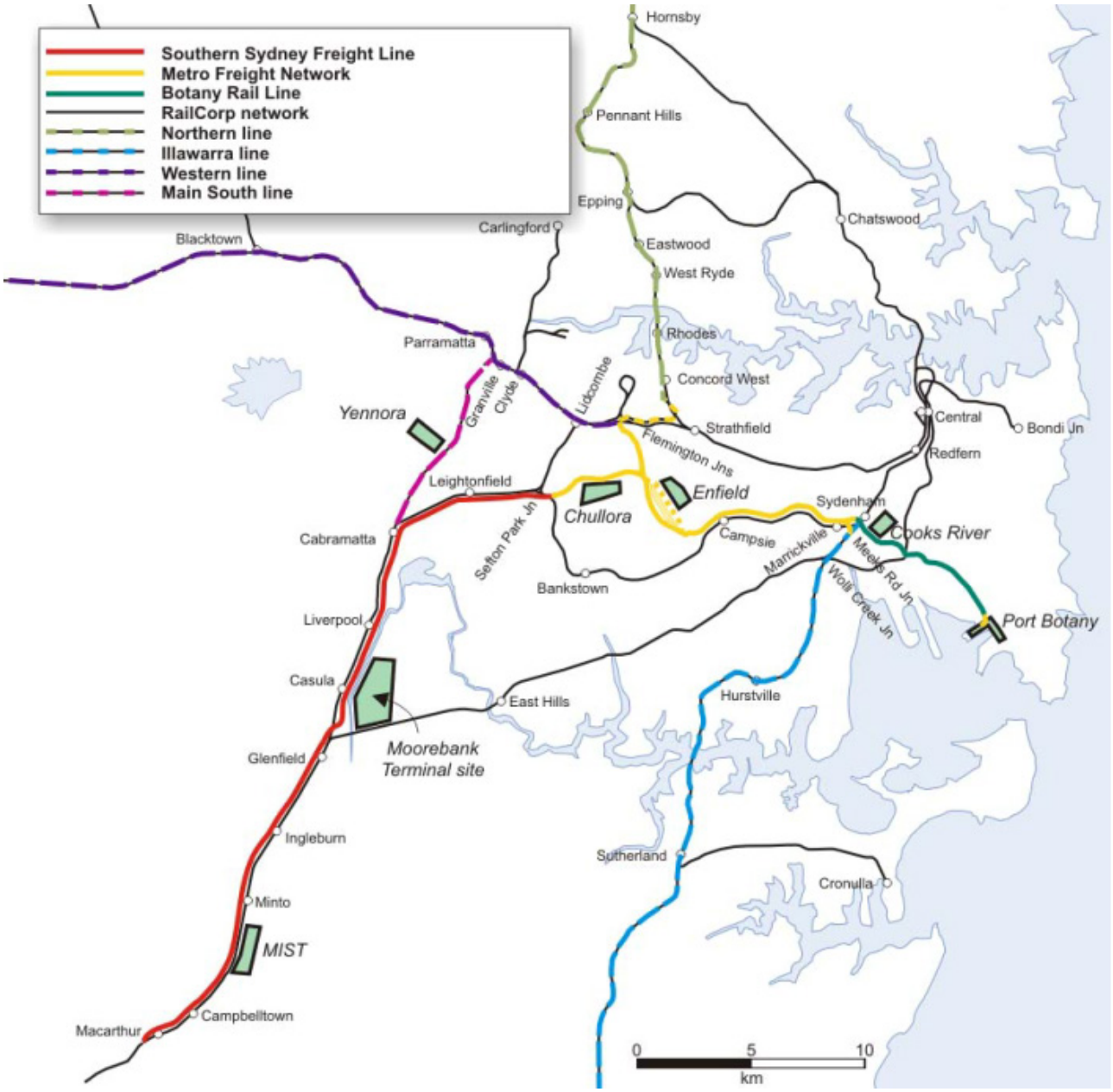

Figure 4.1 Sydney rail freight corridor (*Sydney Metropolitan Freight Strategy 2015-2024*, ARTC, 2015)

Greater Sydney's intermodal terminals play a critical role in increasing the utilisation of the rail freight network by facilitating the transfer of containers and other goods from road to rail. Existing intermodal terminals in Sydney include:

- Port Botany Intermodal Terminal
- Cooks River Intermodal Terminal
- Enfield Intermodal Logistics Centre
- Chullora Intermodal Terminal
- Yennora Intermodal Terminal
- Moorebank Intermodal Terminal
- Macarthur Intermodal Shipping Terminal (MIST)
- Villawood Terminal (operationally known as Leightonfield)
- Banksmeadow Waste Transfer Terminal
- Clyde Waste Transfer Terminal.

Botany Line

The Botany Line is a freight only line forming part of the wider Sydney rail freight corridor which is maintained and operated by ARTC. The project, which is currently configured with a single track, is located within the Botany Line. The project section of single track is three kilometres in length, extending from Mascot to Botany.

The existing Botany Line joins the Metro Freight Network Line at Marrickville Junction. The Metro Freight Network (MFN) Line is the core of the Sydney freight system. It extends from Lidcombe/North Strathfield in the north to Sefton park Junction in the west and Marrickville in the south-east. This network is double track and dedicated to freight, however it shares a corridor with passenger trains on the Bankstown line between Sydenham and Campsie. (*Sydney Metropolitan Freight Strategy 2015-2024*, ARTC, 2015)

A review of ARTC's Master Train Plan (*dated 28 April 2019, version 1*) indicates that the Botany Line is regularly used with train arrivals ranging from 24–33 trains scheduled daily. This includes a range of train types, lengths and carrying various commodity types. It is however understood that unscheduled train arrivals may occur on an as-needed basis.

The total bidirectional number of trains scheduled to use the Botany Line on a daily basis are further detailed in Table 4.1 below.

Table 4.1 Typical daily freight train movements on Botany Line

Day of the week	Total (both directions)
Monday	26
Tuesday	31
Wednesday	29
Thursday	33
Friday	30
Saturday	26
Sunday	24

Source: Master Train Plan – 28-04-2019 V1 (ARTC, 2019)

Prior to the Airport East Precinct upgrade (opened to public in June 2019), a rail level crossing was in operation on the Botany Line at its intersection with General Holmes Drive between Joyce Drive and Botany Road. The Airport East Precinct upgrade project replaced the rail level crossing with a road underpass that links General Holmes Drive, Botany Road and Wentworth Avenue to improve access to the Airport, Mascot and the eastern suburbs.

4.2.3 Road freight network

According to the *NSW Freight and Ports Plan* 2018-2023, and as analysed by Transport for NSW's Transport Performance and Analytics (TPA), about 80 per cent of the greater Sydney freight task is undertaken by road. The Plan identified opportunities to improve freight efficiency by shifting the transporting of some commodities away from road transport to:

- rail – suited for transporting freight in containers (i.e. agricultural exports and construction materials) over longer distances
- coastal shipping – suited for transporting construction materials and other bulk freight

Congestion resulting from general traffic can increase the cost of transporting goods, while heavy trucks can have negative impacts on other road users. There are significant benefits to shifting the mode share for freight movements from road to rail in Greater Sydney. For example, the provision of a single 600-metre long freight train is roughly equivalent to the haulage capacity of around 54 trucks.

Motorways and major roads that are considered key roads in the Greater Sydney's freight network are depicted in Figure 4.2 and listed below:

- M1 Pacific Motorway
- Hume Motorway
- M4/Great Western Highway
- M5 East
- WestConnex (under construction)
- M5 West
- M7 Westlink
- Parramatta Road
- Foreshore road
- NorthConnex (under construction).

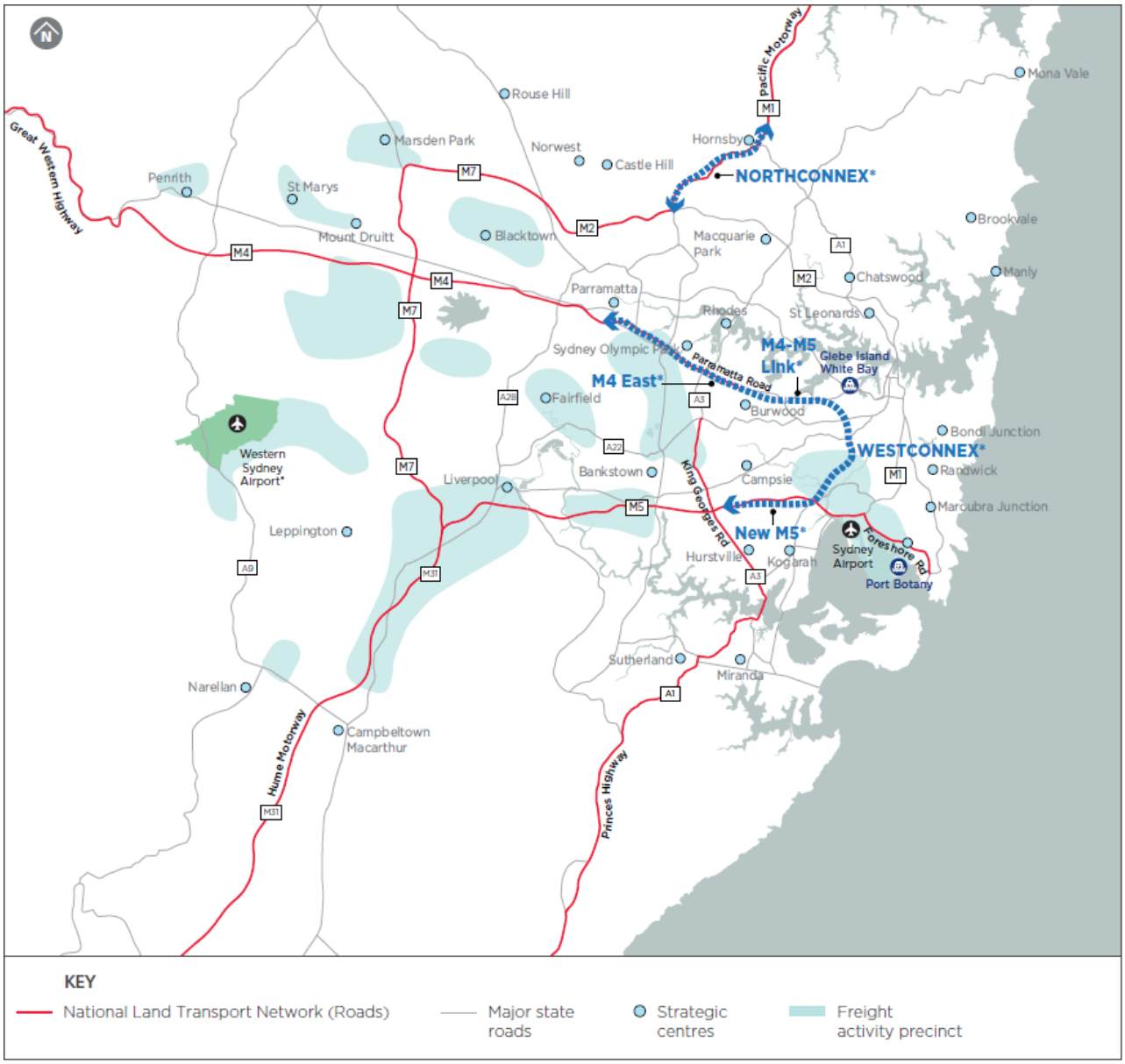

Figure 4.2 Key roads in Sydney's freight network (NSW Freight and Ports Plan 2018–2023)

The impact of congestion is a key issue for road freight, causing increasing costs due to longer travel times and increased fuel consumption. In 2015, avoidable congestion costs were estimated at $6.1 billion (The Bureau of Infrastructure, Transport and Regional Economics). This is expected to rise considerably by 2030. Key corridors that will be impacted further due to increasing traffic congestion include:

- the roads surrounding Port Botany and Sydney Airport
- the M5 West – a major corridor for both passenger and freight traffic
- the M4/Great Western Highway – a busy freight corridor between Sydney and the Central West (NSW Freight and Ports Plan 2018–2023).

As shown in Figure 4.3, private cars make up the majority of the mode share on NSW roads. While shifting more freight from road to rail may not lead to any meaningful improvement in traffic congestion, the costs attributable to congestion of moving freight by road could be reduced.

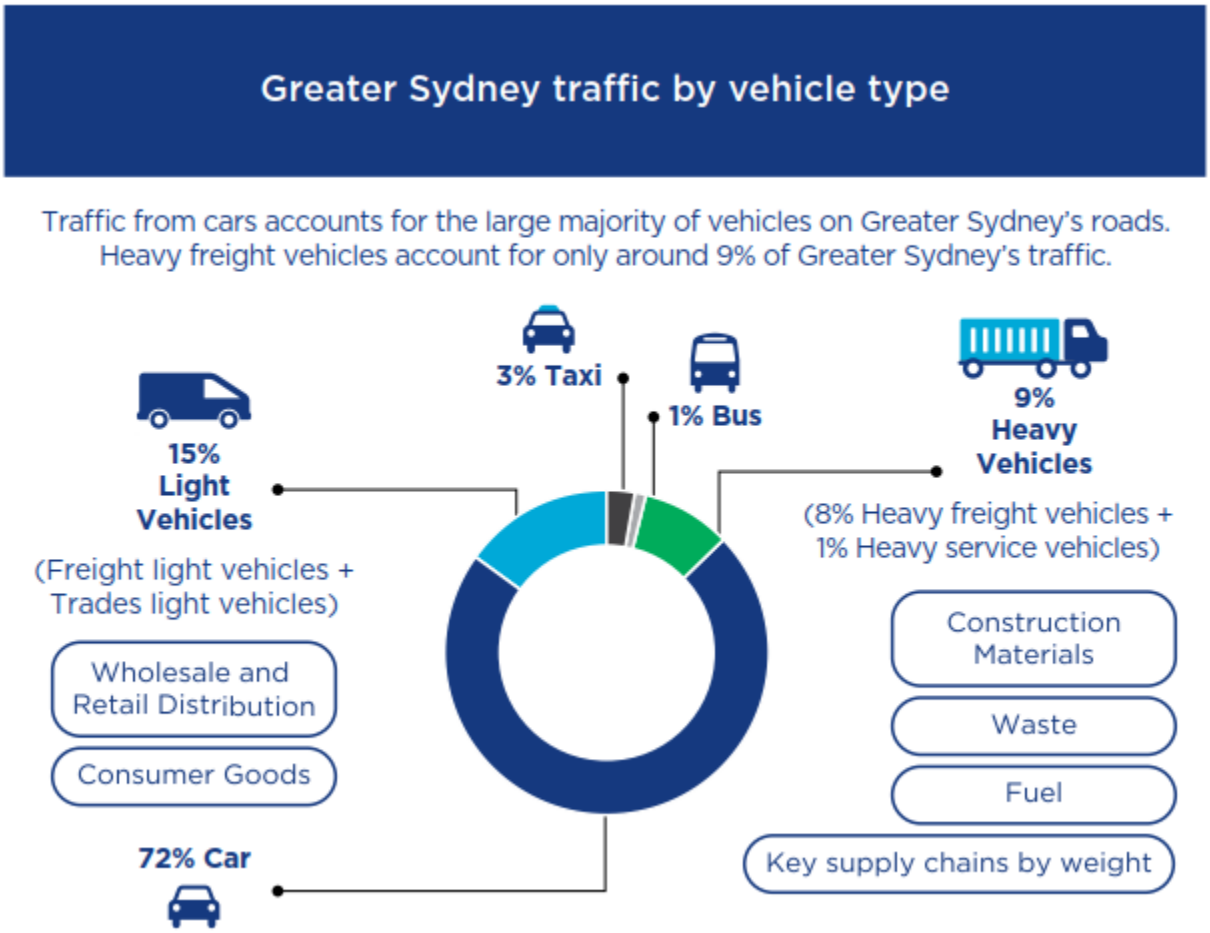

Figure 4.3 Mode share of passenger and freight traffic by vehicle type in Greater Sydney (NSW Freight and Ports Plan 2018-2023)

4.3 Traffic and transport environment

This section provides a description of the land uses and transport network surrounding the project site. Although there would be no operational impacts to the local street network by the project, it is important to describe the existing environment to inform the assessment of construction impacts to the surrounding areas.

4.3.1 Surrounding land uses

Mascot

The most dominant land use in Mascot is Sydney Airport. The airport has significant airside infrastructure as well as hotels, food outlets and industrial uses. Mascot has a mix of uses including commercial, industrial, suburban housing development and a town centre that is focused upon Mascot Station. The Mascot town centre comprises a mix of retail, supermarkets, food and drink outlets, wellness centres and high-density residential development.

Botany

Botany consists of mixed land use between Foreshore Road and the Botany Line. The area south of Southern Cross Drive includes open space (Mill Stream) and the East Lakes Golf Club. Business and industrial parks are located in the vicinity of Foreshore Road, Botany Road and along the Botany Line south of Swindon Street and Page Street. Low and medium density housing is the prevalent land use between Botany Road and Wentworth Avenue.

4.3.2 Road network

All roads in the vicinity of the Botany Line are classified as local, other than Southern Cross Drive, General Holmes Drive, O'Riordan Street, Botany Road, Foreshore Road and the section of Robey Street between O'Riordan Street and Qantas Drive. The local roads are the responsibility of local government authorities and generally are considered to only provide for local access.

There are a number of major arterial roads surrounding the Botany Line duplication construction area including:

- **M1 Southern Cross Drive-General Holmes Drive** extends along the southern edge of the airport, connecting the M5 East Motorway and the Eastern Distributor. Southern Cross Drive is six-lanes, while General Holmes Drive has up to eight-lanes with a section operating as a tidal flow system during the AM peak period. These are limited access motorways with no at-grade intersections and no stopping or parking at any point. Where access to/from adjoining roads is permitted, this is provided in the form of ancillary deceleration and acceleration lanes (e.g. Foreshore Road and Butler Street). The corridor has variable speed limits. However, the default speed limit is set at 70 kilometres per hour. This road is not tolled.
- **Airport Drive and Qantas Drive** run along the northern edge of the airport between West Botany Street-M5 East and O'Riordan Street and Joyce Drive. Airport Drive and Qantas Drive are not state roads as they are located within the SACL leased lands. Airport Drive and Qantas Drive have two traffic lanes in each direction and a posted speed limit of 70 kilometres per hour. These roads provide an important east-west connection between the International and Domestic airports, and for over-height or restricted freight vehicles that cannot use General Holmes Drive due to the low clearance tunnel under the runway. No Stopping' has been installed along its entire length.
- **Joyce Drive and General Holmes Drive** is a state road beginning at the intersection of Joyce Drive and O'Riordan Street, and extending to meet the M1 on the eastern side of the airport. Joyce Drive has a posted speed limit of 60 kilometres per hour. It has recently been widened to six-lanes as a part of the Airport East project which includes a new intersection with a realigned and extended Wentworth Avenue. There is no parking permitted on this road corridor.

- **Botany Road** is a state road and an important north-south connection between the Sydney CBD in the north and Botany in the south. The posted speed limit varies between 50 to 60 kilometres per hour over its length and is generally four to six-lanes wide. Bus Lanes have been introduced in the kerbside lanes, north of Wentworth Avenue. Short-term parking is permitted in designated areas outside of clearway and bus lane operating times.
- **Foreshore Road** is a four-lane divided road which connects Port Botany to M1 General Holmes Drive and is an important link for road freight to and from the port. The posted speed limit is 80 kilometres per hour, with no stopping restrictions along its length.
- **O'Riordan Street and Robey Street** form the primary north-south corridor between the Sydney CBD and Sydney Airport. As a part of the Airport North Precinct upgrade works by Transport for NSW, Robey Street and O'Riordan Street form a one-way couplet.
  - O'Riordan Street, north of Robey Street, is a state road with a posted speed limit of 60 kilometres per hour. The road is generally four to six lanes in width and has numerous signal-controlled intersections. Within the study area, parking is not permitted between Gardeners Road and Joyce Drive. The section of O'Riordan Street between Joyce Drive and Robey Street is a four-lane, one-way street heading south toward the Airport's Domestic Terminals.
  - Robey Street is a state road with a posted speed of 60 kilometres per hour between Qantas Drive and O'Riordan Street. This section is a four-lane, one-way street heading away from the Domestic Terminals. In this section of Robey Street, no stopping restrictions prohibits parking at all times. East of O'Riordan Street, Robey Street is a local road which connects with Botany Road. It has a single lane in each direction with time restricted parking (3P) on both sides, the posted speed limit is 50 kilometres per hour.
- **Wentworth Avenue** is a state road that is generally four to six lanes in width and has a posted speed limit of 60 kilometres per hour between General Holmes Drive-Joyce Drive and Sutherland Street. In this section, there are peak hour clearways in place and no stopping restrictions. Between Sutherland Street and Southern Cross Drive, Wentworth Avenue is generally a six-lane divided road with a posted speed of 70 kilometres per hour. There is no parking permitted along this section of Wentworth Avenue.
- **Mill Pond Road** is a state road that is generally nine to eleven lanes in width and provides an important east-west connection between General Holmes Drive and Botany Road, while also providing access between the airport district and Southern Cross Drive eastbound. There is no parking permitted along the road.

Airport East Precinct Upgrade

The Airport East Precinct upgrade was open to the public in June 2019. According to the project summary found in the Roads and Maritime's website, the key features and benefits of the project are (RMS, 2019):

- replacing the General Holmes Drive rail level crossing with a road underpass that links General Holmes Drive, Botany Road and Wentworth Avenue to improve the movement of rail freight and improve access to the Airport, Mascot and the eastern suburbs
- improving the Mill Pond Road intersections with General Holmes Drive and Botany Road to support future growth and access to the Airport
- widening Joyce Drive and General Holmes Drive between O'Riordan Street and Mill Pond Road to three lanes in each direction to improve traffic flow around the Airport and to Port Botany
- creating a new shared path to link to the existing cycle way on Wentworth Avenue to improve connections for pedestrians and cyclists, at Todd Reserve on Wentworth Avenue
- retaining the northbound bus stop on Botany Road close to the existing location to meet community needs.

Airport North Precinct Upgrade

At the time of writing, this project is under construction and is scheduled to open in the near future. According to the project summary found in the Roads and Maritime's website, the key features of this project are (RMS, 2019):

- converting the southern sections of Robey Street and O'Riordan Street into one-way roads
- widening O'Riordan Street to provide six through lanes between Bourke Road and Robey Street
- reconfiguring the existing traffic lights on O'Riordan Street between Qantas Drive and Bourke Road
- upgrading the footpath on the eastern side of O'Riordan Street.

4.3.3 Peak hour traffic

Weekday

The intersection turning count volume data was collected during the weekday AM peak (6 am to 10 am) and PM peak (3 pm to 7 pm) period to identify existing traffic volumes key intersections within the study area. Surveys were conducted in June 2018 at the following intersections with volumes for these intersections (total intersection traffic) presented in Table 4.2:

- Botany Road and Mill Pond Drive
- General Holmes Drive and Mill Pond Drive
- General Holmes Drive and Joyce Drive
- Joyce Drive and O'Riordan Street
- Qantas Drive and Robey Street
- Robey Street and O'Riordan Street.

Table 4.2 Total existing intersection traffic volumes – Weekday AM and PM peak hours

Intersection name	2018 intersection traffic volume – AM peak (veh/h)	2018 intersection traffic volume – PM peak (veh/h)
Botany Road/Mill Pond Drive	5,387	5,728
General Holmes Drive/Mill Pond Drive	5,185	5,549
General Holmes Drive/Joyce Drive	3,957	4,028
Joyce Drive/O'Riordan Street	5,214	4,909
Qantas Drive/Robey Street	5,554	4,613
Robey Street/O'Riordan Street	4,063	4,385

These surveyed traffic volumes are regarded as typical of the weekday peak periods and were used for comparison against the additional construction traffic to the road network for the qualitative assessment during the typical construction period.

Weekend

The weekend peak hour was determined through intersection turning count surveys during the typical weekend peak periods (Saturday and Sunday from 10 am to 2 pm) in September 2018. The surveys were carried out at the following intersections with volumes (total intersection traffic) presented in Table 4.3:

- General Holmes Drive and Joyce Drive
- Joyce Drive and O'Riordan Street
- Qantas Drive and Robey Street
- Robey Street and O'Riordan Street
- Botany Road and Robey Street
- Botany Road and General Holmes Drive
- Botany Road and Wentworth Avenue.

The results of the survey indicated that the Sunday peak had the highest volumes of traffic and the peak hour was between 1 pm and 2 pm. The surveyed traffic volumes were used for the quantitative assessment during the weekend road closure period.

Table 4.3 Total existing intersection traffic volumes – Saturday and Sunday mid-day peak hours

Intersection	2018 intersection traffic volume – Saturday mid-day peak (veh/h)	2018 intersection traffic volume – Sunday mid-day peak (veh/h)
General Holmes Drive and Joyce Drive	3,507	3,692
Joyce Drive and O'Riordan Street	4,121	4,505
Qantas Drive and Robey Street	3,934	4,078
Robey Street and O'Riordan Street	2,615	2,446
Botany Road and Robey Street	2,262	1,929
Botany Road and General Holmes Drive	2,385	2,028
Botany Road and Wentworth Avenue	3,118	2,723

4.3.4 On street parking

The Project's site extends along the alignment of the Botany Line, providing opportunity to allocate workers to different areas of the Project. This would effectively manage the concentration of parking demand of parking by workers and visitors and by in large contain the provision of off-street parking to be within the work sites.

Considering the above, a detailed parking utilisation survey was not undertaken for the project. However, to provide due consideration of the Project's impacts, existing on-street parking restriction and demand were anecdotally assessed. Key findings associated with parking restrictions within the study area are as follows:

- Key motorways and arterial roads, including Southern Cross Drive, Airport Drive, Joyce Drive, Wentworth Avenue and O'Riordan Street are observed to not allow any on-street parking ensuring availability for all travel lanes to maximise capacity of the road network.
- Short-term timed parking ranging from half-hour up to 3-hour periods is provided within the commercial and retail precincts (e.g. Botany town centre) within the vicinity of the Project's site. These are generally applicable from 8 am to 6 pm on weekdays and from 8 am to mid-day on Saturday.
- Timed parking, with applied restrictions of 3-hour up to 8-hour periods were noted in residential streets within walking distance to/from the commercial, retail and other employment areas. These are generally applicable from 8 am to 6 pm on weekdays and from 8 am to mid-day on Saturday; and are supported by the use of Residential Parking Scheme (RPS), which allow residents with a valid permit to overstay.
- Unrestricted parking is provided in residential streets that are outside of the typical walking distance of key commercial, retail and /or employment areas.

Site visits provided insight into the utilisation of the on-street parking within the study area. Key observations of the utilisation of on-street parking within the study area are as follows:

- high parking utilisation and high turnover observed within the vicinity of the Botany town centre
- high parking utilisation within the vicinity of the business park/light industrial areas north of Sir Reginald Ansett Drive, albeit consisting of a longer time restriction
- high utilisation and low-turnover in the spaces located within the business park/industrial area located between Mill Pond and Booralee Park. An example is on Lord Street shown in Figure 4.4

- high parking utilisation in areas around the medium to high density residential areas, including those located around the Mascot station and near the Botany Aquatic Centre observed in Bay Street as depicted in Figure 4.5
- low to medium utilisation in the residential areas located at further walking distance from major trip generators (i.e. commercial, business park, industrial areas and Airport).

Figure 4.4 High demand kerbside parking activity on Lord Street generated by adjacent businesses

Figure 4.5 On street parking near apartment complexes on Bay Street

4.3.5 Travel behaviour

A review of the Household Travel Survey (TfNSW, 2016) and Journey to Work (ABS, 2016) data was done to understand the travel behaviour of residents and workers respectively, within the vicinity of the Project area. The area analysed include the suburbs of Botany, Mascot, Eastlakes, Eastgardens, Pagewood and Port Botany. The mode share and their respective proportion are detailed in Table 4.4 below.

Table 4.4 Average weekday travel mode share

Data type and source	Vehicle		Public transport		Active transport	Other modes	Worked from home	Mode not stated
	Vehicle driver	Vehicle passenger	Train	Bus				
Household Travel Survey (TfNSW, 2016)	34%	21%	3%	12%	27%	4%	n/a	n/a
Journey to Work (ABS, 2016)	59%		23%		4%	1%	12%	1%

The key points from the analysis are as follows:

- a high proportion of household and work trips are done by private vehicles; this ranges between 55% to 60% of the respective trip purpose total
- use of public transport (23%) is more prominent in the journey to work data, indicating a higher preference for workers in the area to travel by this mode
- use of active transport (27%) is more prominent in the household travel data, indicating a higher preference for residents to walk or cycle to work
- a relatively high proportion of those working from home is noted.

4.3.6 Public transport

Rail services

The two closest passenger rail stations to the study area is Mascot Station and the Sydney Domestic Airport Station. Mascot Station is located north of the Project's area with entry via Bourke Street (between Church Avenue and John Street). Sydney Domestic Airport station is located within the Kingsford Smith Airport domestic terminal.

Both stations are serviced by the one rail line (T8 Airport & South Line); a dual-track line which provide links to the City Circle via Central in the northbound direction and to Leppington in the south-westbound direction.

For most part, the track runs on the surface. However, a portion of the track between Wolli Creek to Central are located underground, servicing (in the northbound direction) the Sydney International Airport, Domestic Airport, Mascot and Green Square stations.

In terms of the T8 line's location in relation to the Botany Line, it overlaps below the intersection of Joyce Drive–Qantas Drive–O'Riordan Street–Sir Reginald Ansett Drive.

A map of the Sydney trains network is included in Figure 4.6 while Table 4.5 presents the AM and PM peak services and frequency of the Sydney Trains' T8 Airport & South Line.

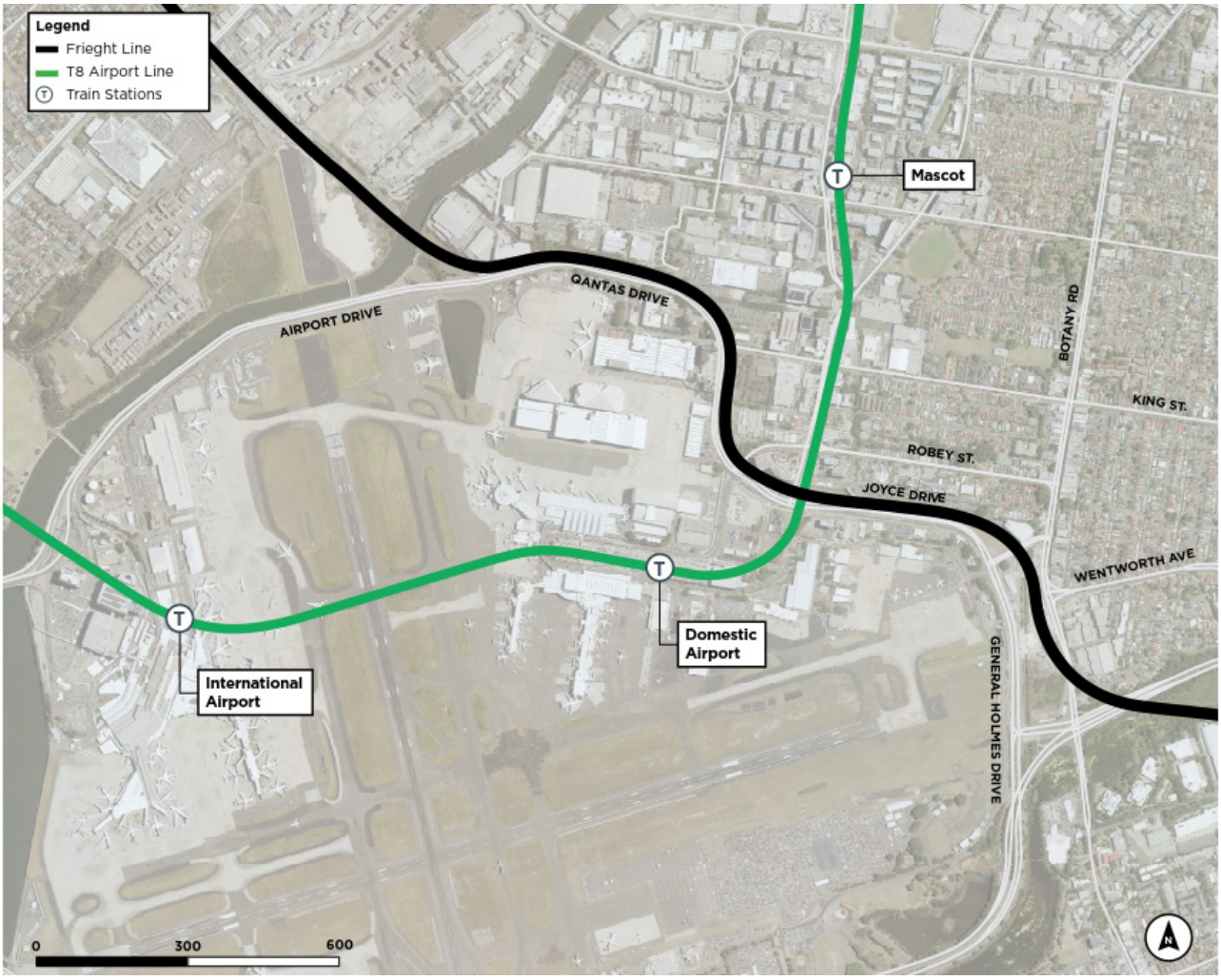

Figure 4.6 Primary train routes serving the study area

Table 4.5 Train services at Mascot station

Line	Network	AM peak services	AM peak frequency	PM peak services	PM peak frequency
T8 inbound	Suburban	20	3–8 mins	16	7–8 mins
T8 outbound	Suburban	18	3–9 mins	18	3–9 mins

Bus services

The study area surrounding the project in Mascot and Botany is served by bus routes from the Eastern Suburbs and Inner West districts provided by State Transit and the private operator, Transit Systems. Many services run through the Mascot Town Centre precinct to the north of the T2/T3 terminal precinct. Although most bus routes run to and from the Sydney CBD, Central or Redfern, there are also some cross-regional services to destinations connecting Sydney Airport and Mascot with destinations to the east and west, including the following:

- **Routes 400, and 400N –** operates between Bondi Junction and Sydney Airport, connecting the International and Domestic Terminals to Mascot station via Airport Drive, Qantas Drive and O'Riordan Street.
- **Routes 420 and 420N** – operates between Burwood and Westfield Eastgardens via Sydney Airport, providing connection from the International and Domestic Terminals to Rockdale station and Mascot station via Airport Drive, Qantas Drive and O'Riordan Street.
- **Route 305** – runs from Railway Square to Mascot, terminating at Stamford Plaza between Robey Street and Qantas Drive.
- **Routes M20, 307, 309, 310, L09, X09 and X10** – runs in a north-south direction along Botany Road from Botany towards the city.
- **Route M20** – runs in a north-south direction from Botany Road in Botany towards the CBD and north to Gore Hill.
- **Routes 301 and 303** – runs in an east-west direction along King Street before joining Botany Road and continuing south.

Figure 4.7 shows the bus network surrounding the project site in Mascot and Botany. The frequencies and number of peak direction services are outlined in Table 4.6.

Table 4.6 Bus services within the study area

Route	Operator	AM peak services	AM peak frequency	PM peak services	PM peak frequency
301	State Transit	4	30 mins	8	15 mins
303	State Transit	7	15 mins	8	15 mins
305	State Transit	–	–	4	3 mins
307	State Transit	11	10 mins	4	30 mins
309	State Transit	10	10 mins	14	10 mins
310	State Transit	11	10 mins	–	–
400 eastbound	State Transit	6	20 mins	6	20 mins
400 westbound	State Transit	6	20 mins	6	20 mins
420 eastbound	Transit Systems	6	20 mins	6	20 mins
420 westbound	Transit Systems	7	15–20 mins	7	15–20 mins
M20	State Transit	12	10 mins	11	10 mins

(1) AM peak is 07.00-09.00 and PM peak is 16.00–18.00. Frequency rounded to the nearest five minutes.

Source: Transport for NSW, 2019

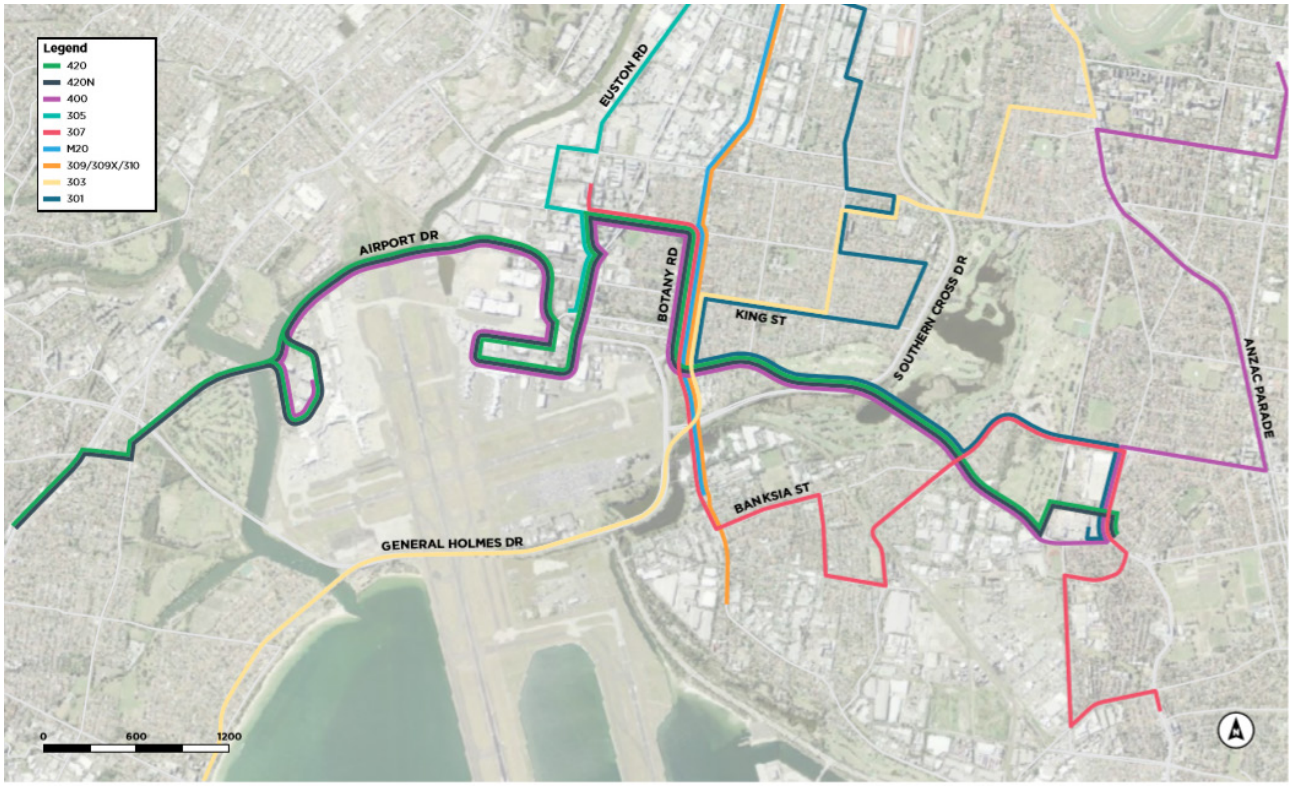

Figure 4.7 Bus routes within the project area

Bus stops are available along these services at regular spacing (approximately 200 m to 400 m). Majority of bus stops are observed to be provided in-lane.

A handful of bus stops consist of bus shelters, and where this does not exist, appropriate signage including plinth and regulatory signs are installed accordingly. These include the bus stops located on Coward Street and botany Road which may be affected by the Robey Street and O'Riordan Street road closure, which are further discussed in Section 5.2.2.

Point to point transport

Point-to-point transport such as taxis, hire cars, tourist services and rideshare services provide important mobility options for first and last mile trips.

In the study area, designated taxi ranks are generally available within the vicinity of transport hubs (i.e. train stations and airport terminals).

It is also a service available through booking and offers customers flexibility, generally with unconstrained routes and stop options, subject to compliance with the NSW Road Rules.

4.3.7 Active transport

Active transport networks traditionally encompass both cycling and pedestrian facilities. At the present time, there are no dedicated cycling facilities within the project site. However, there are a number of active transport corridors located in close proximity to the study area. These are provided in a variety of forms including shared paths and dedicated cycleways.

Active transport infrastructure (as shown in Figure 4.8) in the broader vicinity of the project site includes:

- the Bourke Road Cycleway is a high-quality, 3.4 kilometre north-south separated corridor between Mascot and Woolloomooloo. This provides the major north-south connection in the area for cyclists. The start of the cycleway north of Gardeners Road is just over one kilometre from the project
- the Alexandra Canal shared path ends at Coward Street. While, there is no designated facility, the route is marked with wayfinding signage (Sydney Cycling Map, June 2019, v1.3)
- a shared path is located along Wentworth Avenue between Dranesfield Avenue and Bay Street. The start of this route is approximately 750 metres from the Botany Line.

In addition to the active transport activities in the above facilities, bicycle group rides have been observed on-road along the Southern Cross Drive with riders typically occupying the leftmost traffic lane.

The footpath network is more developed than the bicycle network. The roads in the study area are typical of an urban environment with most streets consisting of constructed footpaths on either side, or at the very least constructed footpaths on one side of the road. The motorways (i.e. Southern Cross Drive), which supports high speed environment, do not consist of any footpath network. Pedestrian movements on the motorway are prohibited through signage and other physical measures.

There is an existing pedestrian crossing over the Botany Line at Banksia Street. This crossing provides access for residents on either side of the rail line to schools, shopping and recreational amenities.

The Domestic Airport (Terminals 2 and 3) is linked to the Mascot Town Centre north of the study area, with pedestrian access to the terminal precinct located along at-grade roadside footpaths via Robey Street and O'Riordan Street to the north.

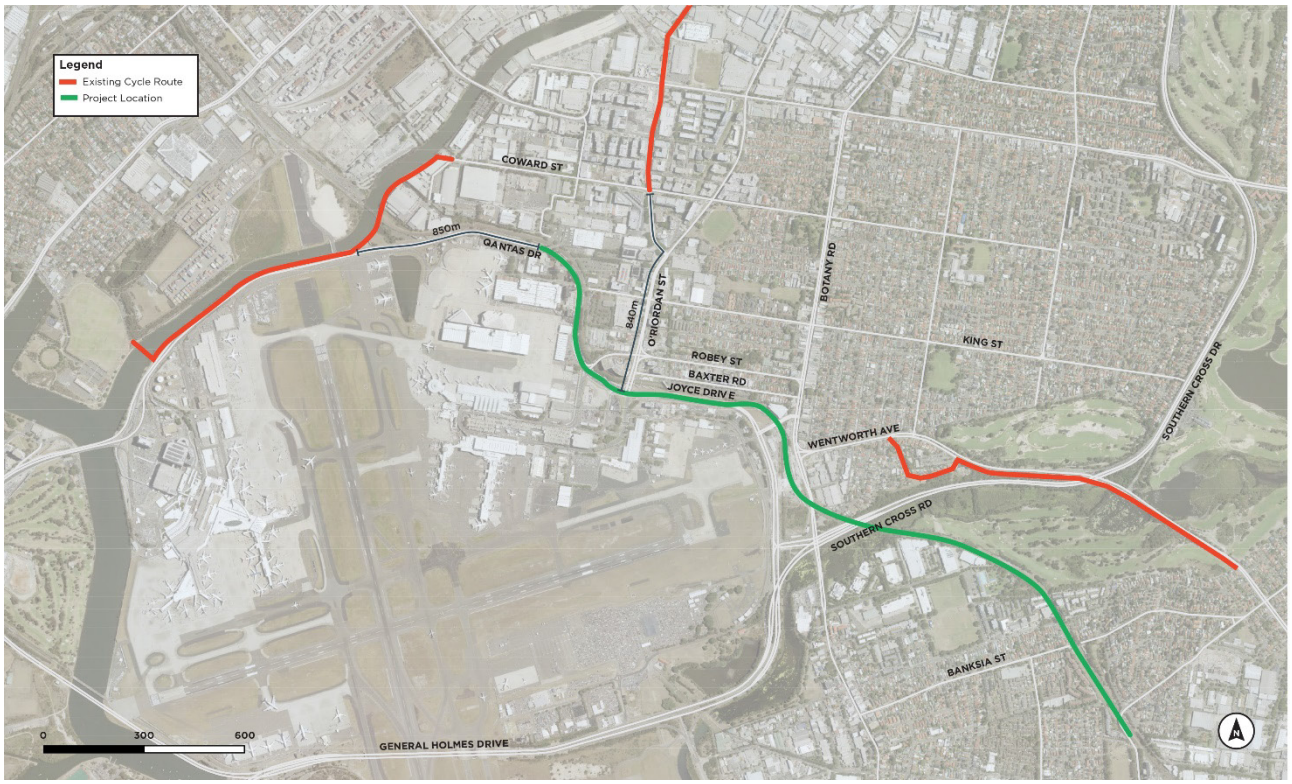

Figure 4.8 Active transport network

5. Impact assessment

This section of the report addresses the construction methodology and associated impacts as required in the SEARs shown in Table 2.1. In particular, the following have been addressed:

- identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts
- demonstrate how options within the project potentially affect the impacts relevant to the issue
- a considered approach to route identification and scheduling or transport movements, particularly outside standard construction hours
- the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements and track machines)
- construction worker parking
- access constraints and impacts on public transport, pedestrians and cyclists
- the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project and measures to minimise any impacts and delays
- the proponent must assess the operational transport impacts of the project for both Road and Rail.

5.1 Construction activities

As described in Section 1.1.2, the works associated with the project would comprise of:

- track duplication for about three kilometres between Botany and Mascot (which in the future would be known as the Down Botany line)
- upgraded track as part of the new track alignment works
- new crossovers at Banksia Street, and between General Holmes Drive and O'Riordan Street
- new rail bridges, including:
  - southern side of existing Mill Stream Bridge
  - southern side of existing Southern Cross Drive Bridge
  - southern side of the existing O'Riordan Street bridge and replacement of the existing bridge
  - southern side of existing Robey Street bridge and replacement of the existing bridge
- retaining walls and embankment widenings to support the new track.

The construction works for the project would start in late 2020 and be carried out over a number of phases. It is anticipated that the line would commence operation in late 2023.

This section describes the impact to the traffic and transport network due to the following construction works:

- enabling works in particular including billboard removal and service relocations
- bridge works in particular demolition
- utility relocation
- oversized deliveries.

These abovementioned works may result in temporary road or lane closures which could create periodic disruptions to the road and transport networks in the project area. In addition, construction haulage and worker access to construction compounds would also affect the surrounding traffic and transport network. Chapter 7 of the main EIS document outlines in greater detail, the indicative construction activities.

Where construction works are required within three metres of the middle of the operational rail track, works would be undertaken during periods where the line is not operational to ensure safety to workers, rail drivers and infrastructure. About four full weekend track possessions occur per year, where the line is not operational to facilitate general maintenance and project works across the network. The project would aim to align with these track possessions for key activities.

Operations of the Sydney Airport sees planes arriving and departing between 6 am and 11 pm daily. Associated with Sydney Airport's operational air space is an Obstacle Limitation Surface (OLS) which acts to limit activity which could create a risk to safe Airport operations. The OLS covers about one kilometre of the project site which could limit the placement of plant and equipment at a range of sizes from general excavators to larger equipment such as piling rigs. As such, some works would need to be undertaken during the 11 pm to 6 am airport curfew, or during other times in consultation with Sydney Airport and relevant approvals.

5.1.1 Worksites, compounds and materials storage

There would be two main construction compounds as well as a number of smaller satellite compounds to ensure sufficient storage and access to the proposed construction work sites.

Prior to construction commencing, a number of activities would be required for site establishment to facilitate construction as part of enabling works. These works include site preparation for and establishment of compounds, parking and materials storage, projection and relocation of affected utilities, installing fencing and hoardings, constructing access ramps and roads, establish site environment management and traffic controls including pedestrian and cyclist diversions or adjustments.

One of the two main compounds would be located off General Holmes Drive on a site which is currently being used as a site compound for the Airport East Precinct upgrade project. The second main compound would be located within an existing cleared area, west of the railway corridor between Banksia Road and the Stephen Road overbridge at Botany.

The satellite compounds are located along the length of the project. Each site has been set up to provide support facilities for the project. Material storage sites have been identified and would be dispersed throughout the corridor. They are associated with specific work sites and would generate construction traffic, including haulage to off-site locations.

There are twenty-five existing access gates located along the corridor. These gates would provide access to site to carry out works, provide worker parking, site offices and materials storage areas. These gates are typically located along local roads which are primarily residential, but also because of logistical and accessibility constraints, have been located adjacent to busy traffic corridors such as Southern Cross Drive. The use of existing access gates along Qantas Drive, Joyce Drive, Robey Street, and Botany Road would be subject to restrictions during peak travel times.

Figure 5.1 shows the location of the project site including works footprint, compounds, access gates, crane pads, materials storage and other construction-related sites.

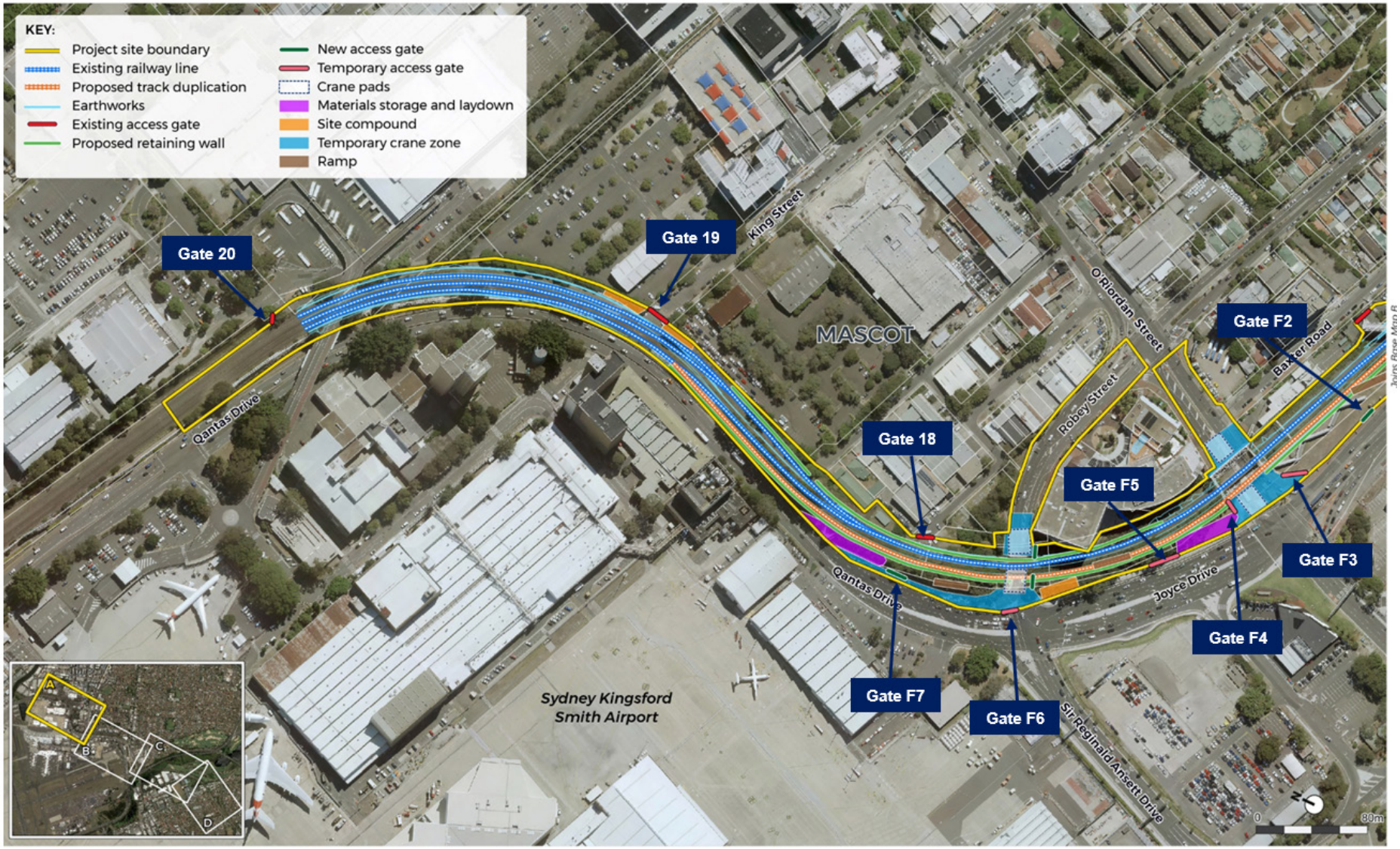

Figure 5.1 Project site – construction footprint, compound and gate locations

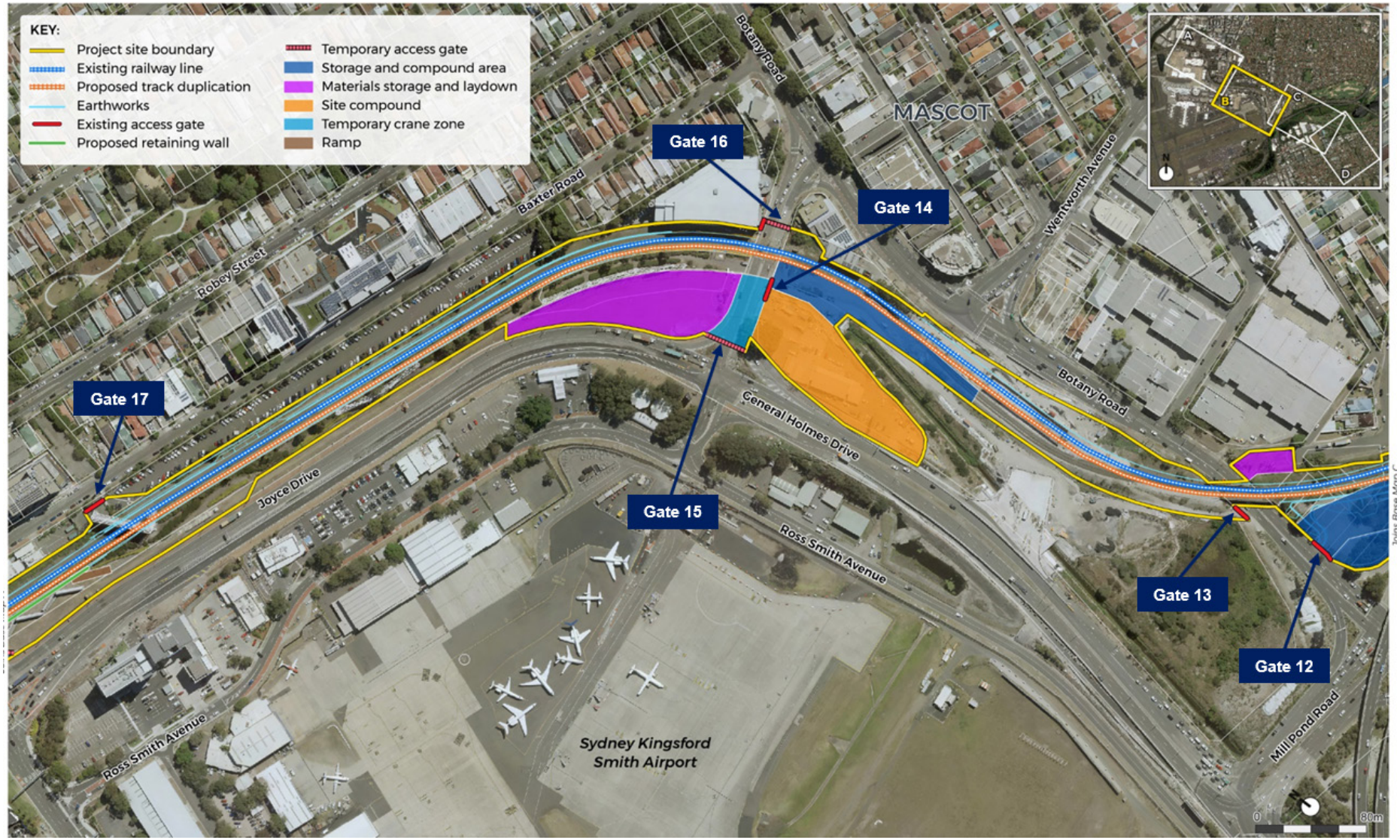

Figure 5.1b Project site – construction footprint, compound and gate locations

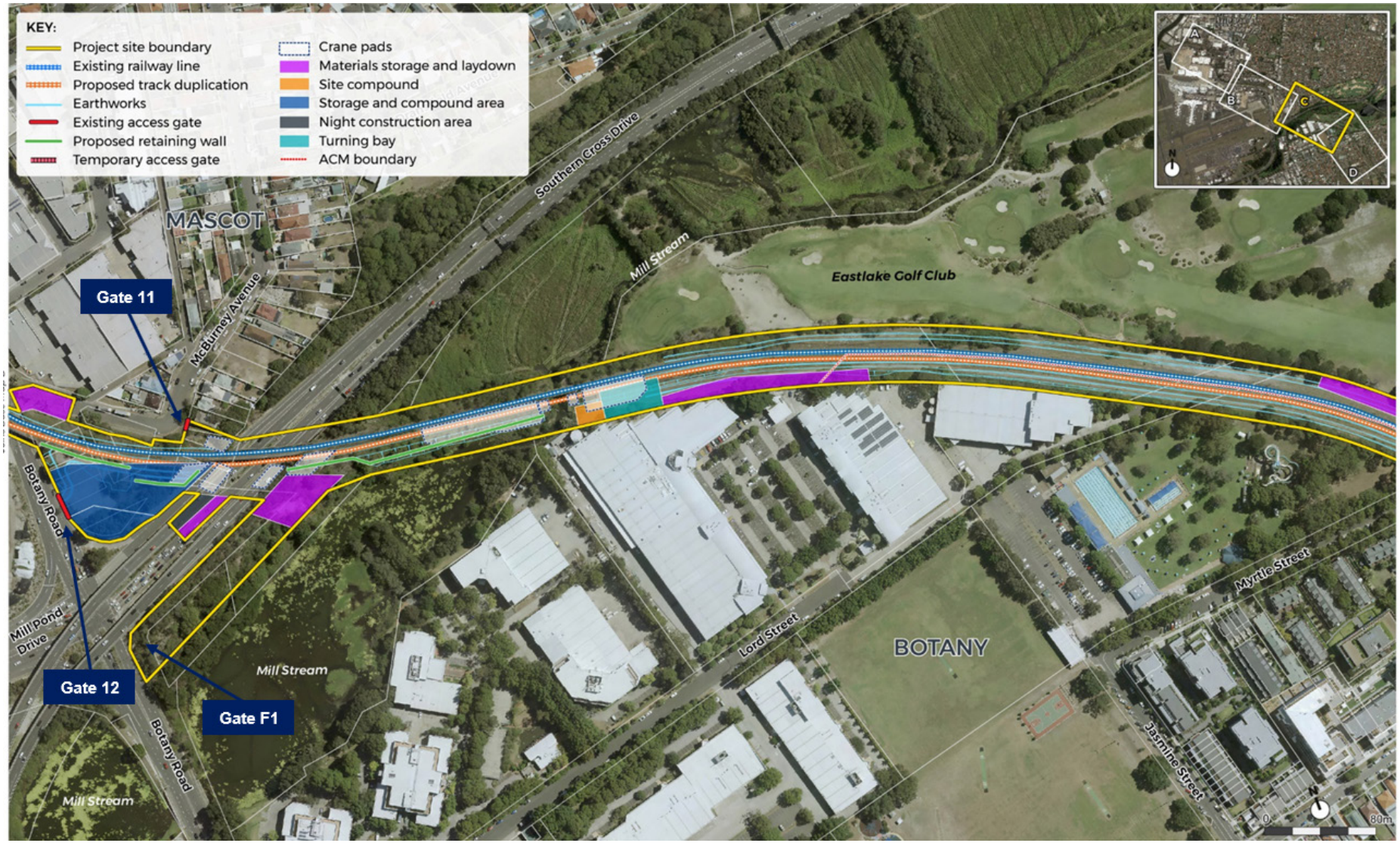

Figure 5.1c Project site – construction footprint, compound and gate locations

Figure 5.1d Project site – construction footprint, compound and gate locations

5.1.2 Workforce

The workforce during non-possession work is anticipated to peak at around 270 workers. During the times when possession work (periods when the rail line is closed to train operations) would be carried out, the workforce is expected to increase to a peak of around 400. The estimated workforce numbers for each of the construction compounds are shown in Table 5.1.

Table 5.1 Indicative workforce

Site compound	Typical construction		Possession (occurs 4 times per year)
	Peak	Average	
Banksia Street (primary site compound)	45	14	70
Mill Stream	21	14	20
Botany Road	70	45	70
Joyce Drive	88	74	115
General Holmes Drive (primary site compound)	24	16	65
King Street	24	14	65
Totals	**272**	**177**	**405**

5.1.3 Access and parking

Despite the existence of public transport options within 400 metres of both the main work compounds, private vehicle is expected to be the main mode for travel to and from the project. The choice of private vehicle as the preferred mode is likely to be a consequence of a combination of factors, including:

- many of the workers being required to carry tools for work
- the early work starts when public transport is less frequent
- the need for multiple changes in mode to travel between home and the work site.

Approximately 50 car park spaces will be available at the General Holmes Drive compound site and there will be parking available at each work sites. Where space is available, some parking would be provided within the construction compounds and/or work areas within the existing rail corridor like the Banksia Street compound site. However, the indicative car parking supply would be less than expected workforce. Therefore, it is recommended that the construction contractor(s) manage the available parking supply without utilising on-street parking facility, including preparation of a parking and Construction Transport, Traffic and Access Management Plan (CTTAMP). Further development of proposed areas for parking would be determined during the detailed design stage by the construction contractor (s).

5.1.4 Construction traffic and haulage routes

Construction traffic would access the compounds, materials storage sites and access gates via a number of roads, which by necessity, will include travel on local residential streets. The proposed construction access routes are shown in Appendix B1.

The construction of the project would also require the haulage of material away from site by heavy vehicles (trucks). While fewer streets have been identified as routes for haulage activities (when compared to the construction routes), some of these are also local roads but are not additional to the identified construction routes. These routes are indicated in Appendix B1.

Table 5.2 outlines the indicative breakdown of the mass haulage volumes required during construction.

Table 5.2 Indicative mass haulage truck movements

Access gate	Proposed truck	Number of movements (in / out)	Mass haul – import / export		
			Work duration (Total days)	Average truck movements per day	Trucks per hour (based on 8-hour shift)
Banksia Street	Truck and dog	3,020	40	80	10
Botany Road – East (Mill Stream Access)	Tipper	1,440	40	40	5
Botany Road – Botany Triangle	Tipper	500	60	10	1
General Holmes Drive	Truck and dog	800	40	20	3
Joyce Drive	Truck and dog	920	40	30	4
Joyce/Qantas Drive	Truck and dog	700	40	20	3
Joyce Drive/Qantas Drive	Tipper	2,520	60	50	6
King Street	Tipper	2,160	60	40	5

Oversize (vehicles measuring over 19 metres long, 2.5 metres wide or 4.3 metres high) or over-mass vehicles (vehicles exceeding 42.5 tonnes) may be required for the transportation of larger equipment including cranes and excavators. These are considered Restricted Access Vehicle (RAV). The use and travel routes of these vehicles would be subject to the release of a permit from the relevant roads authority.

5.1.5 Construction work hours

Generally, the construction works will take place during standard work hours. However, due to the complex nature of the duplication of an operational rail line, its positioning over busy road corridors and being adjacent to Sydney Airport, some work may occur at other times such as over weekends, on Sundays and public holidays, evenings and overnight periods. The standard work hours for construction are:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sundays and public holidays: no work.

Due to the nature of the project (duplicating track on an operational rail line, and bridge works) and its location (over busy roads and adjacent to Sydney Airport) some work activities will occur outside of the standard work hours. In particular, construction activities having an impact on the transport network may need to occur outside of the standard work hours and include but are not limited to:

- delivery of materials and plant by oversized vehicles between 12 am and 6 am
- work requiring lane or full road closures which will impact traffic and compromise vehicle, pedestrian and cyclist safety.

5.1.6 Project construction staging

Early and enabling work are anticipated to be undertaken over a year period. The main construction work would take about three years. The commissioning and finishing work would be undertaken at the end of the main construction work and would be completed in a half year.

The project would be staged, with the program primarily driven by the need for a number of project work being required to be undertaken during rail possession periods to minimise the potential for safety and operational impacts. Figure 5.2 outlines the indicative construction program of the project.

Figure 5.2 Indicative construction program

Due to the limited availability of rail track possessions the construction program would be required to be carefully planned around these possessions. While some work must be completed during possession periods, other work located outside the danger zone of the operational tracks would occur outside these possession periods (i.e. typical day-to-day construction period).

Chapter 7 of the main EIS document outlines in greater detail about the staging of the construction stages.

5.2 Construction impact assessment

5.2.1 Typical construction stage

Road network operation

The estimated traffic volumes accessing each site gate during construction is shown in Table 5.3 for both the AM and PM peak periods. Note that peak construction activities do not occur every day throughout the program as individual construction activities would have varying durations and schedules. Therefore, it should be recognised that estimated construction volumes that travel to and from each compound gate (shown in Table 5.3) and at key intersections (shown in Table 5.4 and Table 5.5) should be reflected as a largest volume that would be generated during the typical construction period.

The construction traffic is divided into light vehicles (up to 4.5 tonnes) and heavy vehicles (over 4.5 tonnes and 12.5 metres long) and includes workers travelling to and from the sites. Not all sites/gates would be active throughout the full duration of the construction program as the individual construction activities would have varying durations and schedules. As such, the numbers in Table 5.3 are cumulative and represent the typical traffic volumes that would be generated in the AM and PM peak periods for when each individual work site is in operation.

Table 5.3 Estimated light and heavy vehicle construction traffic

Gate ID	Access gate	Gate type	Movements per peak hour			
			AM peak hour		PM peak hour	
			Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
8	Banksia Street	Compound	0	14	18	5
7	Morgan Street	Compound	18	14	35	5
9	Banksia Street East	Site	2	4	2	0
10	Bay Street	Site	2	8	2	0
F1	Botany Road (adjacent Mill Stream)	Site	7	26	3	10
12	Botany Road (Botany Triangle)	Site	7	20	3	4
11	McBurney Avenue	Site	6	12	2	0
13	Botany Road Northbound	Site	2	12	2	0
14	General Holmes Drive Compound	Compound	88	36	53	0
15	General Holmes Drive South	Site	8	12	4	4
16	General Holmes Drive North	Site	2	7	0	2
17	Baxter Road	Site	4	7	2	1
F3	Joyce Drive–O'Riordan Street (In)	Site	0	8	0	4
F2	Joyce Drive–O'Riordan Street (Out)	Site	8	8	4	2
F5	O'Riordan Street–Robey Street (In)	Site	0	8	0	4
F4	O'Riordan Street–Robey Street (Out)	Site	8	8	4	2
F7	Qantas Drive (In)	Site	0	9	0	6
F6	Qantas Drive (Out)	Site	8	9	4	3
18	Coleman Street	Site	3	16	2	0
19	King Street	Site	3	28	1	8
20	Lancastrian Drive	Site	2	4	1	0

To identify the impact of the day-to-day construction traffic on the road network, the traffic numbers shown in Table 5.3 have been distributed across the road network based on the methodology outlined in Section 3.3.1.

The percentage of the additional construction traffic to the road network was compared against the total traffic volumes at the key intersections during the AM and PM peak periods in year 2022. The focus of the qualitative assessment is at nearby intersections, as the impacts of increased traffic volumes is greatest at these locations, rather than mid-block. The overall increase in peak period traffic volumes at key intersections for 2022 are shown in Table 5.4 and Table 5.5. The year 2022 was selected as the assessment year, as it aligns with the base year for the proposed future Sydney Gateway project, currently being developed by Transport for NSW.

Table 5.4 Total intersection traffic volume and construction traffic - AM peak hour

Intersection name	2018 intersection traffic volume (veh/h)*	2022 intersection traffic volume (veh/h)	Construction traffic volume (veh/h)**	Total 2022 traffic volume (veh/h)	Construction traffic as a percentage of background traffic
Botany Road/ Banksia Street	N/A	–	53	–	–
Botany Road/ Bay Street	N/A	–	40	–	–
Botany Road/ Mill Pond Drive	5,387	5,496	145	5,641	2.6%
General Holmes Dr/ Mill Pond Drive	5,185	5,289	122	5,411	2.3%
Botany Road/ Wentworth Avenue	N/A	–	68	-	–
General Holmes Dr/ Joyce Drive/ Construction access	3,957	4,037	86	4,123	2.1%
Joyce Drive/ O'Riordan Street	5,214	5,319	52	5,371	1.0%
Qantas Drive/ Robey Street	5,554	5,666	55	5,721	1.0%
Robey Street/ O'Riordan Street	4,063	4,145	60	4,205	1.4%
Botany Road/ Robey Street	N/A	–	149	–	–
Botany Road/ King Street	N/A	–	159	–	–

N/A – Traffic counts data not available

* 2018 Traffic counts data

** Total construction traffic (veh/h) at intersections

Table 5.5 Total intersection traffic volume and construction traffic – PM peak hour

Intersection name	2018 intersection traffic volume(veh/h)*	2022 intersection traffic volume (veh/h)	Construction traffic (vehicles/ hour)**	Total 2022 traffic volume (veh/h)	Construction traffic as a percentage of background traffic
Botany Road/ Banksia Street	N/A	–	56	-	–
Botany Road/ Bay Street	N/A	–	44	–	–
Botany Road/ Mill Pond Drive	5,728	5,843	58	5,901	1.0%
General Holmes Dr/ Mill Pond Drive	5,549	5,661	42	5,703	0.7%
Botany Road/ Wentworth Avenue	N/A	–	27	–	–
General Holmes Dr/ Joyce Drive/ Construction access	4,028	4,109	37	4,146	0.9%
Joyce Drive/ O'Riordan Street	4,909	5,008	23	5,031	0.5%
Qantas Drive/ Robey Street	4,613	4,706	42	4,748	0.9%
Robey Street/ O'Riordan Street	4,385	4,473	21	4,494	0.5%
Botany Road/ Robey Street	N/A	–	60	–	–
Botany Road/ King Street	N/A	–	65	–	–

The results in Table 5.4 and Table 5.5 indicate that the maximum percentage increase in total traffic volume at any intersection would be 2.6 per cent in the AM peak at Botany Road and Mill Pond Drive. In the PM peak, the percentage increase in traffic at any intersection (where existing traffic volume data is available) does not exceed 1.0 per cent. Based upon these relatively modest increases, the construction traffic generated by the project is unlikely to have any tangible impact at key intersections and the overall road network operation. Having said this, there may be the occasional localised impacts to the efficiency of intersections and adjacent roads close to the construction site access gates as a consequence of slow moving heavy (construction) vehicles manoeuvring in and out the site.

The identified impacts to the function of intersections in proximity to the construction site gates as well as the adjacent road links are indicated in Appendix A1. In general, the assessment of these intersections indicates there is potential for short duration high impacts at the following gates:

- Botany Triangle (Gates 13 and F1): due to its close proximity to the Botany Road and Mill Pond Drive intersection.
- Joyce Drive – O'Riordan Street (In) (Gate F3): due to its close proximity to the Joyce Drive and O'Riordan Street intersection.
- O'Riordan Street – Robey Street (In) (Gate F5): due to its close proximity to the Qantas Drive and Robey Street intersection.

- O'Riordan Street – Robey Street (Out) (Gate F4): due to its close proximity to the Joyce Drive and O'Riordan Street intersection.
- Qantas Drive (Out) (Gate F6): due to its close proximity to the Qantas Drive and Robey Street intersection
- Lancastrian Drive (Gate 20): due to its close proximity to the Qantas Drive and Lancastrian Drive intersection.

On-street parking

As described in Section 5.1.3, it is expected that the number of available car parking spaces within compounds and work sites would be less than expected workforce demand. It is responsible for the construction contractor to manage parking supply for both the projected workforce and construction vehicles at all times without utilising on-street parking around compounds and work sites. As the on-street parking around compounds and work sites will be restricted for the workforce to use, the impact on the demand and availability of existing on-street parking in the vicinity of the construction sites and compounds will be negligible.

Local amenity

There is potential for a decrease in the local neighbourhood amenity through increased construction traffic along local streets. In particular, the slight increase in 'heavy vehicle' traffic may be noticeable to local residents due to increased noise resulting from braking and/or travelling over existing speed control measures (such as speed bumps). However, as the volume of construction traffic is low compared to existing traffic volumes, the effects of the temporary increase on the road network is not expected to substantially impact local neighbourhood in the sturdy area.

Public transport

The impacts to public transport services (bus) would be limited to the overall road network impacts described in Section 5.2.1, as the buses in the study area typically travel in general traffic lanes. There are a number of bus services operating in the vicinity of the construction works (as described in Section 4.3.7). No bus stops would be impacted as part of the construction works during typical construction stage works.

The proposed works are not within the immediate vicinity of the rail tunnel servicing the T8 – Airport & South Line, and it is envisaged that the works will have no impact to the Sydney Trains network. However, should there be any direct or indirect impacts to the operation of the Sydney Trains network, ARTC will liaise with TfNSW to ensure satisfactory construction planning and implementation.

Active transport

The construction works would be largely undertaken within the Botany Line rail corridor. Therefore, impacts on pedestrian and cyclist infrastructure is considered minimal. The potential increase in construction traffic on the nominated construction vehicle routes and in particular at the existing access gates may lead to intermittent disruptions to pedestrian and cyclist movements along the existing adjacent footpaths and intersection crossing points. These delays are likely to be most prevalent at gate crossing points (if stopped to give way to entering or exiting construction vehicles). The impact on pedestrian and cyclist safety will also be at its greatest in vicinity of the gates due to the increased vehicle activity.

The gate locations where impacts to footpath users are likely to occur are:

- Banksia Street
- Morgan Street
- Botany Road (adjacent Mill Stream)
- Botany Road (Botany Triangle)
- Joyce Drive–O'Riordan Street (In)
- Joyce Drive–O'Riordan Street (Out)
- Qantas Drive (In)
- Qantas Drive (Out).

Point-to-point transport

As noted in Section 5.2.1, the overall increase in traffic volumes on the road network generated by the project is at worst 2.6 per cent and generally in the order of 1.0 per cent. This level of additional traffic is unlikely to have any tangible effect on point-to-point transport mode (taxis, hire cars, tourist services and rideshare services) travel times in the study area.

5.2.2 Road closure – Robey or O'Riordan Streets

Closing Robey Street or O'Riordan Street in the immediate vicinity of the project area is required to conduct construction activities, ensure worker and general public safety, and ease space constraints (for activities such as moving and erecting new and demolishing redundant bridge structures). A 54-hour weekend closures (from 11 pm Friday to 5 am Monday) would be required to avoid impacts to weekday peak period traffic, and ARTC is currently in consultation with Transport for NSW regarding these proposed temporary closures.

To facilitate the proposed scope of works, approximately 10 weekend road closures over the proposed three-year construction period would be required. Only one of the roads would be closed at one time, resulting in a detour around the closed section of road, which is discussed further in Section 5.2.2.

The SIDRA intersection modelling software package was used for the assessment of impacts during the weekend road closure periods, as the wider road network models developed, have only assessed the weekday peak hours. Saturday and Sunday intersection turn counts from 2018 were reviewed to determine the peak hour for a typical weekend period. This was identified as 1 to 2 pm Sunday, which is specifically related to airport operations. The identified peak hour has been used to generate the estimated 2022 future weekend base network traffic volumes.

The impact of the proposed weekend closures has been assessed at the following key intersections:

- Qantas Drive–Robey Street
- Qantas Drive–O'Riordan Street
- O'Riordan Street–Robey Street
- Robey Street–Botany Road
- General Holmes Drive–Botany Road
- General Holmes Drive–Joyce Drive
- General Holmes Drive–Wentworth Avenue
- Botany Road–Wentworth Avenue.

The Level of Service (LoS) for each intersection analysed has been reported in accordance with Transport for NSW guidelines *(Guide to Traffic Generating Developments*, Roads and Traffic Authority, October 2002), which is shown in Table 5.6. Under these guidelines, the performance of a signalised intersection is measured by the average intersection delay measured in seconds per vehicle.

Table 5.6 Level of Service criteria for intersections

Level of Service	Average delay (seconds per vehicle)	Traffic signals
A	Less than 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity; at signals, incidents would cause excessive delays; roundabouts require other control mode
F	Greater than 71	Unsatisfactory with excessive queuing

Robey Street closure

Proposed detour route

In consultation with Transport for NSW, three existing approach routes to the Robey Street underpass were identified and an alternative detour route developed. The existing and proposed detour routes are described in the following and depicted in Figures 5.3 and 5.4.

- Route 1A:
  - **Existing route**: Eastbound from Qantas Drive, turning left into Robey Street, then left from Robey Street to O'Riordan Street.
  - **Detour Route**: Travel along Joyce Drive and General Holmes Drive, left turn to Wentworth Avenue, travel along Botany Road, left turn to Robey Street, right turn to O'Riordan Street.
- Route 1B:
  - **Existing route**: Northbound through movement from Seventh Street onto Robey Street, left from Robey Street to O'Riordan Street.
  - **Detour Route**: Right turn to Joyce Drive and General Holmes Drive, left turn to Wentworth Avenue, travel along Botany Road, left turn to Robey Street, right turn to O'Riordan Street.
- Route 1C:
  - **Existing route**: Westbound from Joyce Drive, turning right into Robey Street, left from Robey Street to O'Riordan Street.
  - **Detour Route**: Turn right onto Wentworth Avenue (rather than travel along Joyce Drive), travel along Botany Road, left turn to Robey Street, right turn to O'Riordan Street.

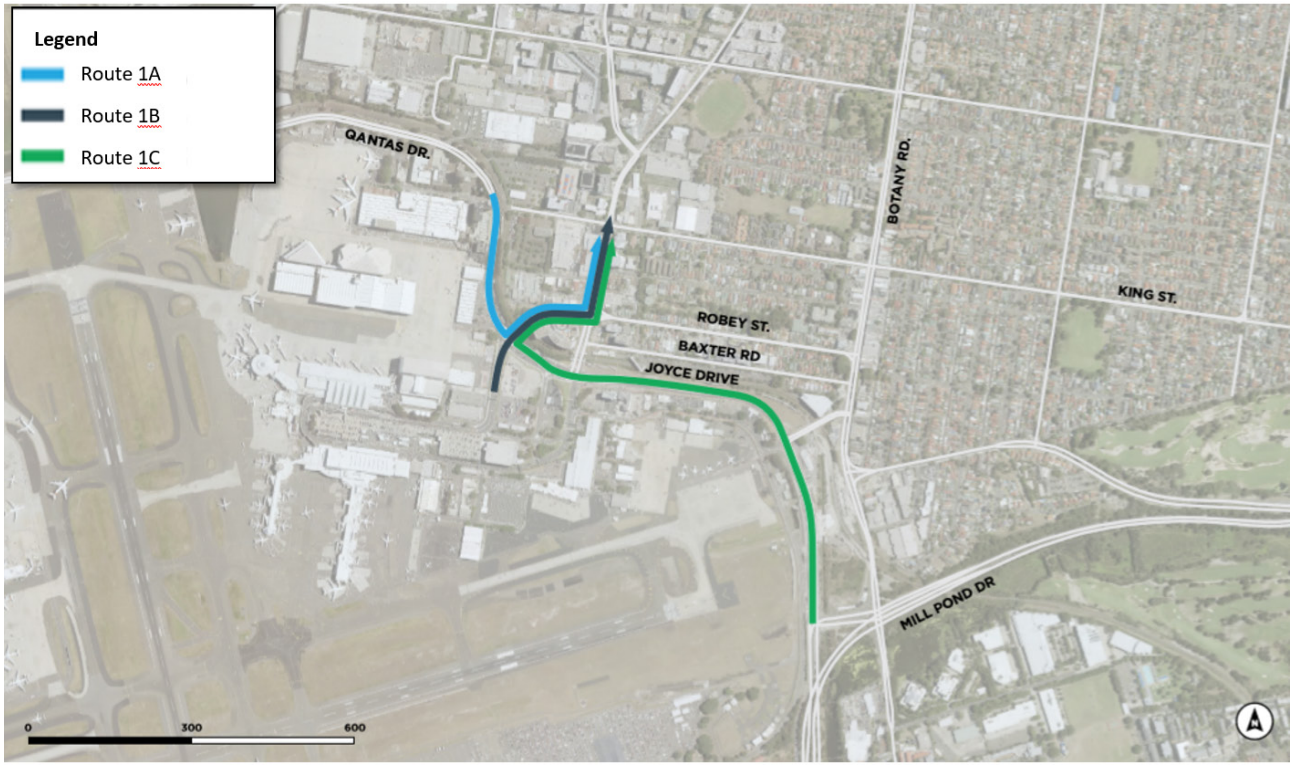

Figure 5.3 Key existing routes for Robey Street closure

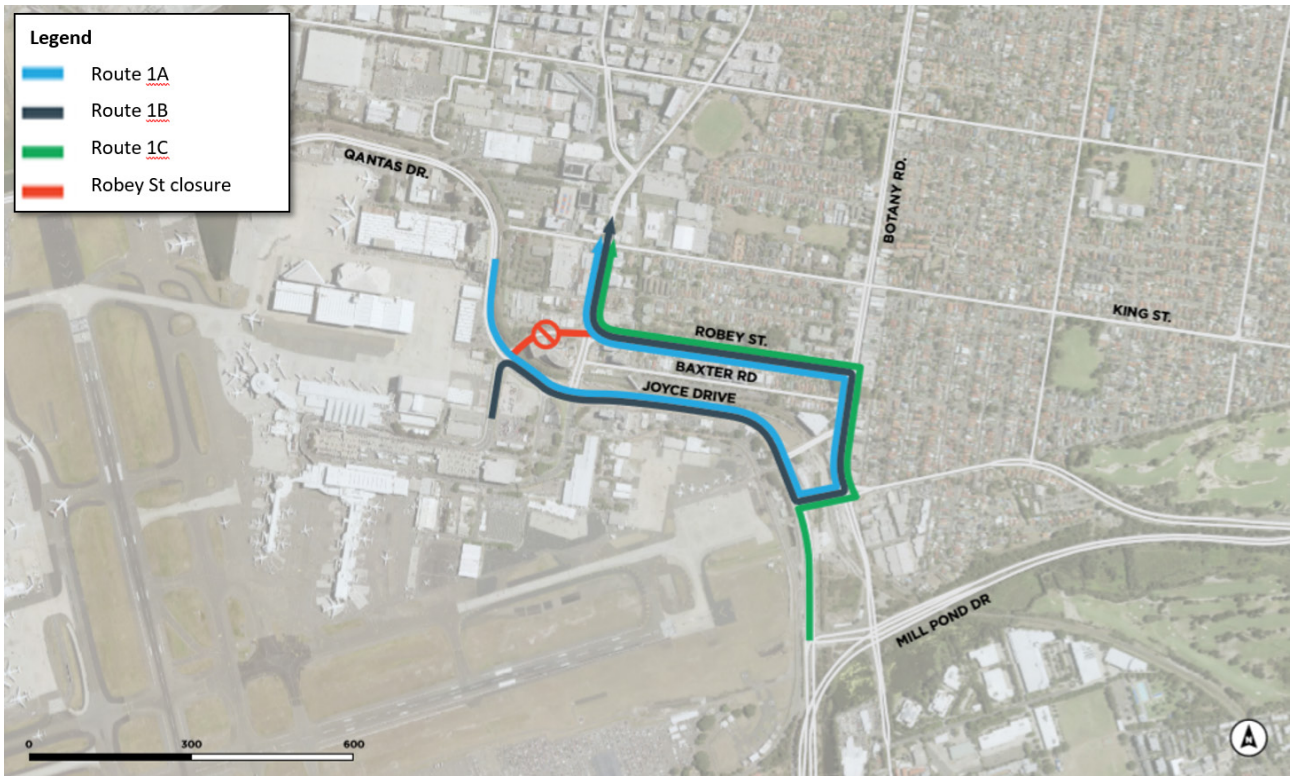

Figure 5.4 Key detour routes for Robey Street closure

The forecast 2022 Base and 2022 Robey Street closure traffic volumes at key intersections, along with the intersection SIDRA performance results are shown in Table 5.7.

This shift in traffic volumes due to the proposed detours would result in adverse impacts to the following intersections, with increased delays and intersection capacity exceeded:

- Qantas Drive/Robey Street (degree of saturation > 1.0, level of service F, average delay 193 seconds), compared to a degree of saturation < 1.0, level of service D and average delay of 52 seconds in base year.
- O'Riordan Street/Robey Street (degree of saturation > 1.0, level of service F, average delay 84 seconds), compared to a degree of saturation < 1.0, level of service C and average delay of 32 seconds in base year.
- General Holmes Drive/Wentworth (degree of saturation > 1.0, level of service F, average delay 82 seconds), compared to a degree of saturation < 1.0, level of service B and average delay of 23 seconds in base year.
- Botany Road/Wentworth Avenue (degree of saturation > 1.0, level of service F, average delay 186 seconds), compared to a degree of saturation < 1.0, level of service C and average delay of 40 seconds in base year.

For vehicles travelling along each of the key impacted routes (1A, 1B and 1C, as shown in Figure 5.4), the detours would result in the following increase in average travel times during the identified Sunday 1 pm–2 pm peak period:

- Detour route 1A: increase of 11.9 minutes
- Detour route 1B: increase of 19.5 minutes
- Detour route 1C: increase of 8.1 minutes.

As such, the average delay for vehicles using the road network during the proposed weekend closure of Robey Street is anticipated to be about 10 to 20 minutes during the Robey Street closure.

Table 5.7 Weekend peak intersection performance – Robey Street closure

Intersection	2022 Base				2022 Construction			
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Degree of saturation	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Degree of saturation
Qantas Drive/Robey Street								
Weekend peak	4920	52	D	0.97	4719	193	F	1.46
Qantas Drive/O'Riordan Street								
Weekend peak	5076	40	C	0.87	6049	36	C	0.80
O'Riordan Street/Robey Street								
Weekend peak	2645	32	C	0.71	2525	84	F	1.03
Robey Street/Botany Road								
Weekend peak	2449	19	B	0.55	3709	15	B	0.55
General Holmes Drive/Botany Road								
Weekend peak	2363	9	A	0.53	3664	<10	A	0.72
General Holmes Drive/Joyce Drive								
Weekend peak	3935	10	A	0.51	4921	<10	A	0.69
General Holmes Drive/Wentworth Avenue								
Weekend peak	4976	23	B	0.64	6160	82	F	1.10
Botany Road/Wentworth Avenue								
Weekend peak	3873	40	C	0.77	5175	186	F	1.39

Public transport

Bus route 400 and 420, which travels along Robey Street, between O'Riordan Street and Qantas Drive, during its outbound (eastbound) route would be directly impacted by the Robey Street weekend closures, requiring a detour to be implemented. Inbound (westbound) bus routes will not be detoured.

The bus detour routes considered for the proposed Robey Street closure are depicted in Figure 5.5. Description to the routes are provided below the image.

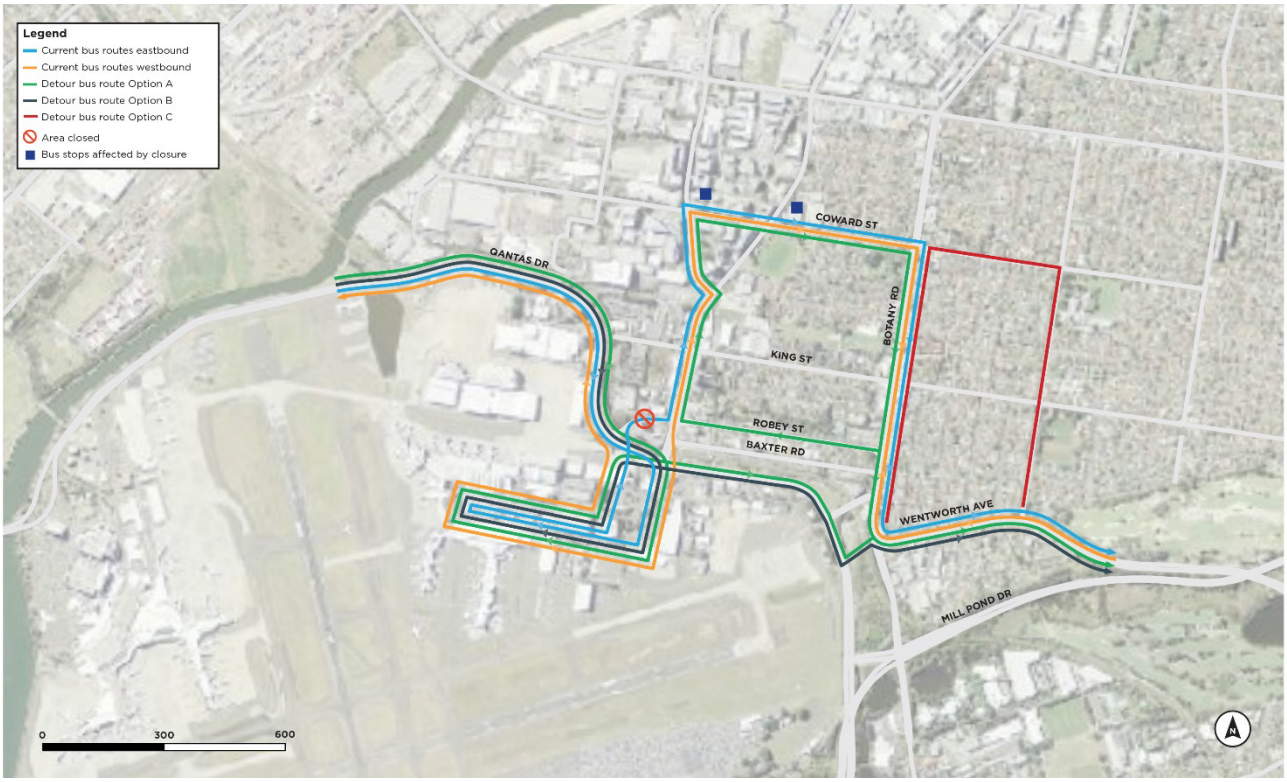

Figure 5.5 Robey Street closure – bus detour routes – 400 and 420

- **Option A – servicing all bus stops**: This option has been designed to ensure all existing bus stops will be serviced during the closure. Outbound bus services to follow the proposed detour route 1A in the eastbound direction, via Joyce Drive, General Holmes Drive, Wentworth Avenue, Botany Road, and Robey Street to O'Riordan Street. This route will result in approximately a two kilometre detour and buses will be subjected to the same delay as the general traffic, potentially reducing the on-time punctuality of the services.
- **Option B – priority for on-time running**: This option has been designed to provide a route which is would be more reliable for buses on-time running, and remove the two kilometre detour considered in Option A. The route will truncate the bus services through O'Riordan Street, Bourke Road, Coward Street and Botany Road. Instead, it would follow Joyce Drive and General Holmes Drive to continue its journey eastbound at Wentworth Avenue. In this option, the outbound stops on Coward Street and Botany Road will not be serviced, potentially compromising accessibility at the affected bus stops, which includes the Mascot town centre.
- **Option C – balancing on-time running and accessibility**: Route 400 and 420 provides key public transport access to Mascot town centre and its abutting developments, connecting it to strategic town centres such as Bondi Junction, Randwick and Burwood.

  This option has been developed to ensure services to the Mascot town centre on Botany Road is maintained, while selecting a route that is less impacted by the closure of Robey Street. The eastbound detour route will travel via Joyce Drive, General Holmes Drive, Botany Road, Coward Street, Sutherland Street before continuing its journey eastbound at Wentworth Avenue.

Bus services 400 and 420 to eastbound bus stops on Coward Street west of Botany Road, will be temporarily removed. However, access to these stops will not be compromised as bus patrons will be able to utilise route 307 (travelling between Mascot train station and Mascot town centre) to connect to bus route 400 and 420 on Botany Road.

Considering the available options above, it is considered that Option C is ideal for Route 400 and 420 during the day, where a balance of accessibility and on-time running are important. However, Option A would be more ideal for Route 420N, as it prioritises accessibility for all stops and is less likely to be affected by potential traffic congestion issues, due to the low background traffic at night time.

It is also noted that a bus stop currently exist on Robey Street (*stop number 202014*) between O'Riordan Street and Qantas Drive. This bus stop is used for the northbound service of route 305 (*Redfern to Mascot Stamford Hotel*) operational on weekdays only between approximately 6 am–9 am and 2:30 pm–6 pm. As such, this bus stop will not be affected by the proposed weekend road closure.

Routes M20, 303, 301, 307, 309, 310, L09, XO9, X10 all run along roads that are proposed as part of the Robey Street detour route. Therefore, these bus services would be affected to some degree by the delays as a result of congestion generated by the diversion away from Robey Street.

Active transport

There are no dedicated on-road cycle facilities on Robey Street, however a pedestrian footpath is provided on both sides of the road which would also be closed as a result of the road closure.

Pedestrians and cyclists would be diverted to Qantas Drive and O'Riordan Street as an alternate route to bypass the Robey Street closure. While this would increase trip distance (by approximately 100 metres), the overall impact is likely to be minimal. Appropriate signage would also be provided to ensure that pedestrians are appropriately directed to alternative pedestrian routes.

Point-to-point transport

Point-to-point transport modes (i.e. taxis, hire cars, tourist services and rideshare services) would be subject to the same road network delays and detours as general traffic, as described earlier in this Section. In particular, those trips to/from the Airport terminals would be subject to additional travel time, and therefore additional passenger costs.

Parking

There is no on-street parking on this section of Robey Street, therefore there is no parking impact resulting from the temporary road closure.

Temporary lane closures

There may be a need to implement traffic controller managed temporary lane closures on Robey Street to support safe and efficient access to the construction gates for larger vehicles and to allow for major construction activity such as installing cranes to build and remove bridge structure. If a traffic lane closure is required, it would reduce the mid-block capacity of the road, which may increase network congestion especially at the Qantas Drive / Robey Street intersection. Further information around such closures including timing and duration, would be provided by the appointed construction contractor to the relevant road occupancy approval authority.

O'Riordan Street closure

Proposed detour route

In consultation with Transport for NSW, three existing approach routes to the O'Riordan Street underpass were identified and an alternative detour route developed. The existing and proposed detour routes are described in the following and depicted in Figures 5.6 and 5.7.

- Route 2A:
  - **Existing route**: Southbound from O'Riordan Street, turning right into Qantas Drive.
  - **Detour Route**: Left turn onto Robey Street, right turn onto Botany Road, right turn into Wentworth Avenue, travel along General Holmes Drive or Joyce Drive.
- Route 2B:
  - **Existing route**: Southbound through movement from O'Riordan Street to Sir Reginald Ansett Drive.
  - **Detour Route**: Left turn onto Robey Street, right turn onto Botany Road, right turn into Wentworth Avenue, travel along General Holmes Drive/Joyce Drive, left turn into Sir Reginald Ansett Drive.
- Route 2C:
  - **Existing route**: Southbound from O'Riordan Street into Joyce Drive.
  - **Detour Route**: Left turn onto Robey Street, right turn onto Botany Road, right turn into Wentworth Avenue, left turn into General Holmes Drive for travel south.

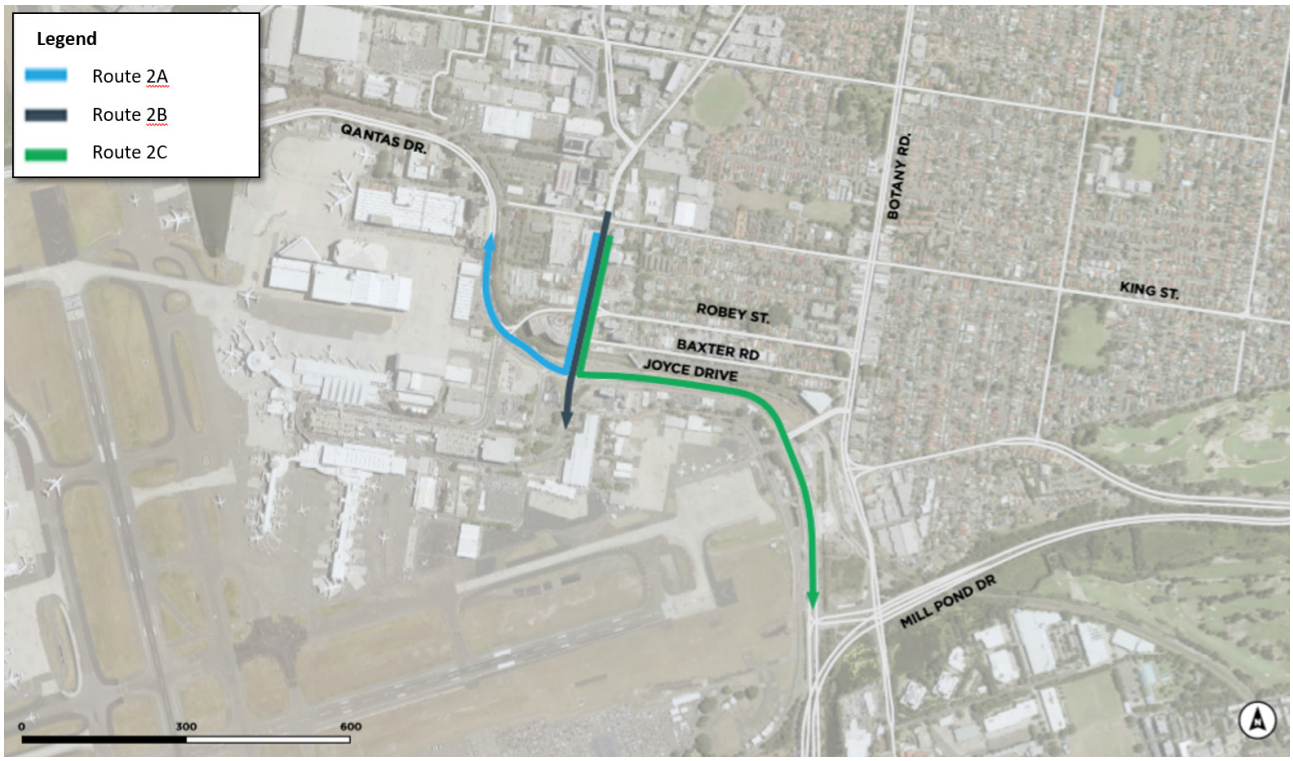

Figure 5.6 Impacted key routes for O'Riordan Street closure

Figure 5.7 Key detour routes for O'Riordan Street closure

The forecast 2022 Base and 2022 O'Riordan Street closure traffic volumes at key intersections, along with the intersection SIDRA performance results are shown in Table 5.8.

This shift in traffic volumes due to the proposed detours would result in adverse impacts to the following intersections, with increased vehicle delays and intersection capacity being exceeded:

- Robey Street/Botany Road (degree of saturation > 1.0, level of service F, average delay 74 seconds), compared to degree of saturation <1.0, level of service B and average delay of 19 seconds (in base year).
- Botany Road/Wentworth Avenue (degree of saturation > 1.0, level of service F, average delay 177 seconds), compared to degree of saturation <1.0, level of service C and average delay of 40 seconds (in base year).

For vehicles travelling along each of the key impacted routes (2A, 2B and 2C, as shown in Figure 5.7), the detours would result in the following changes in average travel times:

- Detour route 2A and 2B: increase of 9.9 minutes
- Detour route 2C: increase of 7.9 minutes.

The average delay for vehicles using the road network is anticipated to be about 10 minutes during the O'Riordan Street closure.

Table 5.8 Weekend peak intersection performance – O'Riordan Street closure

Intersection	2022 Base				2022 Construction			
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Degree of saturation	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Degree of saturation
Qantas Drive/Robey Street								
Weekend peak	4920	52	D	0.97	4532	51	D	1.00
Qantas Drive/O'Riordan Street								
Weekend peak	5076	40	C	0.87	4446	29	C	0.87
O'Riordan Street/Robey Street								
Weekend peak	2645	32	C	0.71	2137	15	B	0.58
Robey Street/Botany Road								
Weekend peak	2449	19	B	0.55	3145	74	F	1.01
General Holmes Drive/Botany Road								
Weekend peak	2363	9	A	0.53	3064	19	B	0.90
General Holmes Drive/Joyce Drive								
Weekend peak	3935	10	A	0.51	4266	9	A	0.59
General Holmes Drive/Wentworth Avenue								
Weekend peak	4976	23	B	0.64	5407	28	B	0.73
Botany Road/Wentworth Avenue								
Weekend peak	3873	40	C	0.77	4568	177	F	1.46

Public transport

Bus route 400 and 420, which travels along O'Riordan Street between Robey Street and Qantas Drive, in its inbound (westbound) route would be directly impacted by the O'Riordan Street weekend closures, requiring a detour to be implemented. Inbound (westbound) bus routes will not be detoured.

The bus detour routes considered for the proposed Robey Street closures are depicted in Figure 5.8. Description to the routes are provided below the image.

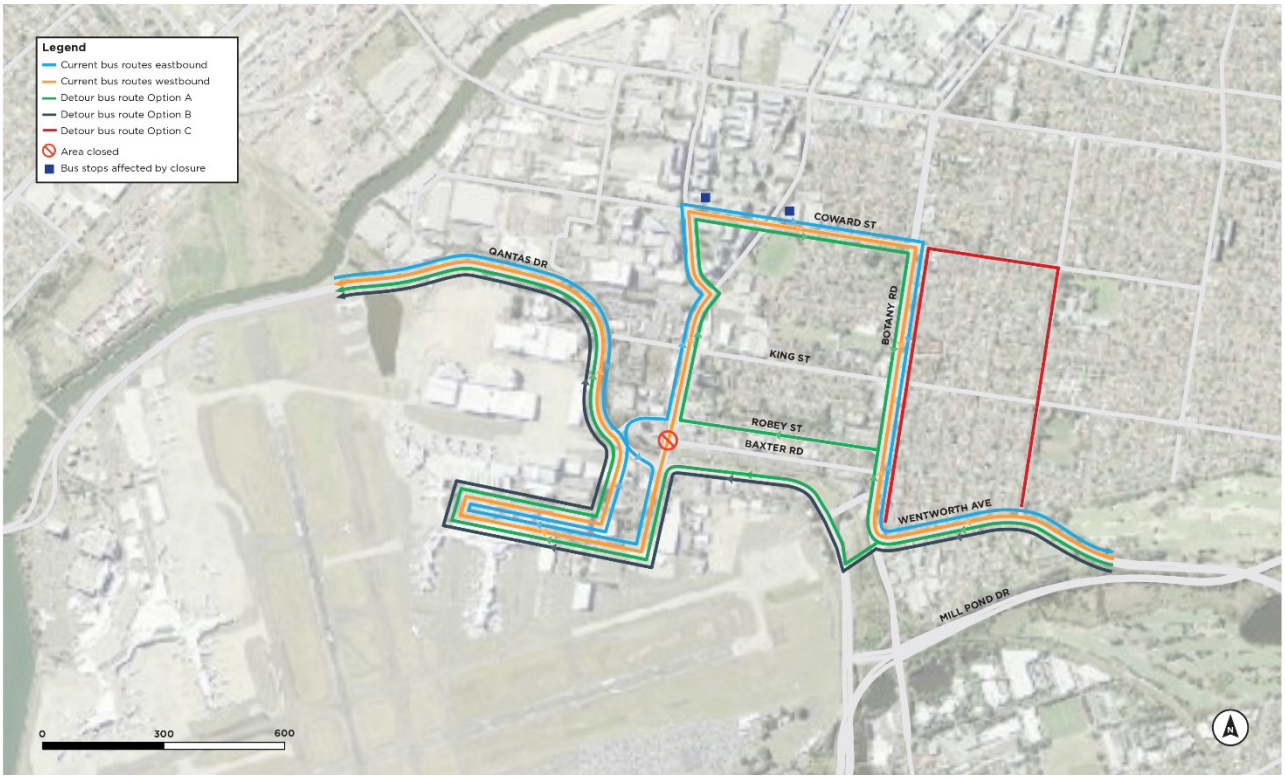

Figure 5.8 O'Riordan Street closure – bus detour routes for 400 and 420

- **Option A – servicing all bus stops**: This option has been designed to ensure all existing bus stops will be serviced during the closure. Inbound bus services to follow the proposed detour route 2B in the westbound direction, via Robey Street, Botany Road, Wentworth Avenue, General Holmes Drive and Joyce Drive, to the intersection of Joyce Drive–Qantas Drive–Sir Reginald Ansett Drive. This route will result in approximately a two kilometre detour and buses will be subjected to the same delay as the general traffic, potentially reducing the on-time running of the services.
- **Option B – priority for on-time running**: This option has been designed to provide a route which is would be more reliable for buses on-time running, and remove the two kilometre detour considered in Option A. The route will truncate the bus services through Botany Road, Coward Street and O'Riordan Street. Instead, it would follow Wentworth Avenue, General Holmes Drive and Joyce Drive to continue its journey westbound at Joyce Drive–Qantas Drive–Sir Reginald Ansett Drive intersection. In this option, the outbound stops on Coward Street and Botany Road will not be serviced by route 400 and 420, potentially compromising accessibility at the affected bus stops, which includes the Mascot town centre.
- **Option C – balancing on-time running and accessibility**: Route 400 and 420 provides key public transport access to Mascot town centre and its abutting developments, connecting it to strategic town centres such as Bondi Junction, Randwick and Burwood.

This option has been developed to ensure services to the Mascot town centre on Botany Road is maintained, while selecting a route that is less impacted by the closure of O'Riordan Street. The westbound detour route will travel via Sutherland Street, Coward Street, Botany Road, General Holmes Drive and Joyce Drive, before continuing its journey westbound at Joyce Drive–Qantas Drive–Sir Reginald Ansett Drive intersection.

Bus services 400 and 420 at westbound bus stops on Coward Street west of Botany Road, will be temporarily removed. However, access to these stops will not be compromised as bus patrons will be able to utilise route 307 (travelling between Mascot train station and Mascot town centre) to connect to bus route 400 and 420 on Botany Road.

Considering the available options above, it is considered that Option C is ideal for Route 400 and 420 during the day, where a balance of accessibility and on-time running are important. However, Option A would be more ideal for Route 420N, as it prioritises accessibility for all stops and is less likely to be affected by potential traffic congestion issues, due to the low background traffic at night time.

It is also noted that a bus stop currently exist on O'Riordan Street between Robey Street and Qantas Drive. This bus stop is used for the southbound service of route 305 (*Redfern to Mascot Stamford Hotel*) operational on weekdays only between approximately 6 am–9 am and 2:30 pm–6 pm. As such, this bus stop will not be affected by the proposed weekend road closure.

As per the Robey Street closure, routes M20, 303, 301, 307, 309, 310, L09, XO9, X10 all run along roads that are to be used as part of the O'Riordan Street detour route. Therefore, these bus services would be affected by the delays as a result of congestion generated by the diversion away from O'Riordan Street as noted in Table 5.8.

Active transport

The are no dedicated on-road cycle facilities on O'Riordan Street, however a pedestrian footpath is provided on both sides of the road which would also be closed as a result of the road closure.

Pedestrians and cyclists would be diverted to Qantas Drive and Robey Street as an alternate route to bypass the O'Riordan Street closure. While this would increase trip distance (by approximately 260 metres), the overall impact is considered to be manageable.

Point-to-point transport

Point-to-point transport modes (i.e. taxis, hire cars, tourist services and rideshare services) would be subject to the same road network delays and detours as general traffic, as described earlier in this Section. In particular, those trips to/from the Airport terminals would be subject to additional travel time, and therefore additional passenger costs.

Parking

There is no on-street parking on this section of O'Riordan Street, therefore there is no parking impact resulting from the temporary road closure.

Temporary lane closures

There may be a need to implement temporary lane closures on O'Riordan Street to support safe and efficient access to the construction gates for larger vehicles and to allow for major construction activity such as installing cranes to build and remove bridge structure. If a traffic lane is required to be closed, it may lead to a short duration reduction in mid-block capacity of the road, which may increase network congestion around the O'Riordan Street-Robey Street intersection and O'Riordan Street-Joyce Drive intersection. Further information around such closures including timing and duration, would be provided by the appointed construction contractor to the relevant road occupancy approval authority.

5.2.3 Road closure – Southern Cross Drive

Proposed road closure arrangement

There are three potential road closure arrangements for the Southern Cross Drive to correspond with the types of works required at the rail overpass at the Southern Cross Drive. Works are proposed generally with closure of the carriageway in one direction with an additional lane closure in the opposing direction. Full closure is not currently anticipated, however given that work in this area are subject to multiple constraints including approval for access within the OLS, it has been considered as a worst-case scenario. In all cases, the road closure period would be between 11 pm and 5 am to align with the airport curfew. Around six closures are anticipated across the three-year construction period in order to construct the new bridge.

The types of road closures proposed are discussed further in Table 5.9. It is anticipated that any required road closures would typically occur between Monday and Thursday, however there may be some periods where weekend closures are required (such as to align with a scheduled track possession period). As such, potential assessment of both weekday and weekend period impacts has been undertaken.

The detailed staging of the bridge works and the proposed staging will be developed by the construction contractor and is subject to approval by the roads authority.

This section details the impact which results from the three types of road closures proposed.

Table 5.9 Proposed road closure typology

	**Full road closure** This represents the worst-case scenario and will have the most impact to the road network. Both directions on the Southern Cross Drive will be impacted and traffic will be detoured via Wentworth Avenue and General Holes Drive or Joyce Drive to travel south-west bound or north-west bound respectively.
	**Eastbound carriageway road closure** The road closure proposes to occupy the entire eastbound carriageway and one westbound lane. Eastbound traffic on the Southern Cross Drive will be detoured Wentworth Avenue. The westbound carriageway will be operating at a reduced capacity.

Westbound carriageway road closure

The road closure proposes to occupy the entire westbound carriageway and one eastbound lane.

Westbound traffic on the Southern Cross Drive will be detoured via Wentworth Avenue. The eastbound carriageway will be operating at a reduced capacity.

Proposed detour route

The identified detour routes during the proposed closure of Southern Cross Drive in either direction are shown in Figure 5.9 below. The detour routes include:

- route between Southern Cross Drive from/to Sydney CBD and Qantas Drive/ Airport Drive in the north-west direction will be detoured via Wentworth Avenue–General Holmes Drive–Joyce Drive–Qantas Drive (shown as red dotted line in Figure 5.9)
- route between Southern Cross Drive from/two Sydney CBD and the M5 East in the south-west direction will be detoured via Wentworth Avenue–General Holmes Drive/M5 East (shown as blue dotted line in Figure 5.9).

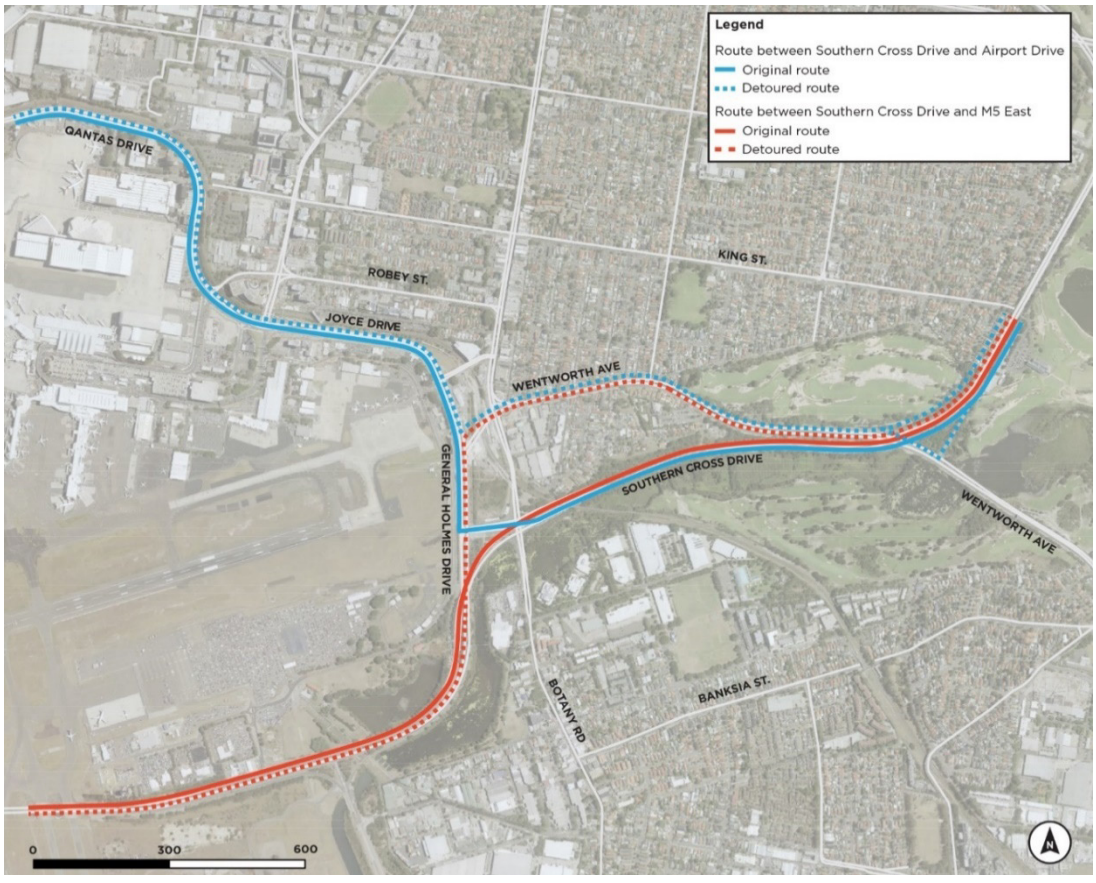

Figure 5.9 Proposed detour routes during Southern Cross Drive closure

Assessment of potential weekday closure

The highest night time one-hour traffic volume on Southern Cross Drive during the midweek period was recorded on Thursday between 11 pm and midnight, where flows on Southern Cross Drive reached 900 vehicles/hour and 400 vehicles/hour in the westbound and eastbound directions respectively. Although a higher bidirectional volume was observed on Wednesday between 4 am and 5 am, modelling has indicated that the westbound closure has a far more significant impact on network performance. Therefore, the one-hour volume for Thursday 11 pm to midnight was identified as the critical weekday period as the westbound flow was higher during this time period.

- Modelling results of the 2022 traffic condition the during critical weekday evening peak period 11 pm to midnight are summarised Table 5.10 with key findings as follows:
  - the six key intersections affected by the proposed closure currently operate satisfactorily, with the worst performing intersections (Mill Pond Drive/Botany Road) operating at a level of service B, not surpassing maximum desirable level of service D typically applied in NSW
  - a full-closure during this period will results in slight deterioration of road network performance, with level of service C forecasted at Mill Pond-Botany Road. However, the six key intersections affected by proposed closure would operate satisfactorily, achieving a level of service C or better
  - road closure impacting the eastbound carriageway and one westbound lane will result in slight deterioration of the road network performance. The existing level of service at the assessed intersections are generally able to be maintained.
- The most adverse travel time increase observed during full road closure is observed in the route travelling eastbound from M5 to Southern Cross Drive in the weekday period 11 pm to midnight. The current travel time of approximately 6.7 minutes will be increased to approximately 9.5 minutes, representing an increase of 42 per cent. Similar delay is also experienced in the closure of the westbound carriageway. The modelling results for the critical peak hour (11 pm-midnight) during the weekday night time period is tabulated in Table 5.11.

Table 5.10 Intersection performance comparison across all road closure scenario (weekday 11 pm-midnight)

ID	Intersection	No closure		Full closure			Eastbound carriageway closure			Westbound carriageway closure		
		Delay (s)	Level of service	Delay (s)	Level of service	Increased delay from 'no closure' (s)	Delay (s)	Level of service	Increased delay from 'no closure' (s)	Delay (s)	Level of service	Increased delay from 'no closure' (s)
1	General Holmes Drive–Wentworth Avenue	15	B	24	B	9	27	B	12	17	B	2
2	General Holmes Drive–Mill Pond Drive	16	B	18	B	2	19	B	3	17	B	1
3	Mill Pond Drive–Botany Road	28	B	42	C	14	31	C	3	35	C	7
4	Wentworth Avenue–Botany Road	20	B	22	B	2	23	B	3	22	B	2
5	Wentworth Avenue–Southern Cross Drive on-ramp	9	A	8	A	-1	9	A	0	9	A	0
6	Wentworth Avenue–Southern Cross Drive off-ramp	2	A	21	B	19	2	A	0	21	B	19

Table 5.11 Key route performance across all road closure scenario (11 pm-midnight on weekday)

Travel Time Route	No closure travel time	Full closure		Eastbound carriageway closure		Westbound carriageway closure	
	Travel time (minutes: seconds)	Travel time (minutes: seconds)	Increase from 'no closure' (%)	Travel time (minutes: seconds)	Increase from 'no closure' (%)	Travel time (minutes: seconds)	Increase from 'no closure' (%)
Airport Drive to Southern Cross Drive (citybound)	6:43	8:04	20%	7:49	16%	6:50	2%
Southern Cross Drive to Airport Drive (north-west bound)	7:03	7:51	11%	7:24	5%	7:49	11%
M5 West to Southern Cross Drive (citybound)	6:46	9:35	42%	9:33	41%	6:46	0%
Southern Cross Drive to M5 East (south-west bound)	7:20	9:24	28%	7:20	0%	9:19	27%

Assessment of potential weekend closure

Weekend night traffic volumes were higher than on any weekday evening. During the peak/critical hour (11 pm to midnight), the traffic volume on the Southern Cross Drive was in the order of 2,400 vehicles/hour and 900 vehicles/hour in the westbound and eastbound direction respectively. Friday was found to be the peak weekday period and during the critical hour it carries approximately 1,300 vehicles/hour and 780 vehicles/hour in the respective westbound and eastbound direction, indicating a lower traffic volume than the weekend periods.

- Modelling results of the 2022 traffic condition during the critical weekend evening peak period 11 pm to midnight are summarised in Table 5.12 with key findings as follows:
  - The six key intersections affected by the proposed closure currently operate satisfactorily, with the worst performing intersections (Mill Pond Drive–Botany Road and Wentworth Avenue–Botany Road) operating at a Level of Service C, not surpassing maximum desirable level of service D typically applied in NSW.
  - A full-closure during this period will adversely impact the performance of the network with level of service F observed at General Holmes Drive–Mill Pond Drive and Wentworth Avenue–Southern Cross Drive off-ramp; level of service E is found at General Holmes Drive–Wentworth Avenue.
  - Road closure impacting the eastbound carriageway and one westbound lane will result in slight deterioration of the road network performance, however still within the maximum desirable threshold of level of service D, which will be experienced at the worst-performing intersection (Wentworth Avenue–Botany Road). Other intersections will operate with acceptable level of service.
  - Road closure impacting the westbound carriageway and one eastbound lane will generally have higher impact to the road network. Wentworth Avenue–Southern Cross Drive off-ramp will operate at level of service F and Wentworth Avenue–Botany Road will operate at level of service E. A significant intersection delay of 354 seconds (approximately 6 minutes) on average will be experienced at the intersection of Wentworth Avenue–Southern Cross Drive off-ramp; this intersection currently operates at level of service A with an average delay of five seconds.
- Modelling results of the 2022 traffic condition during the second highest weekend peak hour of midnight to 1 am are summarised in Table 5.13 with key findings as follows:
  - The six key intersections affected by the proposed closure currently operate satisfactorily, with the worst performing intersection (Mill Pond Drive–Botany Road and Wentworth Avenue–Botany Road) operating at a Level of Service C, not surpassing maximum desirable level of service D typically applied in NSW.
  - A full-closure during this period will result in deterioration of the road network performance, with level of service F forecasted at Wentworth Avenue–Southern Cross Drive off-ramp forecasted. level of service D is forecasted at the intersection of General Holmes Drive–Wentworth Avenue and Wentworth Avenue–Botany Road.
  - Road closure impacting the eastbound carriageway and one westbound lane will result in slight deterioration of the road network performance. The existing level of service at the assessed intersections are generally able to be maintained.
  - Road closure impacting the westbound carriageway and one eastbound lane will have higher impact to the road network compared to the eastbound carriageway closure.
- Level of service D is forecasted at the intersection of Wentworth Avenue–Botany Road with an average delay of 42 seconds. This is an increase of one second from the baseline (no closure) operation.

  The worst performing intersection, Wentworth Avenue–Southern Cross Drive off-ramp, is forecasted to operate at level of service F with the average delay at the intersection estimated at 173 seconds (approximately 3 minutes), which is half the delay of those assessed in the period 11 pm–midnight. This level of service is not desirable and the average delay of 173 seconds is a significant increase for the 4 seconds assessed without any road closure.

Due to the declining traffic volume from mid-night onwards (see Figure 5.10), the traffic modelling assessment at this intersection noted that there would be a lower risk of residual demand, compared to the hours of 11 pm–midnight.

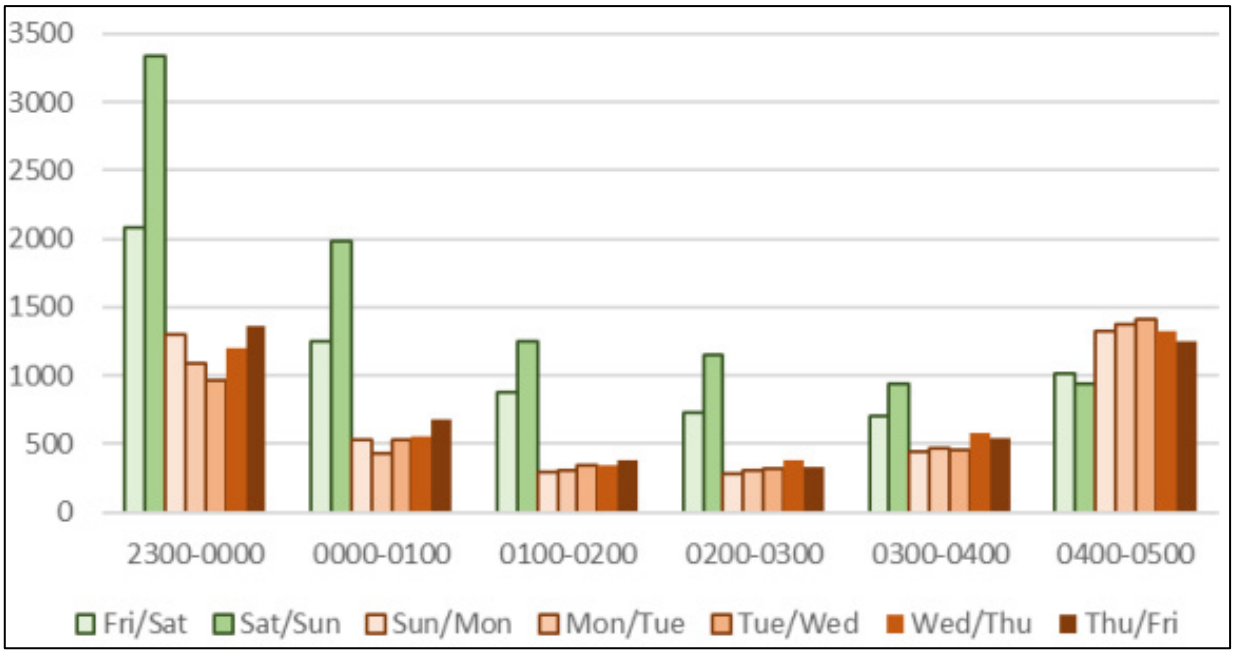

Figure 5.10 Southern Cross Drive – Traffic demand profile (11 pm–5 am)

- Impact to travel time of the key routes affected by the detour correspond with the findings of intersection performance above. The modelling results for the critical peak hour (11 pm to midnight) and the second highest peak hour (midnight to 1 am) during the weekend night time period are tabulated in Table 5.14 and Table 5.15 respectively. The key findings of the analysis are as follows:
  - All routes are expected to be subjected to increased travel time.
  - The most adverse travel time increase observed during full road closure is observed in the route travelling westbound from Southern Cross Drive to M5 in the weekend period 11 pm to midnight. The current travel time of approximately 7.5 minutes will be increased to approximately 19 minutes, representing an increase of 148%. Similar delay is also experienced in the closure of the westbound carriageway. Due to the higher traffic volume affected in the westbound direction, the closure of the westbound carriageway is considered to be the key driver of substantial delay experienced in the road network.

    During this period, closure of the eastbound carriageway will result in a slight increase in travel time. The worst increase is observed for the citybound route from M5 to Southern Cross Drive. This route will experience an increase from under 7 minutes to approximately 11 minutes.
  - In the second peak hour during weekend period (midnight to 1 am), the most adverse travel time increase observed during full road closure is observed in the route travelling westbound from Southern Cross Drive to M5. The current travel time of approximately 7.5 minutes will be increased to approximately 13.5 minutes, representing an increase of 86%. Similar delay is also experienced in the closure of the westbound carriageway. Due to the higher traffic volume affected in the westbound direction, the closure of the westbound carriageway is considered to be the key driver of substantial delay experienced in the road network.

    During this period, closure of the eastbound carriageway will result in a slight increase in travel time. The worst increase is observed for the citybound route from M5 to Southern Cross Drive. This route will experience an increase from under 7 minutes to approximately 11 minutes.

Table 5.12 Intersection performance comparison across all road closure scenario (11 pm-midnight on weekend)

ID	Intersection	No closure		Full closure			Eastbound carriageway closure			Westbound carriageway closure		
		Delay (s)	Level of service	Delay (s)	Level of service	Increased delay from 'no closure' (s)	Delay (s)	Level of service	Increased delay from 'no closure' (s)	Delay (s)	Level of service	Increased delay from 'no closure' (s)
1	General Holmes Drive–Wentworth Avenue	25	B	67	E	42	38	C	13	25	B	0
2	General Holmes Drive–Mill Pond Drive	24	B	75	F	51	28	B	4	16	B	-8
3	Mill Pond Drive–Botany Road	29	C	42	C	31	31	C	2	35	C	6
4	Wentworth Avenue–Botany Road	39	C	54	D	15	44	D	5	63	E	24
5	Wentworth Avenue–Southern Cross Drive on-ramp	11	A	12	A	1	11	A	0	10	A	-1%
6	Wentworth Avenue–Southern Cross Drive off-ramp	5	A	359	F	354	16	B	11	354	F	349

Table 5.13 Intersection performance comparison across all road closure scenario (weekend midnight-1 am)

ID	Intersection	No closure		Full closure			Eastbound carriageway closure			Westbound carriageway closure		
		Delay (s)	Level of service	Delay (s)	Level of service	Increased delay from 'no closure' (s)	Delay (s)	Level of service	Increased delay from 'no closure' (s)	Delay (s)	Level of service	Increased delay from 'no closure' (s)
1	General Holmes Drive–Wentworth Avenue	24	B	48	D	24	41	C	17	26	B	2
2	General Holmes Drive–Mill Pond Drive	23	B	24	B	1	26	B	3	14	B	-9
3	Mill Pond Drive–Botany Road	28	C	41	C	13	32	C	4	35	C	7
4	Wentworth Avenue–Botany Road	41	C	52	D	11	38	C	-3	42	D	1
5	Wentworth Avenue–Southern Cross Drive on-ramp	11	A	11	A	0	11	A	0	11	A	0
6	Wentworth Avenue–Southern Cross Drive off-ramp	4	A	141	F	137	15	B	11	173	F	169

Table 5.14 Key route performance across all road closure scenario (11 pm-midnight on weekend)

Travel Time Route	No closure travel time	Full closure		Eastbound carriageway closure		Westbound carriageway closure	
	Travel time (minutes: seconds)	Travel time (minutes: seconds)	Increase from 'no closure' (%)	Travel time (minutes: seconds)	Increase from 'no closure' (%)	Travel time (minutes: seconds)	Increase from 'no closure' (%)
Airport Drive to Southern Cross Drive (citybound)	6:32	8:47	34%	8:46	34%	8:54	36%
Southern Cross Drive to Airport Drive (north-west bound)	7:41	17:15	124%	9:41	26%	17:39	130%
M5 West to Southern Cross Drive (citybound)	6:48	15:30	128%	10:58	61%	9:16	36%
Southern Cross Drive to M5 East (south-west bound)	7:32	18:42	148%	10:14	36%	19:18	156%

Table 5.15 Key route performance across all road closure scenario (midnight–1 am on weekend)

Travel time route	No closure travel time	Full closure		Eastbound carriageway closure		Westbound carriageway closure	
	Travel time (minutes: seconds)	Travel time (minutes: seconds)	Increase from 'no closure' (%)	Travel time (minutes: seconds)	Increase from 'no closure' (%)	Travel time (minutes: seconds)	Increase from 'no closure' (%)
Airport Drive to Southern Cross Drive (citybound)	6:35	8:57	36%	8:43	32%	9:11	40%
Southern Cross Drive to Airport Drive (north-west bound)	7:39	11:40	52%	9:39	26%	12:18	61%
M5 West to Southern Cross Drive (citybound)	6:44	11:16	68%	10:49	61%	9:09	36%
Southern Cross Drive to M5 East (south-west bound)	7:20	13:41	86%	9:58	36%	14:10	93%

Public transport

Rail services

The road closure location on Southern Cross Drive is not within the vicinity of passenger rail lines, as such presenting no impact to the passenger rail network.

Bus services

There are currently no bus services on Southern Cross Drive, as such the road closure will not directly impact any bus services.

Bus services however are currently available on Wentworth Avenue, which is the detour routes for the proposed road closure.

According to Transport for NSW information website, regular bus service 400 and 420 conclude their service approximately around mid-night and 1 am respectively. Route 420N (night service), however continues to service the route, arriving hourly between 1 am to 5 am.

Buses may experience slight delay through the proposed detour route, during the implementation of road closure.

Active transport

The are no dedicated pedestrian or bicycle facilities on the Southern Cross Drive.

As noted in Section 4.3.7, bicycle groups have been observed to travel on the Southern Cross Drive. The bicycle ride however is typically done during daylight, outside of the proposed road closure period. However, this does not preclude any on-road bicycle access, cyclists will be detoured in the same manner as motorised vehicles.

Through liaison with the appropriate bicycle groups, it is considered that the proposed impact to the active transport mode in general is minimal.

Taxi transport

Point-to-point transport modes (i.e. taxis, hire cars, tourist services and rideshare services) would be subject to the same road network delays and detours as general traffic, as described earlier in this Section. However, as the major attractor/generator for point-to-point transport mode (Kingsford Smith Airport) will not be operating during the proposed road closure period, the impact to this mode is considered minimal.

Parking

All parking will be contained within the work site, presenting no impact to the surrounding roads.

5.3 Operational impact assessment

As described previously, the primary driver of the project is to support improved rail efficiency to and from Port Botany and enable more freight to be moved by rail to meet expected increases in freight demands over the long term.

Following completion of construction, the project is not expected to result in any permanent changes to the existing road network, pedestrian footpaths or bus networks. There would be no impacts during operational period given the project lies within the existing rail corridor which was allocated with the intent of duplication in the future. In addition, the project would not preclude the establishment of any new active transport corridors outside or adjacent to the current rail corridor.

The duplication of the Botany Line would unlock additional rail network capacity (with improved travel times through the Botany Line), resulting in a potential increase in the number of freight rail services supporting the movement of goods. By 2030, the Botany Duplication Project is expected to allow for increased freight movement on the Botany Line from the current average of about 20 trains per day (per direction) up to around 45 trains per day (per direction) by 2030, based on current and predicted operational requirements identified by ARTC.

The project also presents an opportunity to encourage a shift of freight transport from road towards rail. The increased rail capacity also has the potential to reduce the number of number of trucks in the region This would also support a potential reduction in the rate of growth in truck movements and associated traffic congestion around Sydney Airport and Port Botany. The reduction of heavy vehicle traffic on the road network would not only free up capacity for general traffic, it also has the potential to provide road safety advantages. Based on the data available in the NSW Freight and Ports Plan 2018–2023, the provision of a single 600-metre long freight train is roughly equivalent to the haulage capacity of around 54 trucks.

While overall there may not be any noticeable decrease in congestion levels on the road network, the cost of freight movement may decrease as freight is shifted from a mode which can be severely impacted by road network congestion to another which has no interaction with other modes. The increased efficiency of the existing rail line as a result of the project would be a vital part of the solution to encourage freight to be transported by rail, reducing the need to transport freight by road and therefore overall congestion on the roads around Port Botany and Sydney Airport.

5.4 Cumulative impacts

Cumulative construction traffic, transport and access impacts may occur if construction on the project occurs at the same time as construction on other nearby projects. Table 5.16 summarises the potential projects which are expected to commence during the construction of the project or there would be some cumulative construction traffic, transport and access impacts.

Table 5.16 Summary of cumulative construction traffic, transport and access impacts

Project	Potential cumulative construction traffic, transport and access impacts
Sydney Gateway road project	Construction of the Sydney Gateway road project is likely to increase the overall level of traffic using the existing road network, increasing the potential impact and duration of the traffic delays and other impacts experienced by drivers and pedestrians/cyclists.
WestConnex Stage 3a (the M4–M5 Link)	The opening of WestConnex Stage 3a (the M4–M5 Link) would have notable network impacts, which is proposed to begin in late 2022, and which coincides with the project's bridge construction works at Robey Street, O'Riordan Street and Southern Cross Drive. Construction of the two projects would have the potential to result in increases to general traffic in the local area. Additionally, should the two projects not overlap directly, increased traffic fatigue may still be experienced by drivers and pedestrians/cyclists.
Airport North and Airport East upgrades	It is anticipated that both the Airport North and Airport East upgrade projects would be completed when the construction of the project begins. However, while not directly overlapping, construction fatigue from ongoing increases in traffic levels (as a result of ongoing construction works) may be experienced by drivers and pedestrians/cyclists.
F6 Extension – Stage 1	Should construction of this facility overlap with construction of the project, the increase amount of traffic between the two projects may result in increases to the overall level of traffic within the vicinity of the project (in particular at the western end of the project site).

Where more than one project occurs in the same area consecutively, there may also be a combined effect from the increased duration of impacts on nearby receivers. This effect is termed ‘construction fatigue’. There is the potential for construction traffic fatigue for drivers and pedestrians/cyclists who currently utilise the local road network. This is due to several consecutive and ongoing projects in the area including Airport East, Airport North, Sydney Gateway road project and the currently proposed project.

The 2022 future baseline assessment carried out to as part of the overall modelling package for Sydney Gateway. The modelling assumes both Airport North and Airport East upgrade projects are completed when the construction of the Botany Rail Duplication project begins. However, the Sydney Gateway project will be under construction simultaneously with the Botany Rail Duplication.

Road closures of Robey Street and O’Riordan Street would require traffic detours at the following intersections, estimated to occur up to 10 times over three years:

- Qantas Drive/Robey Street/Seventh Street where the Level of Service would deteriorate from D to F with an increase in delay of 142 seconds
- General Holmes Drive/Wentworth Avenue where the Level of Service would deteriorate from B to F with an increase in delay of 59 seconds
- Botany Road/Wentworth Avenue where the Level of Service would deteriorate from C to F with an increase in delay of 146 seconds (due to performance changes due to the Robey or O’Riordan Street closure during a weekend works period).

WestConnex is an ongoing scheme currently being rolled out to deliver improvements to the M4 and M5 motorways and would support improved connections to the Sydney Airport. The modelling that was completed for Sydney Gateway also considers the proposed construction staging (and opening) of the WestConnex project.

The proposed opening of WestConnex Stage 3a (the M4–M5 Link) would have notable network impacts with the construction of the T2/T3 viaduct, which is proposed to begin in late 2022, and which coincides with the project’s bridge construction works at Robey Street, O’Riordan Street and Southern Cross Drive.

6. Management of impacts

This section of the report addresses the management of impacts on the road network associated with the construction of the project as required in the SEARs shown in Table 2.1. In particular, the following have been addressed:

- demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies)
- detail how likely impacts that have not been avoided through design would be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant)
- detail how any residual impacts would be managed or offset, and the approach and effectiveness of these measures.

This section describes the recommended mitigation measures for the construction of the project. As there will be inevitable delays resulting from many of the construction works, recommended measures to mitigate the impacts of the activities have been recommended.

6.1 Approach

During construction there would be inevitable road network delays within the project area. However, it is possible to reduce the impacts through a number of mitigation measures. Key to this would be the development of a Construction Transport, Traffic and Access Management Plan (CTTAMP) as part of the Construction Environmental Management Plan. The CTTAMP would include the guidelines, general requirements and principles of traffic management to be implemented during construction. It would be prepared in accordance with Austroads Guide to Road Design (with appropriate Transport for NSW supplements), the Roads and Traffic Authority *Traffic Control at Work Sites* manual and AS1742.3: *Manual of uniform traffic control devices – Part 3: Traffic control for works on roads*, and any other relevant standard, guide or manual. It would seek to minimise delays and disruptions and identify and respond to changes in road safety as a result of project construction works.

The overarching strategy of the CTTAMP would be to:

- ensure all stakeholders are considered during all stages of the project
- provide safe routes for pedestrians and cyclists during construction
- develop project staging plans in consultation with relevant traffic and transport stakeholders, which would include measures to manage impacts during special events (such as sporting events)
- plan and stage works to minimise the need for road occupancy, where possible
- minimise the number of changes to the road users' travel paths and, where changes are required, implement a high standard of traffic controls which effectively warn, inform and guide
- comprehensively communicate changes in traffic conditions on roads or paths to emergency services, public transport operators, other road user groups and other affected stakeholders
- identify measures to manage the movements of construction-related traffic to minimise traffic and access disruptions in the public road network
- minimise the use of local roads by the project's heavy vehicles and identify haulage routes
- stage the construction works on key parts of the network to enable these key roads to continue to function with as minimal impact as possible.

The CTTAMP would outline a process to develop site-specific Traffic Management Plans in consultation with Transport for NSW. Part of this process would be to facilitate relevant licenses and permits for road occupation.

The recommended CTTAMP construction-phase mitigation measures are described below.

6.2 Road network impact of heavy vehicles

This section details the mitigation measures proposed to minimise the impact of the typical arrangement of construction site access and gate locations, the temporary closure of Robey Street and O'Riordan Street, and the temporary closure of Southern Cross Drive.

In all cases, it is recommended that a Traffic and Transport Liaison Group (TTLG) is set up with the relevant stakeholders to provide a forum to communicate implementation of the Construction Transport, Traffic and Access Management Plan (CTTAMP). These include existing and upcoming traffic issues, and any scheduled road closures proposed as part of the Project. Stakeholders may include ARTC, Transport for NSW, local councils, emergency vehicles, and representatives from relevant Chamber of Commerce.

6.2.1 Typical construction stage

While the day-to-day construction activities were shown to have minimal impact on the operation of the road network (as the overall increase in traffic was less than 2.6 per cent at any key intersection), there are likely to be some localised impacts in the vicinity of some of the site access gates due to the movement of heavy vehicles.

The following mitigation measures should be considered to avoid the impact of the heavy vehicle movements in vicinity of the site gates:

- **Suitably designed construction site accesses and traffic management** to implement safe management of vehicles, pedestrians, public transport, and emergency vehicle accesses through, around or approaching the construction sites. This encompasses design consideration in line with road design guidelines, conspicuous temporary regulatory, warning and guide signs, and use of accredited traffic controllers where appropriate. As part of the site access design, deceleration lanes may be considered at accesses abutting high-trafficked roads; this includes Qantas Drive north of the intersection with Robey Street, Botany Road south of Southern Cross Drive and Mill Pond Drive east of Botany Road. The design criteria and location will be determined through design development and in consultation with the roads authority.
- **Time limitations for heavy vehicles:** Consider hauling materials in the off-peak to and from sites where the gates are accessed from busy roads. The recommended gates are 12, 13, 20, F1 F2, F3, F4, F5, F6 and F7. Where this is not feasible, the access to these gates between 7.00–9.00 am and 4.00–6.00pm by heavy vehicles should be minimised. Heavy vehicles accessing gates 7, 8, 9, and 10 should be limited to non-peak times to reduce the impact of these vehicles on the residential streets (Banksia Street and Morgan Street), particularly the impact on the safety of local residents.
- **Actively collaborate and inform relevant stakeholders** (roads authority, emergency services and public) of the construction activities proposed affecting the road network, the likely impact and mitigation measures in place. Information may be communicated through temporary and permanent Variable Message Signs (VMS), media advertisements, electronic mails and letter drop-off.
- **Actively monitor the performance of the road network** during road closures and record any improvements which could be actioned to further minimise the impact to the road network.

6.2.2 Road closures – Robey Street and O'Riordan Street

The alternating weekend closures of Robey Street and O'Riordan Street would have a notable impact on the road network due to the extent of the diversions required (as shown in Figures 5.3 and 5.6). To assist in reducing the impacts of the weekend closures, the following mitigation measures should be considered:

- **Manage closures in off-peak periods**: to minimise the operational impact of the road closure to the road network, Robey Street and O'Riordan Street road closures will be carried out on weekends where the traffic volume is more subdued.
- **Information exchange**: ARTC would coordinate with Transport for NSW to inform the public of proposed road closures, well in advanced, to change travel behaviours within the study area and discourage use of motor vehicles during road closure. Information would include: timings of road closures, detour routes, available public transport options and other changes to the transport network resulting from construction activities. This information would be of critical importance when addressing the potential impact to travellers headed to the domestic and international airport terminals for outbound flights.
- **Consultation with Transport for NSW and bus operators** to minimise the impact of bus detour to the punctuality of bus services in the area and accessibility of public transport to the community. Bus route detour options have been discussed in Section 5.2.2, which will require further consultation with the relevant stakeholders. Appropriate signs and information sheets at the affected bus stops and routes are to be provided during the closures, to ensure bus patrons and the community are aware of the proposed temporary changes.
- **Implement suitable traffic management** during the road closure to ensure motorists are aware at the approaches to the work site and are managed appropriately around the work site. This would be detailed further in the Construction Transport, Traffic and Access Management Plan (CTTAMP) and will consider items including Traffic Control Plans (TCP), heavy vehicle movement plans (VMP) and pedestrian and bicycle management plan (PMP).

6.2.3 Road closure – Southern Cross Drive

Detour as described in Section 5.2.3 will be required during Southern Cross Drive temporary closure. To assist in minimising the impacts of the road closures, the following mitigation measures should be considered:

- **Manage closures and implementation of detour routes in off-peak periods**: to minimise the operational impact of the road closure to the road network, Southern Cross Drive road closures will be carried out at night, where the traffic volume is more subdued.

  Traffic modelling done to analyse the impact of the Southern Cross Drive closure to the road network revealed that a full road closure during the critical peak periods (11 pm–midnight) of the proposed 11 pm–5 am closure will adversely impact the performance of the road network with level of service (LOS) F expected at key intersections. Full road closure outside of this critical period however indicate a more acceptable increase in delay, with the worst performing intersection not exceeding the maximum desirable threshold of LOS D.

  Half road closure of the eastbound carriageway presents least impact with the worst performing intersection not exceeding LOS D. As such, implementation of a half-road closure should be considered at the commencement of the proposed closures to minimise impact to the road network.
- **Actively collaborate and inform relevant stakeholders** (roads authority, emergency services and public) of the construction activities proposed affecting the road network, the likely impact and mitigation measures in place. Information may be communicated through temporary and permanent Variable Message Signs (VMS), media advertisements, electronic mails and letter drop-off.

- **Implement suitable traffic management** during the road closure to ensure motorists are aware at the approaches to the work site and are managed appropriately around the work site. This would be detailed further in the Construction Transport, Traffic and Access Management Plan (CTTAMP) and will consider items including Traffic Control Plans (TCP), heavy vehicle movement plans (VMP) and pedestrian and bicycle management plan (PMP).
- **Monitoring of the traffic conditions**, including queueing and travel time at the intersection of Southern Cross Drive off-ramp at Wentworth Avenue should be done during closure to ensure that it does not result in undesirable impacts to the community and motorists.

  Mitigation measures, which may need to be considered further in the project, would include:

  - phase time and cycle time adjustments at the intersection of Wentworth Avenue–Southern Cross Drive off-ramp, with a view to favour green time for the detour
  - where additional queueing capacity is required, the Southern Cross Drive off-ramp which is 7 metres wide may be divided into 2 x 3.5 metres lanes, with a reduction in approach speed
  - consider temporary localised geometrical adjustment to the intersection during construction to increase the capacity of critical approaches to the intersection.

6.3 Parking management

The indicative car parking supply within the main construction compound (General Holmes Drive and Banksia Street) and work sites would be less than expected workforce. Therefore, it is recommended that the construction contractor(s) manage the parking demand without utilising on-street parking facility, including preparation of parking spaces and developing the CTTAMP. The CTTAMP should cover that the construction contractor would review the available parking at compound sites and predicted workforce. In the event the parking demand exceeds supply, the contractor may seek alternative off-street parking locations. For those works site with a limited parking space, it is envisaged that carpooling and/or construction company operated shuttle bus services would be provided to transfer the construction workforce between construction compounds.

As the existing on-street parking around compounds and work sites will be restricted for the workforce to use, it is anticipated that there would be limited impact upon parking for local residences and businesses during construction of the project.

6.4 Public transport

The CTTAMP would identify procedures to consult with Transport for NSW in the planning of weekend road closures. This would aim to identify potential opportunities for alternative detours for buses and ensure commuters are informed. The approach to informing passengers would consider:

- notification of the potential impacts to bus travel times, in particular for those routes that provide bus-rail connections, or service the International and Domestic terminals. These notifications could include social media, print media, local area newsletter drops etc.
- information posted at bus stops along affected routes regarding potential impacts, as well as on the buses themselves
- information on alternate travel options available (train, walking, cycling, car-share etc.).

6.5 Active transport

As part of the CTTAMP, traffic management measures would be required to provide safe access for pedestrians and cyclists in vicinity of the construction access gates. Where no alternate option is available, manned control of pedestrian and cyclist access across the gates during construction vehicle access/egress should be considered.

During the construction phase of the project a slight increase in construction traffic on the road network would occur. Project communications should include a focus on the need for pedestrians and cyclists to be aware of the increased traffic presence when crossing roads in local areas, particularly along Banksia Street and Morgan Street.

To ensure safe travel for pedestrians and cyclists, the CTTAMP should consider:

- appropriate sight lines where existing paths deviate due to work sites
- management of movements across work sites and access gates
- provision of accredited traffic controllers at the construction gates.

6.6 Residual impacts

Despite the measures introduced in Section 6.2 through to Section 6.5, there would likely be some residual impacts associated with the construction of the project. This would include delays along the key routes within the study area as well as at key intersections during road closure periods. Some delays may also result from general construction traffic and haulage accessing the main construction compounds and satellite work sites.

The CTTAMP would include measures to reduce the impacts, however there may be some residual impacts that cannot be avoided.

6.7 Management of cumulative impacts

Key mitigation measures to assist with the management of cumulative impacts associated with the Botany Rail Duplication project, WestConnex and the overall Sydney Gateway project should include:

- **Construction Programming:** ongoing review of the construction programs for key projects to identify potential high-risk timeframes, and where possible amend scheduling to reduce the likelihood of large scale activities overlapping. This is particularly relevant for the proposed opening of the various WestConnex stages.
- **Travel Demand Management:** as indicated in Section 6.2.2, strategies which encourage changes in travel behaviour within the study area, should be developed as part of the information exchange between ARTC and Transport for NSW. This is particularly relevant during times of increased impacts resulting from construction (such as during temporary road closures).

6.8 List of mitigation measures

The recommended traffic and transport mitigation measures are listed in Table 6.1.

Table 6.1 Mitigation measures

Stage	Impact	Measure
All	Detailed	Implementation of Construction Transport, Traffic and Access Management Plan (CTTAMP). As a minimum, the Plan will include: ■ identification of haulage routes ■ notification and consultation strategy with public and relevant authorities/stakeholders ■ special event and emergency services management ■ parking restrictions ■ protocol for monitoring cumulative traffic impact. The Plan would not be created for enabling works, however the relevant mitigation measures will form part of the Site Environmental Management Plans.
Construction – typical	Localised vehicular, pedestrian, cyclists and public transport management around site accesses	Provide suitably designed construction site access which would consider: ■ road design guidelines ■ conspicuous temporary regulatory, warning and guide signs ■ Use of accredited traffic controllers where appropriate ■ Provision of deceleration lanes at accesses abutting highly trafficked roads.
	Increased of heavy vehicles in the road network	■ Administrative control to limit truck activities during peak periods. ■ Implement radio communication and designated truck idling areas to minimise impact of truck queuing on public roads. ■ Temporary traffic controls.
	On-street parking management	■ Maximise parking at each site and compound. ■ Encourage carpooling/cycling/public transport. ■ Shuttle buses between off-site parking locations. ■ Shuttle buses between the two main on-site compounds and smaller construction compounds.
	Public transport services travel time	■ Notification to service providers and public. ■ Changes to services during possessions.
	Active transport facility closures and diversions	■ Ensure appropriate detours such as maintaining access on at-least one side of the road. ■ Provide safe access across site gates.
Construction – road closures	Reduced accessibility on the road network Detour can result in increased travel time	■ Manage closures during off-peak periods. ■ Select a bus detour route that would minimise impact to punctuality of bus services and minimise public transport accessibility impact to the community. ■ Implement suitable traffic management during closures to manage and guide motorists at the approaches and through or around the work sites. ■ Public information campaigns. ■ Truck travel time management.
Cumulative impacts	Construction programming	■ Coordinate with ongoing projects.

7. Conclusion

This report has assessed the traffic and transport impacts of the project during construction to address the requirements of the SEARs outlined in Section 2.2.

Overall, the project will have no negative impact on the road network upon completion. The project would improve the efficiency of the rail network and may have a secondary impact on the reduction of trucks travelling to Port Botany.

During construction of the project there would be inevitable delays in the road network within the project area. However, it is possible to reduce the impacts of this through the implementation of recommended mitigation measures, which are provided in this report. Key to this is the development of a CTTAMP, as part of the Construction Environmental Management Plan. The CTTAMP would be developed by the contractor once the construction staging and required activities are finalised.

7.1 Construction activities

Construction of the project is anticipated to take three years, starting in late 2020 and finishing in late 2023. The construction strategy focuses on the need for the construction to occur safely and efficiently while minimising impacts on the community and users of the road network. Construction activities that impact traffic and transport are bridge works at Robey Street, O'Riordan Street and Southern Cross Drive, and enabling works within the project site.

7.2 Construction methodology

The methodology used for the assessment of the project's construction impacts on the road network is described below. For this assessment, the construction activities have been defined as:

- typical construction which includes day-to-day construction activities that would occur throughout the duration of the project (such as haulage of materials, transport of construction workforce)
- temporary road closures which refer to the occasional road or lane closures during construction to support construction activities such as bridge works at Southern Cross Drive, Robey Street and O'Riordan Street.

The project's construction activities are assessed as follows:

- a **qualitative** assessment of ''typical' construction stages. Construction vehicle activity during these periods would be low and therefore a qualitative assessment is appropriate. These activities would occur over an extended duration of time (2021 to 2023).
- a **quantitative** assessment of 'Temporary road or lane closure' construction stages. These activities have been comprehensively quantified and assessed using detailed traffic modelling.

7.3 Construction impacts

The project's construction impacts are:

- Robey Street and O'Riordan Street bridge include 54-hour weekend road closures that will occur 10 times over the three-year construction program (with no concurrent closures of Robey Street and O'Riordan Street). Proposed detour routes have been identified to divert traffic around the closures. Key intersections along these routes were modelled with the following impacts identified:
  - reduction in the level of service at key intersections
  - increased travel times
  - impacts on bus travel times and bus stops.
- Bridge works on the Botany Line overpass at Southern Cross Drive bridge will require road closures between 11 pm–5 am to coincide with the airport curfew and to minimise impact to the road network. Six major closures are anticipated on the Southern Cross Drive throughout the Project's construction period. Proposed detour routes have been identified to divert traffic around the closures.

  Traffic modelling carried out for a full road closure at the commencement of weekend road closure period (i.e. 11 pm–midnight), indicates an unacceptable deterioration of the road network. However, there is less impact with the implementation of a half road closure.

  A full road closure during the critical weekday night time period (i.e. Thursday 11 pm–midnight) will result in a slight deterioration of the road network performance. However, the existing level of service at the assessed intersections are generally able to be maintained.

  As such, implementation of a full road closure during the weekday night time period or a half-road closure during the weekend night time period should be considered as the default position when planning for the proposed closures to minimise impact to the road network.
- Minor impacts from the movement of construction vehicles on the road network.

7.4 Mitigation measures

To minimise the impact of construction activities on the community and users of the road and transport networks, the following mitigation measures are recommended:

- developing communication plan with relevant stakeholders and form a Traffic and Transport Liaison Group (TTLG) to include relevant stakeholders as a forum to communicate existing and upcoming traffic issues, and any scheduled road closures proposed as part of the Project
- creating an overarching Construction Transport, Traffic and Access Management Plan (CTTAMP) as part of the Construction Environmental Management Plan outlining the road design guidelines, general requirements and traffic management using accredited traffic controllers where appropriate
- developing a set of measures to minimise the impact of heavy vehicle movements:
  - provision of deceleration lanes at accesses abutting highly trafficked roads
  - administrative control to limit truck activities during peak periods
  - implement radio communication and designated truck idling areas to minimise impact of truck queuing on public roads
  - providing temporary traffic controls
- maximise parking at each compound site, encourage carpooling and public transport and provide shuttle buses between off-site parking locations
- providing a series of mitigation measures during full road closures (weekends and overnight), including public information campaigns to advise of closures and alternative transport options
- alternating the weekends when Robey Street and O'Riordan Street will be closed.

Appendix A
Significant construction impacts

A1. Significant construction impacts

The following table provides an overview of the construction impacts at each access gate. The total amount of construction traffic per hour during the AM and PM peaks, both entering and exiting through each gate has been identified in order to determine the significance of the impact that the construction vehicles would have on the adjacent roads and intersections. The impacts are classified as ‘low’, ‘medium’ and ‘high’. Of the 21 access points identified, 11 would have a low impact, three would have a medium level impacts and seven would have a high impact.

The significance of these impacts is evaluated based on distance to key intersections, background traffic volumes and the potential to impact traffic at the key intersections. Each intersection has been evaluated using these criteria. Based on the evaluation, specific comments related to impacted intersections have also been included in the table.

Table A-1 Identified impacts of construction access gates on the adjacent roads and intersections and significance of impacts

Gate description	Total construction traffic (veh/h)				Significance of impacts	Comments
	AM		PM			
	In	Out	In	Out		
Banksia Street	-	32	-	40	Low	Gate is not located adjacent to any key intersection. Low background traffic volumes.
Morgan Street	14	-	23	-	Low	Gate is not located adjacent to any key intersection. Low background traffic volumes.
Banksia Street – east	4	2	0	2	Low	Gate is not located adjacent to any key intersection. Low background traffic volumes.
Bay Street	6	4	0	2	Low	Gate is not located adjacent to any key intersection. Low background traffic volumes.
Botany Road–Mill Stream	16	17	5	8	Medium	The gate is located approximately 70 metres south of Botany Road/Mill Pond Road intersection (south leg exit) and approximately 210 metres north of Botany Road/ Lord Street intersection (north approach). Southbound traffic volume on Botany Road adjacent to Gate 'F1' are 1,180 veh/h and 770 veh/h during AM and PM peaks respectively. Moderate impact on Botany Road operation during in/out of construction traffic due to moderate traffic volume on Botany road. Potential impacts: ■ slowing down traffic on southbound exit lane(s) of Botany Road.
Botany Road–Botany Triangle	8	10	0	2	Low	No significant impact.
McBurney Avenue	13	14	2	5	High	The gate is located approximately 50 metres north of Botany Road/Mill Pond Road intersection (north approach). Southbound traffic volume on Botany Road adjacent to Gate '12' are 1,083 veh/h and 1,440 veh/h during AM and PM peaks respectively. Potential high impact on Botany Road/Mill Pond intersection (IN03) operation during exiting of construction traffic. Potential impacts: ■ blocking southbound left turn vehicles of Botany Road/Mill Pond Road intersection by construction traffic during egress manoeuvre from the construction site and merging with Botany Road traffic ■ potential long queue on north approach of Botany Road/Mill Pond Road intersection ■ slowing down southbound traffic on Botany Road/Mill Pond Road intersection.
Botany Road northbound	8	6	0	2	Low	Gate is not located adjacent to any key intersection.
General Holmes Drive compound	53	71	18	35	Medium	General Holmes Drive between Botany Road/ General Holmes Drive intersection and General Holmes Drive/Joyce Drive/Construction Access intersection would be closed during the construction phase. The impacts associated with the operation of Gate '14' have been reviewed and are considered to be of medium significance given the proximity of the gate to Joyce Drive and the potential for conflict of construction traffic at the gate with mainstream traffic, although this is conserved unlikely.
General Holmes Drive south	10	10	2	6	Medium	General Holmes Drive between Botany Road/General Holmes Drive intersection and General Holmes Drive/Joyce Drive/Construction Access intersection would be closed during the construction phase. The impacts associated with the operation of Gate '15' have been reviewed and are considered to be of medium significance given the proximity of the gate to Joyce Drive/ General Holmes Drive and the potential for conflict of construction traffic at the gate with mainstream traffic, although this is conserved unlikely.
General Holmes Drive north	9	-	1	1	Low	Gate is not located adjacent to any key intersection.
Baxter Road	-	11	-	3	Low	Gate is not located adjacent to any key intersection.
Joyce Drive–O'Riordan Street	8	-	2	2	High	The gate is located approximately 65 metres east of Joyce Drive/O'Riordan Street intersection (east approach exit). Eastbound traffic volume on Joyce Drive adjacent to Gate 'F3' are 1,425 veh/h and 1,360 veh/h during AM and PM peaks respectively. Potential high impact on Joyce Drive/O'Riordan Street intersection (IN07) during access manoeuvre of the construction traffic. Potential impacts: ■ slowing down eastbound traffic on Joyce Drive/O'Riordan Street intersection ■ potential long queue on eastbound exit lane(s) of Joyce Drive/O'Riordan Street intersection due to construction traffic entering the construction site.
Joyce Drive–O'Riordan Street	-	16	-	6	Low	Gate is not located adjacent to any key intersection.

Gate description	Total construction traffic (veh/h)				Significance of impacts	Comments
	AM		PM			
	In	Out	In	Out		
O'Riordan Street–Robey Street	8	-	2	2	High	The gate is located approximately 30 metres west of Joyce Drive/O'Riordan Street intersection and approximately 110 metres east of Qantas Drive/ Robey Street intersection. Eastbound traffic volume on Qantas Drive adjacent to Gate 'F5' are 1,821 veh/h and 1,431 veh/h during AM and PM peaks respectively. Potential high impact on Qantas Drive/Robey Street intersection (IN08) operation during access manoeuvre of the construction traffic. Potential impacts: ■ slowing down eastbound traffic on Qantas Drive/Robey Street intersection ■ potential long queue on eastbound exit lane(s) of Qantas Dr/Robey St intersection due to construction traffic entering the construction site.
O'Riordan Street–Robey Street	-	16	-	6	High	The gate is located approximately 35 metres east of Qantas Drive/Robey Street intersection and approximately 105 metres west of Joyce Drive/O'Riordan Street intersection. Eastbound traffic volume on Qantas Drive adjacent to Gate 'F4' are 1,821 veh/h and 1,431 veh/h during AM and PM peaks respectively. Potential high impact on Joyce Drive/O'Riordan Street intersection (IN07) operation during egress manoeuvre of the construction traffic. Potential impacts: ■ blocking eastbound through vehicles of Qantas Drive by construction traffic during exiting the construction site and merging with Qantas Drive traffic ■ potential long queue on east approach of Qantas Drive/O'Riordan Street intersection due to exiting/merging of construction traffic ■ slowing down eastbound traffic on Qantas Drive/ O'Riordan Street intersection.
Qantas Drive	9	-	3	3	Low	Gate is not located adjacent to any key intersection.
Qantas Drive	-	17	-	7	High	The gate is located approximately 90 metres north of Qantas Drive/Robey Street intersection. Southbound traffic volume on Qantas Drive/Robey Street intersection adjacent to Gate 'F6' are 2,097 veh/h and 1,039 veh/h during AM and PM peaks respectively. Potential high impact on Qantas Drive/Robey Street intersection operation during egress manoeuvre of the construction traffic. Potential impacts: ■ blocking southbound through/left turn vehicles of Qantas Drive/Robey Street intersection by construction traffic during exiting the construction site and merging with Qantas Drive traffic ■ potential long queue on north approach of Qantas Drive/Robey Street intersection due to exiting/merging of construction traffic ■ slowing down southbound traffic on Qantas Drive/Robey Street intersection.
Coleman Street	10	9	0	2	Low	Gate is not located adjacent to any key intersection.
King Street	15	16	4	5	Low	Gate is not located adjacent to any key intersection.
Lancastrian Drive	3	3	0	1	High	The gate is located approximately 70 metres east of Qantas Drive/Lancastrian Road intersection. Eastbound traffic volume on Qantas Drive adjacent to Gate '20' are 2,226 veh/h and 1,083 veh/h during AM and PM peaks respectively. Potential high impact on Qantas Drive/Lancastrian Road intersection operation during entry of construction traffic. Potential impacts: ■ slowing down eastbound traffic on Qantas Dr/Lancastrian Rd intersection ■ potential long queue on eastbound exit lane(s) of Qantas Drive/Lancastrian Road intersection due to construction traffic entering the construction site.

Appendix B
Construction vehicle routes

B1. Construction vehicle routes

The following figures provide an overview of the indicative construction vehicle routes. Figure B-1 shows the identified routes for general construction vehicles accessing the work compounds and sites within the project area. It has been assumed that construction vehicles would travel to each site via the closest arterial route.

Figure B-2 shows the identified routes for heavy vehicles, which would primarily be used for haulage of materials to and from the compounds. These activities would likely occur during non-peak traffic times to reduce impacts on the road network.

Figure B-1 Construction vehicle routes – General work vehicles

Figure B-2 Construction vehicle routes – Heavy vehicles

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