M1 (North) Smart Motorway Project

Traffic and Transport Report

Prepared by: GTA Consultants (NSW) Pty Ltd for Transport for New South Wales
on 04/12/2020

Reference: N192720
Issue #: A

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EXECUTIVE SUMMARY

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The urban motorway network that forms the focus of the M1 (North) Smart Motorway (M1NSM) project include some of the most critical and highly utilised road transport links within Sydney. The corridor experiences both significant recurrent and non-recurrent congestion issues with significant delays experienced by road customers for extended periods of the typical morning and afternoon peak periods with flow breakdown contributing to poor travel times, travel time reliability and road safety.

In response to performance issues along the corridor, the forecast impact of planned changes in the motorway network, and the increasing evidence-based support for planning and implementing smart motorway technologies in NSW, Transport for New South Wales led the development of a Concept Design and Review of Environmental Factors (REF) for the delivery of smart technologies and associated infrastructure upgrades along the M1NSM corridor.

This Traffic and Transport Report is one of several documents that have been prepared to provide pertinent technical information and analysis required to inform the Concept Design and REF for the project.

Project Overview

The proposed smart technologies and associated infrastructure upgrades along the M1NSM corridor are intended to respond to existing network performance issues by optimising the capacity of the corridor and by allowing better transport management where motorways and arterial roads are managed as one integrated network. The key features of the project include, but are not limited to, wayfinding infrastructure, Integrated Speed and Lane Use Sign (ISLUS)and Variable Speed Limit Signs (VSLS).

Project Objectives

There are a number of primary objectives associated with the project:

- increase network resilience
- enhance travel time and reliability
- improve traffic safety and incident management
- enhance the road user experience
- optimise transport asset utilisation and investment.

The project aims to achieve all five of these objectives to enhance the overall corridor operation for road users, and as such, travel time savings is not used as the only performance metric. Further, it should be noted that the M1NSM corridor is not a typical motorway corridor, given the constraints it is operating within and its overall function. As a result, the introduction of smart motorway technology should be seen as one of a suite of possible measures designed to bring benefits to the corridor.

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Abbreviations

Term	Description
ARRB	The Australian Road Research Board
ATRF	Australian Transport Research Forum
BL	Beaches Link
CAV	Connected and Autonomous Vehicles
CBD	Central Business District
CCTV	Closed Circuit Television Camera
CML	Concessional Mass Limit
CQPR	Circular Quay Precinct Renewal
EB	Eastbound
ESC	Easing Sydney's Congestion
GML	General Mass Limit
GSC	Greater Sydney Commission
HML	Higher Mass Limit
IP	Inter Peak
ISLUS	Integrated Speed and Lane Use Sign
LGA	Local Government Area
M1NSM	M1 (North) Smart Motorway
M4-M5 Link	WestConnex Stage 3A (between Haberfield and St Peters)
MMS	Managed Motorway System
NB	Northbound
OP	Off-peak
REF	Review of Environmental Factors
RAV	Restricted Access Vehicles
SB	Southbound
SBC	Strategic Business Case
SHB	Sydney Harbour Bridge
SIS	State Infrastructure Strategy
SMPM	Strategic Motorway Planning Model
STM	Sydney Strategic Travel Model
TfNSW	Transport for New South Wales
VC Ratio	Volume over Capacity Ratio
VHT	Vehicle Hours Travelled
VKT	Vehicle Kilometres Travelled
VMS	Variable Message Signs
VSLS	Variable Speed Limit Signs
WB	Westbound
WCX	WestConnex
WD	Western Distributor
WFU	Warringah Freeway Upgrade
WHTBL	Western Harbour Tunnel and Beaches Link

1. INTRODUCTION

1.1. Project Background

Comprised of the Anzac Bridge and Western Distributor, the urban motorway network links that form the focus of the M1 (North) Smart Motorway Project (the project) represent some of the most critical and highly utilised road transport links within Sydney. When viewed through the lens of the network's connectivity with the Sydney Harbour Bridge, Sydney Harbour Tunnel and Cross-City Tunnel, the network performs both significant Sydney CBD access functions and bypass functions between urban catchments and for significant volumes of people and goods travelling by bus, taxi, commercial vehicles and private vehicles.

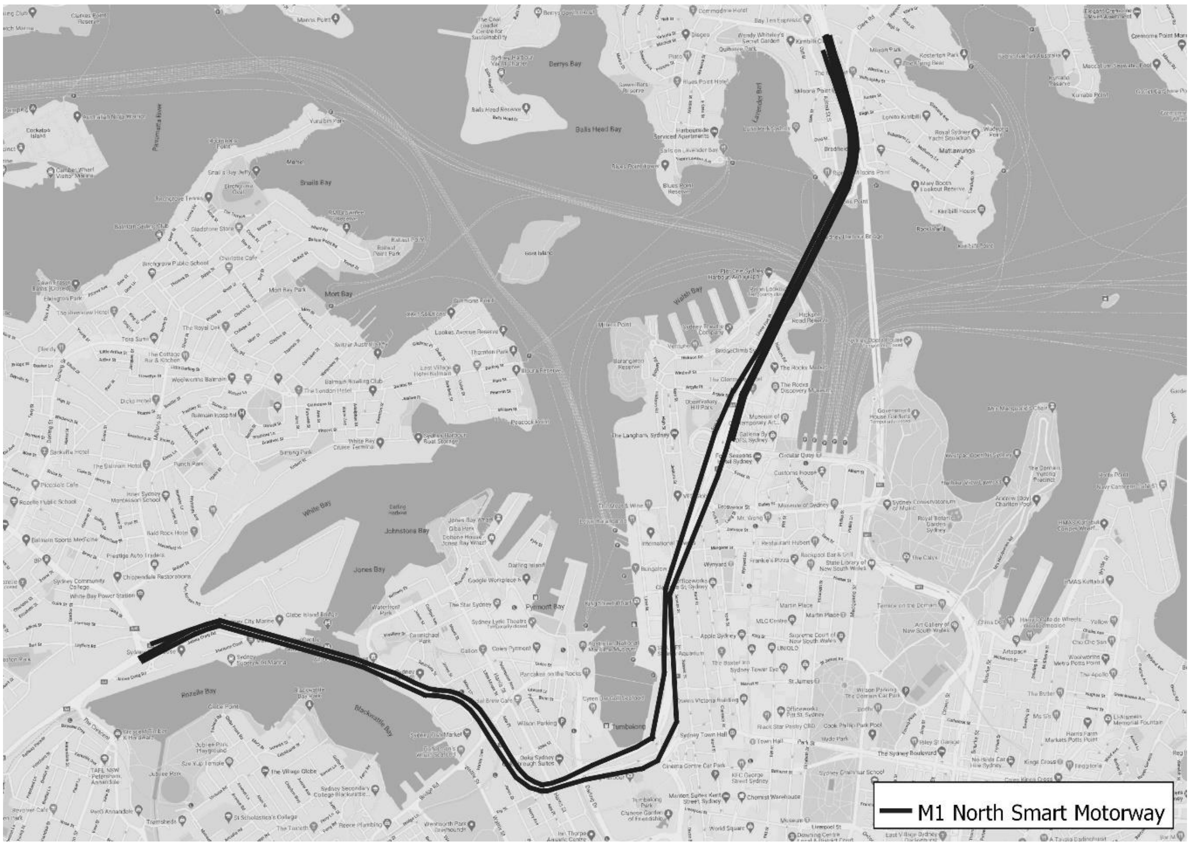
Currently, the corridor experiences both significant recurrent and non-recurrent congestion issues. Significant delays are experienced for extended periods of the typical morning and afternoon peak periods with flow breakdown contributing to poor travel times, travel time reliability and road safety. The network is currently an unmanaged motorway network, which means that traffic entering and exiting the motorway is uncontrolled and unable to respond effectively to the formation of congestion or respond to incidents on the motorway.

In response to performance issues along the corridor, the forecast impact of planned changes in the motorway network, and the increasing evidence-based support for planning and implementation of smart motorway technologies in New South Wales, Transport for New South Wales (TfNSW) led the development of a Strategic Business Case (SBC) for the delivery of smart technologies and associated infrastructure upgrades along the network. The Strategic Business Case was led out of TfNSW (former Roads Maritime) Easing Sydney's Congestion (ESC) program and completed in 2016, which resulted in the securing of funding to progress the project to Concept Design and Review of Environmental Factors (REF).

1.2. Study Area

The study area for the M1 (North) Smart Motorway (M1NSM) project is illustrated in Figure 1.1. The project is located in the North Sydney, City of Sydney and Inner West Local Government Areas (LGAs) and extends on to the suburbs of Milsons Point, Dawes Point, The Rocks, Sydney, Pyrmont and Rozelle.

Figure 1.1: M1NSM Study Corridor



Source: SMPM model, Transport for NSW

1.3. Project Objectives

The primary objectives of the project are:

- Objective 1 – Increase network resilience.
- Objective 2 – Enhance travel time and reliability.
- Objective 3 – Improve traffic safety and incident management.
- Objective 4 – Enhance the road user experience.
- Objective 5 – Optimise transport asset utilisation and investment.

1.4. Project Overview

Transport for New South Wales propose to introduce smart motorway technologies to the M1NSM corridor, to respond to existing network performance issues by optimising the capacity of the corridor and by allowing better transport management where motorways and arterial roads are managed as one integrated network. Further details are presented in Section 8.1.

Key features of the project include:

- Wayfinding infrastructure: including dynamic directional message signs and variable message signs (VMS) that allow strategic placement of key messages and repeater messages to optimise lane selection and lane changes.

- Integrated Speed and Lane Use Sign (ISLUS): on 17 new gantries, on eleven existing gantries and on the King Street overpass (northbound), the King Street footbridge (southbound) and the Domain Tunnel portal (northbound and southbound).
- Variable Speed Limit Signs (VSLS): for on ramps, to provide speed limit information for vehicles entering the network.
- Changes to lane alignments, lane management, advance signage: to address current issues with weaving at several locations along the mainline
- Smart motorway hazard and vehicle detection system: covering the full elevated motorway and sections without a shoulder/emergency lane.
- On and off ramp vehicle detection.
- Closed circuit television camera infrastructure (CCTV): to achieve full coverage across the corridor.
- Cables, pits and cabinets: to support intelligent transport systems.

1.5. Report Purpose

The Traffic and Transport Report was previously prepared and issued in July 2019 to provide pertinent technical information and analysis required to both inform and support the Concept Design and REF for the project.

Due to the latest changes in designs and exclusion of Cahill Expressway, the objective of this report is to update details of the methodology, assumptions and results from a holistic traffic and transport assessment that was undertaken to identify constraints/opportunities within the existing transport network and establish forecast traffic and transport conditions in the study area with and without the project.

1.6. Report Structure

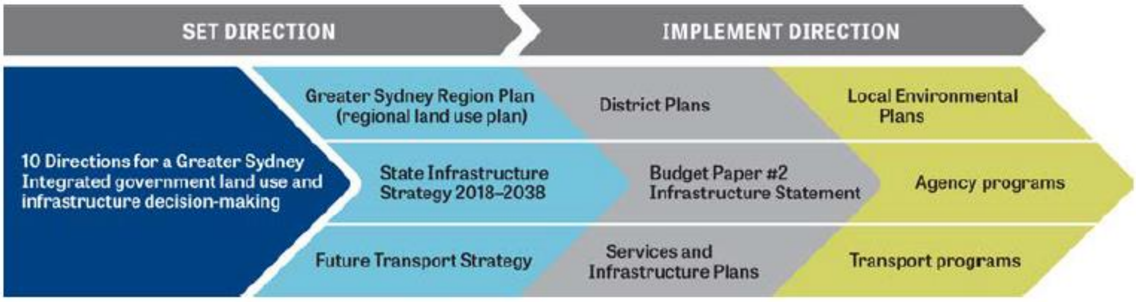
This report has been structured into the following subsequent chapters:

- Section 2: highlights how the project aligns with relevant plans and policies.
- Section 3: explains the process that has been adopted for the traffic and transport assessment of the project.
- Section 4: provides details of relevant existing land use features, travel behaviours and transport infrastructure, services and operations within the study area.
- Section 5: outlines how land use features and transport infrastructure and services are forecast to change in the future, without the Project.
- Section 6: presents key elements of the project that has resulted from the Concept Design development process.
- Section 7: provides details of how the project is forecast to benefit and impact the traffic and transport network.
- Section 8: includes a summary of likely impacts to the transport network during construction.
- Section 9: provides an overview of the findings of the traffic and transport impact assessment.

2. STRATEGIC CONTEXT

Sydney is growing and with growth there are emerging challenges facing the city and its communities. A coordinated response to these challenges is structured around a policy framework as illustrated in Figure 2.1. This figure illustrates the hierarchy of plans which set the direction to overcome future challenges and capture opportunities to create a Greater Sydney. This includes the NSW Government vision, goals and desired outcomes which frame the response to current and future challenges along the M1NSM corridor.

Figure 2.1: Government policy context and hierarchy



Source: Department of Premier and Cabinet (2018)

The M1NSM project has been driven by, informed by, or is in alignment with, a variety of these NSW Government plans and policies – the associations with which are highlighted as follows.

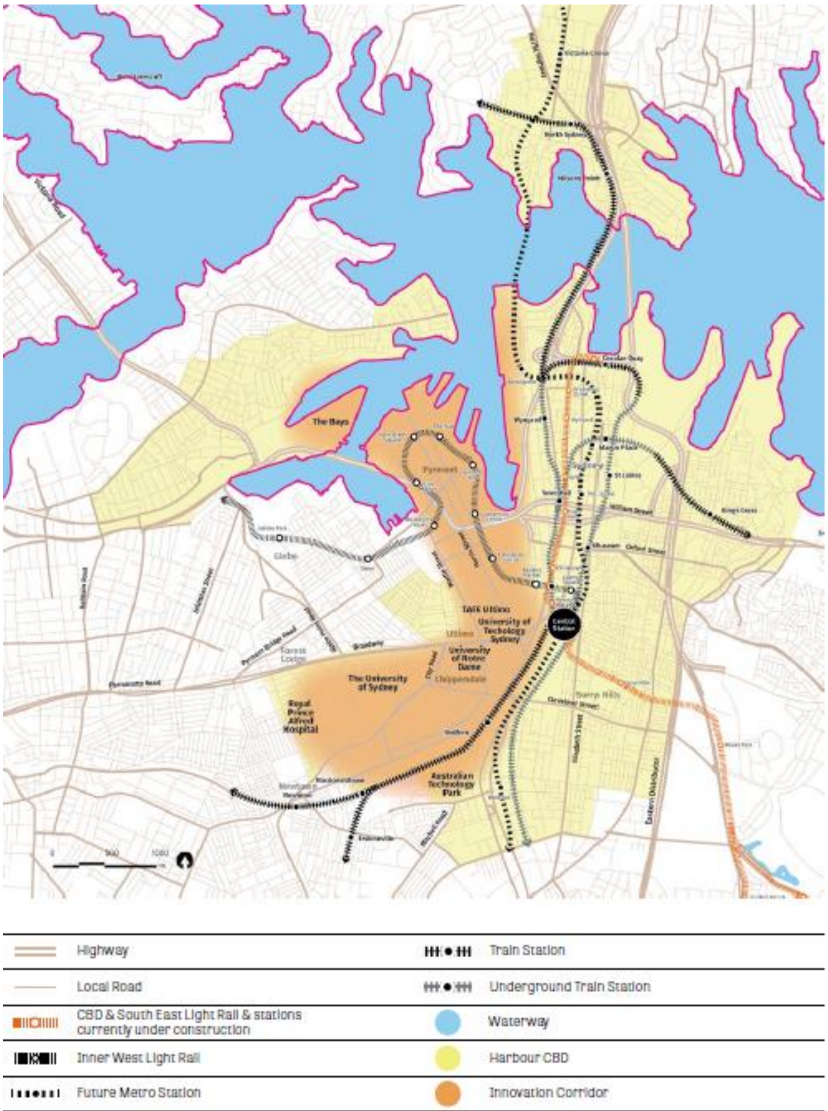
2.1. Plans and Policies

2.1.1. Greater Sydney Region Plan

The first regional plan developed by the GSC presents a vision and series of actions for managing Greater Sydney's growth and enhancing its status as one of the most liveable global cities and is supported by a series of district plans. For the inner Sydney area in which the corridor lies, GSC's guiding metropolitan strategy document is the Eastern City District Plan. The plan underlines the importance of the continued strengthening of the international competitiveness of Australia's global gateway and financial capital - the "Harbour CBD". The Harbour CBD includes Sydney CBD, North Sydney CBD, Barangaroo, Darling Harbour, Pyrmont and The Bays Precinct – each of which the M1NSM corridor facilitates access to in various capacities.

The Plan reinforces the need to optimise existing access but also highlights targeted growth for the Harbour CBD including at the western end of the M1NSM corridor in particular. With a baseline target job growth for the Harbour CBD of approximately 185,000 jobs to 2036, a significant increase in the movement of people and goods to and from the city centre is forecast – enhancing the need for investment.

Figure 2.2: Harbour CBD

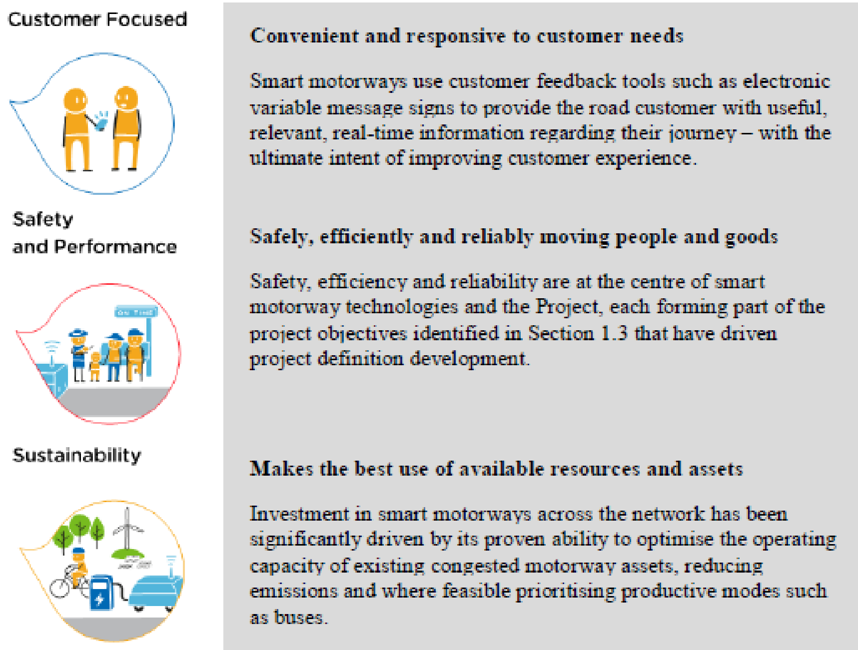


Source: Eastern City District Plan (Great Sydney Commission, 2018)

2.1.2. Future Transport Strategy

Future Transport Strategy 2056 (Transport for NSW, 2018) (Future Transport) presents an exciting range of plans and initiatives for the next 40 years of how we will live, work and move across the state. It is the key policy document driving investment in transport infrastructure and services for the future and is supported by a suite of documents including most notably the *Greater Sydney Services and Infrastructure Plan* (Transport for NSW, 2018) and the *Road Safety Plan* (Transport for NSW, 2018).

The vision for transport to 2056 is built on the six outcomes: customer focussed, successful places, a strong economy, safety and performance, accessible services and sustainability. The alignment between the M1NSM project and three of these are summarised below.


Customer Focused

Convenient and responsive to customer needs

Smart motorways use customer feedback tools such as electronic variable message signs to provide the road customer with useful, relevant, real-time information regarding their journey – with the ultimate intent of improving customer experience.

Safety and Performance

Safely, efficiently and reliably moving people and goods

Safety, efficiency and reliability are at the centre of smart motorway technologies and the Project, each forming part of the project objectives identified in Section 1.3 that have driven project definition development.

Sustainability

Makes the best use of available resources and assets

Investment in smart motorways across the network has been significantly driven by its proven ability to optimise the operating capacity of existing congested motorway assets, reducing emissions and where feasible prioritising productive modes such as buses.

Source: Greater Sydney Regional Plan A Metropolis of Three Cities – connecting people (Transport for NSW, 2018)

The strategy highlights integration of smart motorway technologies as a key part of NSW being prepared for new technology, and its delivery across all NSW motorways is a future direction to investigate. The strategy also reinforces commitment to progressing key interfacing projects including Western Harbour Tunnel and Beaches Link, WestConnex, Sydney Metro West – the relevant impacts of which are discussed in further detail in relevant sections of this report.

"Technologies available today, such as Smart motorway systems…can also benefit the existing network by improving incident response and congestion outcomes…These more agile solutions should be our first response to congestion and performance variability."

"Roads and Maritime Services is planning smart motorway improvements across a range of projects, including NorthConnex, WestConnex, Western Harbour Tunnel, Beaches Link, M12 Airport Motorway, Western Distributor, General Holmes Drive and Southern Cross Drive, and the Princes Motorway and Pacific Motorway upgrades"

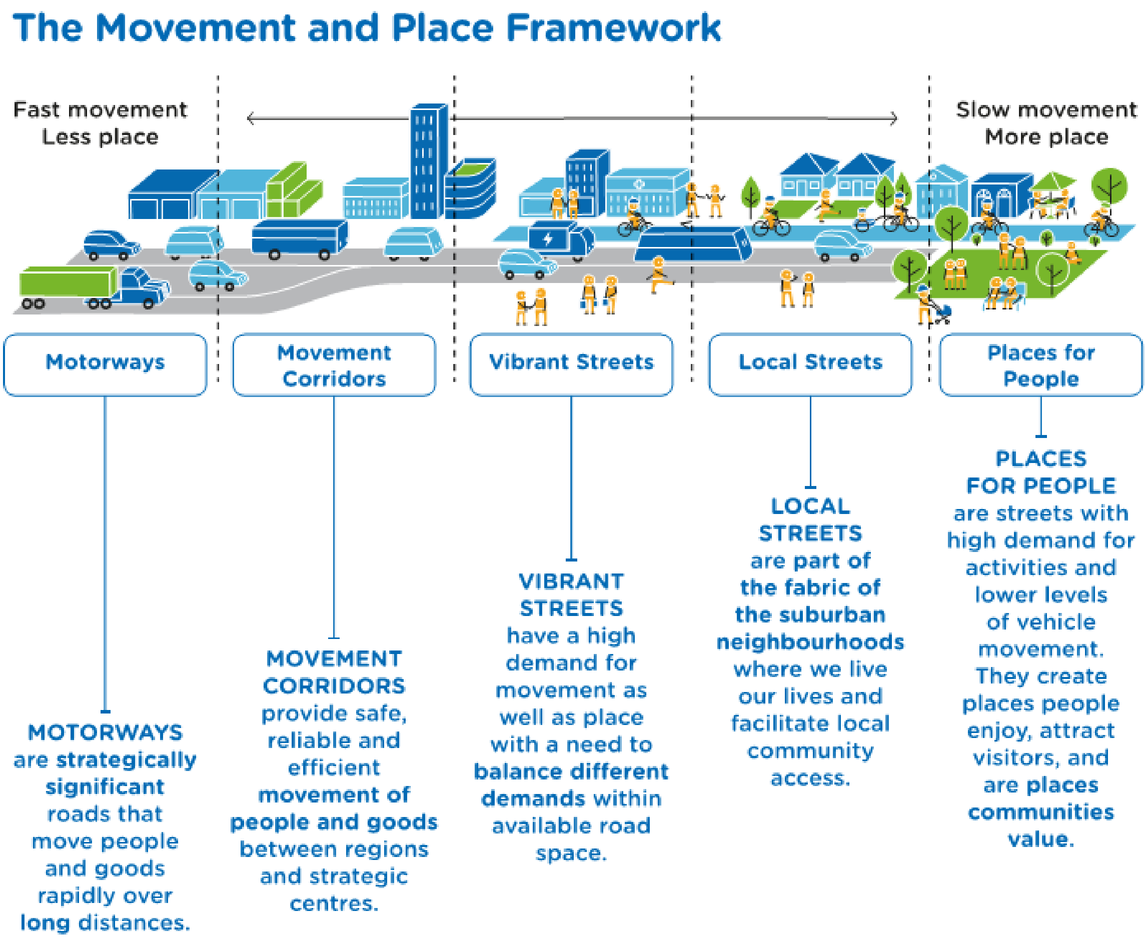
Source: Future Transport Strategy 2056 (Transport for NSW, 2018)

Movement and Place Framework

Future Transport is underpinned by the Movement and Place Framework. A critical element of the framework is the evidence-based identification of current and future movement and place functions of a subject transport network or link through a collaborative stakeholder engagement process and identifying actions and functions that should form the focus of future investment – leading to achievement of common city-shaping visions and objectives.

The M1NSM corridor can be broadly described as an urban motorway – a grade separated, free-flow facility with high relative accessibility from interfacing road networks. The corridor characteristically facilitates high movement functions – for all vehicle-based road user types including buses, commercial vehicles, taxis and private vehicles – and low place function. Despite forecast changes in the motorway network and the corridor's function within this network, it is considered the future role of the corridor will remain in the safe and efficient movement of people and goods – aligning with the desired outcomes of smart motorway technologies (and the associated need for investment).

However, it should be acknowledged that the corridor does operate adjacent, and provide access to, some of Sydney's most significant existing (Sydney CBD) and future (The Bays) places. As such, interfacing place functions have been considered closely in project development and assessment, as has the prioritisation of movement along the corridor for its various road-based customers.



Source: Future Transport Strategy 2056 (Transport for NSW, 2018)

Greater Sydney Services and Infrastructure Plan

Of most direct relevance from Future Transport, the Greater Sydney Services and Infrastructure Plan (Transport for NSW, 2018) includes a 2056 vision for the "Harbour City" (Sydney CBD and its surrounding inner suburbs), which is illustrated for the study area in Figure 2.3. This vision sets the tone for desired functionality of the transport system in the area, and associated planning and investment focus.

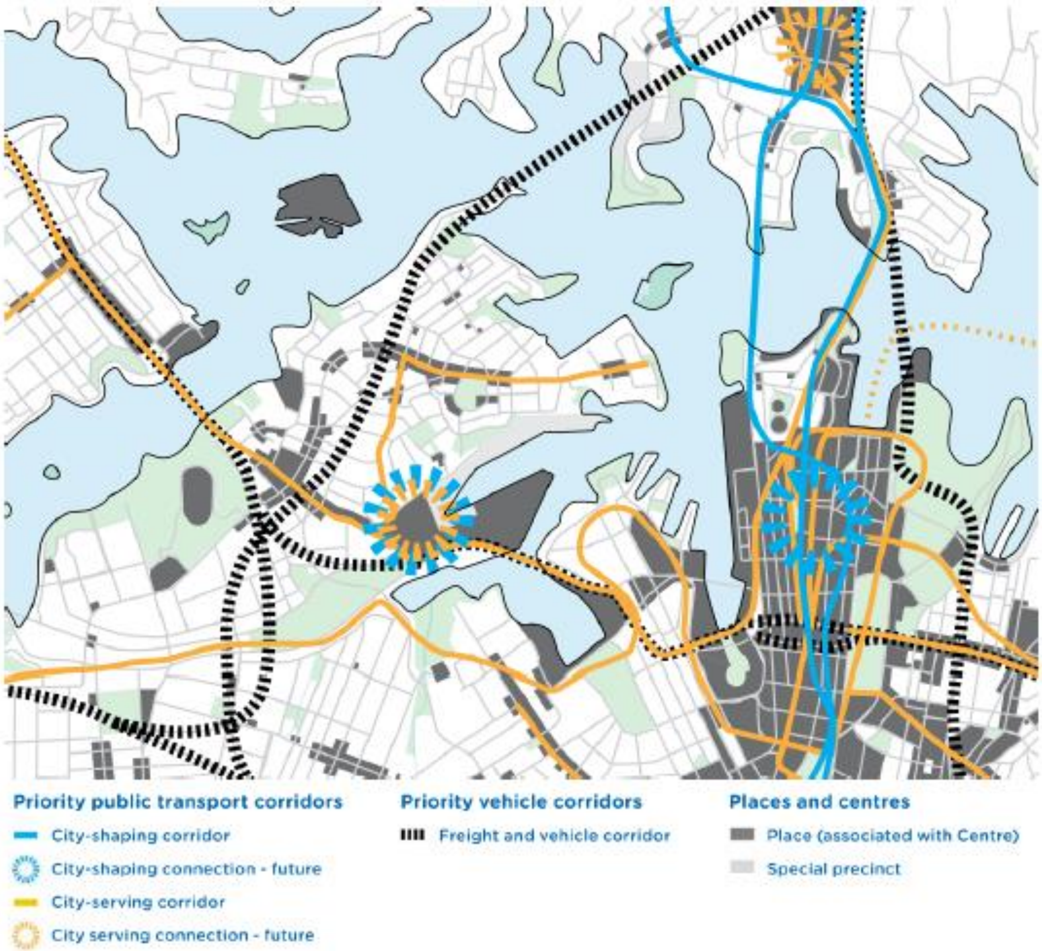
Most notably for the M1NSM corridor it identifies the following:

- Priority vehicle corridors: Eastern Distributor and Western Distributor

  (Anzac Bridge to Cross-City Tunnel only)
- Priority public transport corridors: Western Distributor (including Anzac Bridge), Sydney Harbour Bridge and Bradfield Highway.

The combination of these highlight the NSW Government's envisioned continued high focus for the corridor on vehicle movement of people and goods along the corridor by vehicle. Notwithstanding, with the inclusion of the approved WestConnex and planned Western Harbour Tunnel, the Sydney Harbour Bridge and connecting northern segments of the Western Distributor are notably not included as part of the 'priority vehicle corridor' network.

Figure 2.3: 2056 vision for the Harbour City (Transport for NSW, 2018)



Source: Greater Sydney Service and Infrastructure Plan (Transport for NSW, 2018)

The Connected and Automated Vehicles (CAV) Plan (Transport for NSW, 2019) outlays NSW Government's five-year plan to enable connected and automated vehicles, focussing on the opportunity for NSW to lead the way in encouraging the use of CAVs on NSW roads over the next five years. It puts goals and actions in place to embrace the technology as well as address potential challenges, such as cybersecurity and ensuring safe interactions between automated vehicles and other road users.

The Plan identifies that the M4 Smart Motorway project, as an example, incorporates design standards to support digital connectivity and automation. It also supports the actions identified in the NSW State Infrastructure Strategy 2018-2038 (see below), to develop business cases for the deployment of smart motorway technology.

2.1.3. Stage Infrastructure Strategy 2018 -2038

The State Infrastructure Strategy (SIS) 2018-2038 was produced by Infrastructure NSW in its function of delivering independent advice to the NSW Government on the highest priority infrastructure projects for the State. The most recent version of this strategy looks beyond existing infrastructure backlogs and current projects and identifies the policies and strategies needed to maintain momentum in infrastructure delivery in line with population and economic growth.

The plan identifies 122 actions including 32 related directly to transport as well as many others indirectly related. Of most relevant is recommendation 55, as highlighted below.

Recommendation 55

> *"Infrastructure NSW recommends that Transport for NSW develop business cases to complete the deployment of smart motorway technology and digital infrastructure across the network in time for the expected opening of the Western Harbour Tunnel."*

Source: State Infrastructure Strategy 2018-2038: Building Momentum (INSW, 2018)

2.1.4. Premier's and NSW State Priorities

The Premier and NSW Government have highlighted 30 priorities being actioned that will make the state of NSW even better. Three key relevant priorities are highlighted below, each with strong alignment with the objectives and drivers of the project.

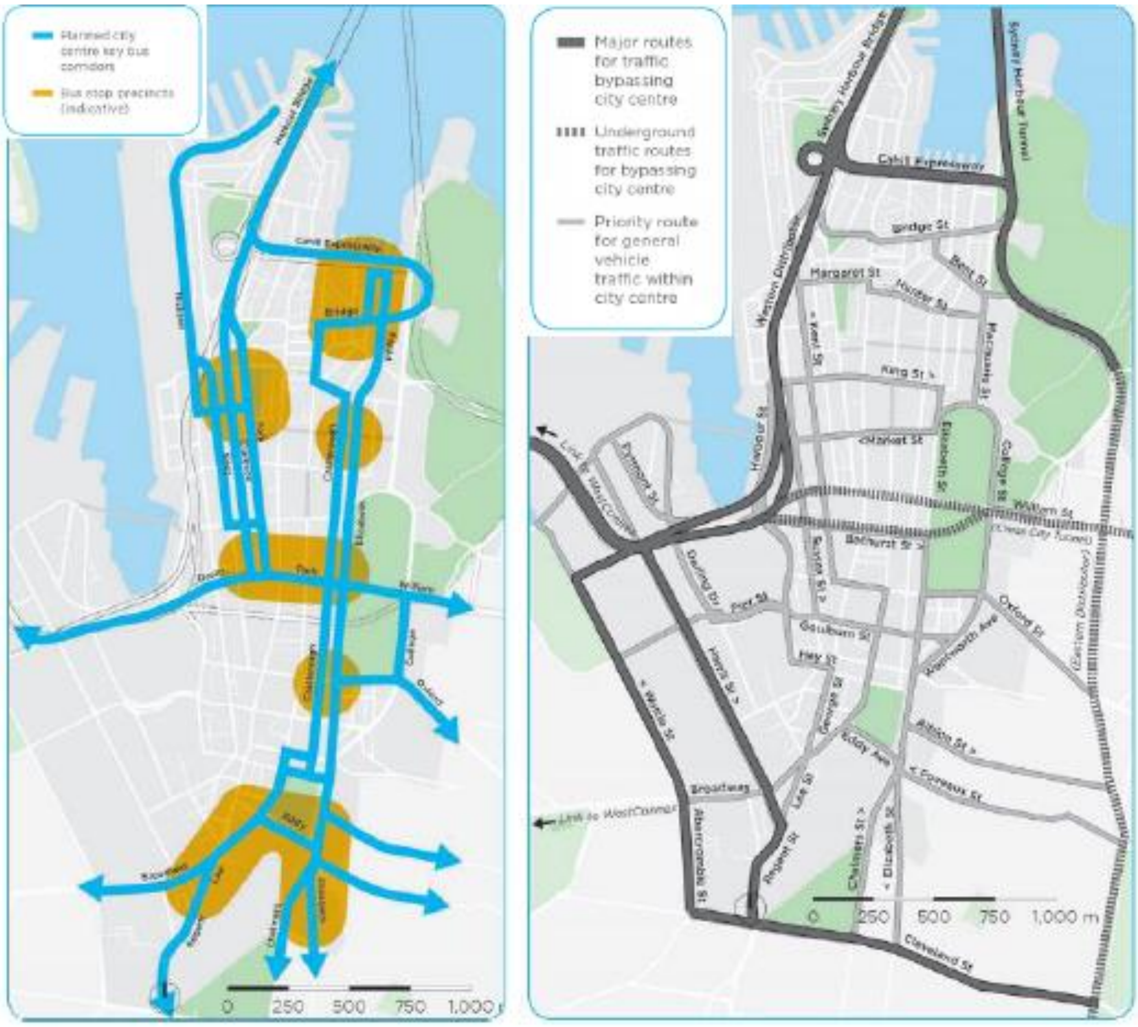
Source: Department of Premier and Cabinet (2018)

2.1.5. Sydney City Centre Access Strategy

The Sydney City Centre Access Strategy was developed by Transport for NSW in 2013. This document plans out how various transport modes will be used to move people in, out and around the CBD over the next 20 years.

While the plans looked to prioritise public transport, one aspect of the strategy is to maintain and use existing traffic bypass routes for both service and private vehicles. This will facilitate efficient access into the CBD from the surrounding road network, as well take by-passing traffic off local roads. These traffic bypass routes are outlined in Figure 2.4 and include the M1NSM corridor. Figure 2.4 also reinforces that two of the main bus access points into the CBD are included within the M1NSM corridor - the Sydney Harbour Bridge (via the Cahill Expressway and via York and Clarence Street) and Anzac Bridge (via Druitt Street).

Figure 2.4: Future city centre bus and major street network



Source: Transport for NSW 2013

3. METHODOLOGY

This chapter provides an overview of the methodology that has been applied with regards to assessment from a traffic and transport point of view.

3.1. Traffic and Transport Assessment

3.1.1. Transport modelling and forecasting

The strategic modelling tool has been applied to evaluate existing and future road network performance in the study area, with and without the Project.

Sydney Strategic Motorway Planning Model (SMPM) has been used to supply estimates of future changes in traffic patterns and demands in the project area. Underpinned by car and heavy vehicle demand matrices extracted from the Sydney Strategic Travel Model (STM - Sydney's primary transport, land use and pricing transport model), the SMPM is a traffic assignment model which covers the entire Sydney Greater Metropolitan Area. The SMPM was developed to provide traffic forecasts in the project definition development phases of inner Sydney motorway projects including WestConnex (WCX), Western Harbour Tunnel and Beaches Link (WHTBL), and the F6 Extension. As the tool was developed specifically to inform these nearby motorway network projects, it was considered the most appropriate available traffic forecasting model to inform project development and assessment.

3.1.2. Existing Conditions (2016)

2016 base year AM, PM peak, Inter-peak (IP) and Off-peak (OP) period were extracted from the SMPM for the project corridor and were assessed.

3.1.3. Future Conditions

Future year AM, PM peak, Inter-peak (IP) and Off-peak (OP) period, as well as daily outputs were extracted from the SMPM for the project corridor and with the network configurations listed in Table 3.1. Note that two 2031 future year scenarios have been assessed due to WHTBL currently being committed but unfunded, and should it be delivered it is likely there would be several years between the delivery of each the M4-M5 Link project (WestConnex Stage 3 or WCX3) and WHTBL – driving the need to investigate the performance and impacts of the project with and without WHTBL. Details regarding the assumptions made within the STM for the corresponding SMPM scenarios were not available at the time of preparing this report.

Table 3.1: SMPM assumptions on planned motorway network by scenario

Project	2021	2026	2031	2031 with WHTBL	2036
WestConnex Stage 1 and 2	✓	✓	✓	✓	✓
WestConnex Stage 3	✓	✓	✓	✓	✓
Western Harbour Tunnel				✓	✓
Beaches Link				✓	✓
M6E (A)	✓	✓	✓	✓	
M6E (ABC)					✓
Eastern Distributor two-way Tolling				✓	✓

Source: SMPM Future Year Assumptions

The SMPM outputs from the scenarios listed above were used as a reference to forecast the effects of smart motorway and to provide statics to support the development of the Final Business Case.

2021 model outputs with 80% of the demand were also used to carry out sensitivity testing for post Covid-19 demands.

3.1.4. Future conditions with the project

Although in the aggregate, the benefits of the introduction of smart motorway technology to the corridor are anticipated to be reflected in the overall performance of the transport network, the individual and separate measurement of each of these measures lie beyond the abilities of the traditional strategic modelling approach.

The SMPM outputs, including volumes, speed and capacity were used to estimate the base case performance within the Project Corridor while the project case improvement was informed by a literature review and benchmarking.

It was assumed that the Project Case would provide a 15.1 per cent improvement in travel time, which has been based on the before-after studies, compiled by Wang et al. (2017) and ARRB (2015) to quantify the improvements on the road network.

It is assumed that no route and mode shift has been included in future years. It should also be noted that the SMPM does not provide an estimate of bus volumes separately on the road network. Therefore, the SMPM output has bene adjusted against observed travel times in calibration, which include bus volume as a ‘pre-load’ to which the assigned volumes are added.

Limitations have been applied to the travel time improvements where the adjusted speed may exceed the sign-posted limit. The improved speed has been capped by the sign-posted limit. In addition, a volume-capacity (VC) ratio below 0.5 was excluded for the analysis to avoid overstate the Project benefits as the SMPM results suggest that vehicles are close to free-flow when the VC ratio is 0.5 or below.

To enable a systematic analysis of the benefits of the project, the set of scenarios listed in Table 3.2 were assessed.

Table 3.2: List of future scenarios

	SMPM Scenario Runs	Model Year	Smart Motorway
Existing	2016_M3001	2016	-
Future Base Case	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	2021	
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	2026	
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	2031	
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	2031	
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	2036	
Future Project Case	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	2021	• Automatic vehicle and hazard detection • Expanded CCTV coverage • Variable speed limit signs • Integrated Speed and Lane Use Management Signs (ISLUS) • Dynamic directional signage • Managed Motorway System (MMS) • Supporting infrastructure including gantries, communication and power network.
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	2026	
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	2031	
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	2031	
	2036_M3351 – 2036 WCX123 + Gateway + M6(ABC) + WHT + BL; w 2-way toll on ED	2036	

4. EXISTING CONDITIONS

4.1. Road Safety

An assessment of the crash statistics provided by TfNSW for a six-year period between 2013 and 2018 (inclusive) along the entirety of the corridor was undertaken.

In total, there were 282 crashes, 183 of which resulted in an injury. The primary crash types recorded for the study area were classified as same direction crashes (accounting for 68% of all crashes), followed by off path crashes (accounting for 18% of all crashes). Same direction crashes are usually an indication of a congested driving environment and are commonly rear-end crashes. Off path crashes are often characterised by driver tiredness and distractions due to poor signage or line marking. 64% of same direction crashes resulted in injury, and likewise for 71% of off path crashes.

The safety characteristics for a 6U road classification are averaged at 3.9 casualty crashes per kilometre per year. The length of the main corridor is approximately 8km and a total of 273 incidents were recorded over the 6-year period. This equates to a rate of 5.7 causality crashes per year, 1.5 times the average rate for a 6U corridor.

The distribution shows that incidents on the network occurred across the entire route. However, the crash density analysis highlights a concentration of crashes around Southern Toll Plaza1, Harris Street/ Fig Street ramps, and the Pyrmont Bridge Road ramps. Generally, the concentration of crashes is around interchanges, and intersections at on and off ramps connecting the corridor to the local road network. There is still however, a high density of crash clusters along Anzac Bridge and Harbour Bridge.

4.2. Traffic

4.2.1. Context and Function

The M1NSM corridor is a class 6U urban motorway with the primary function of providing free-flow movement of people and goods by road-based vehicles, with access only at interfacing arterial roads and CBD access streets. 6U roads are high-speed, grade separated, multi-lane divided carriageways with strictly limited direct access.

The functional road hierarchy of the corridor and surround road network, based on the Schedule of classified roads and State and Regional Roads (TfNSW, 2017), is highlighted Figure 4.1. The corridor is identified as a 'Highway', which characteristically have the highest traffic volumes including freight, public transport, commercial and private vehicles.

The links that comprise the corridor perform a variety of functions for generally traffic, two of which are particularly key:

- CBD access: enabling connecting to the Sydney CBD and surrounds, particularly for the medium to long range trips less served by public transport.
- CBD bypass: enabling traffic to bypass the Sydney CBD and surrounds, rather than traversing through it.

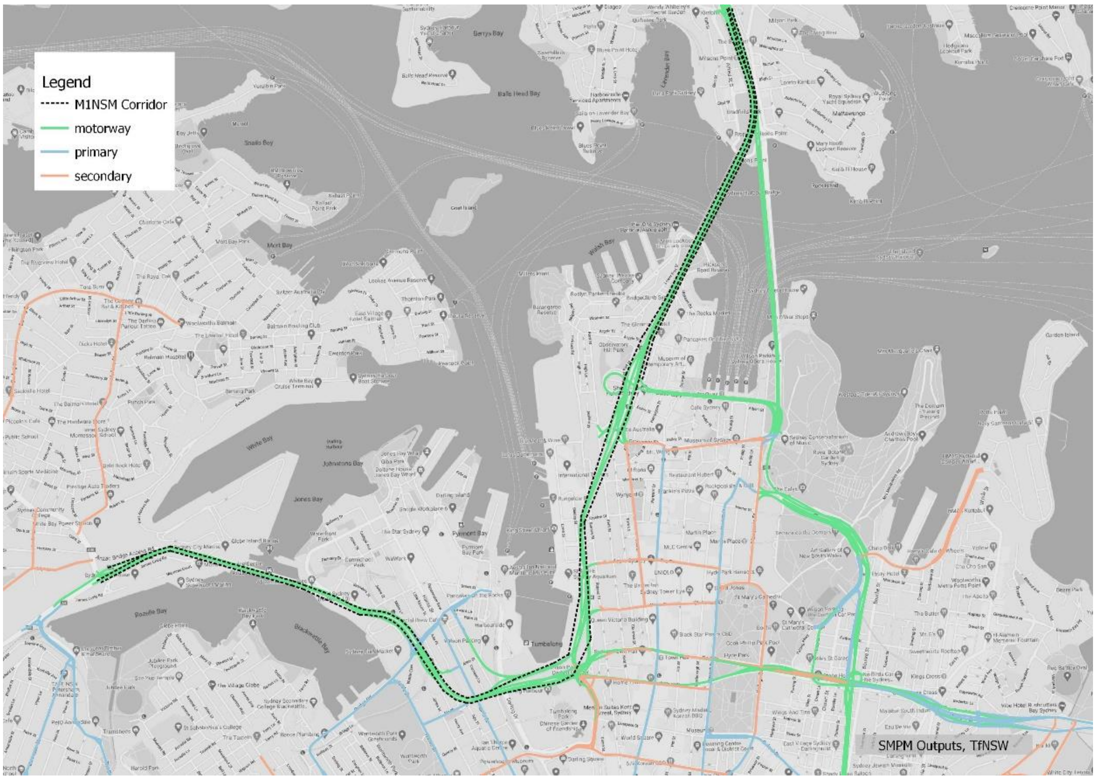
The corridor is a physically complex and highly constrained corridor, with many segments of the mainline and inter-connecting network being on grade separated structures, in a condensed urban environment where space is limited.

The functional classification of the interfacing road network with the corridor, to which ramp access is provided, is provided in Table 4.1.

Table 4.1: Functional roads classification of interfacing roads

Road	Classification	Posted Speed	Owner/ Operator
Eastern Corridor			
Cross City Tunnel	Motorway	80km/h	Transurban
Macquarie Street	Arterial	40km/h	TfNSW
Sir John Young Crescent	Sub-arterial	50km/h	
Cowper Wharf Road	Sub-arterial	50km/h	
Western Corridor			
Cross City Tunnel	Motorway	80km/h	Transurban
Pyrmont Bridge Road	Arterial	50km/h	TfNSW
Harris Street	Arterial	50km/h	
Harbour Street	Arterial	50km/h	
Druitt Street	Arterial	40km/h	
Grosvenor Street	Arterial	40km/h	
Market Street	Sub-arterial	40km/h	
Pyrmont Street	Sub-arterial	50km/h	
Kent Street	Collector	40km/h	
Clarence Street	Collector	40km/h	

Figure 4.1: Strategic functions of corridor and surrounds



Source: SMPM Outputs

Sydney Harbour Bridge

The Sydney Harbour Bridge forms one of the most critical transport links in NSW with a lane management scheme that consists of electronic gantry signage and remotely controlled moveable medians located at both approaches and a number of ramps. This enables TfNSW to vary the orientation of lanes on the bridge from a possible combination of two northbound/ six southbound through to five northbound/ three southbound lanes. The varying configuration allows for the effects of tidal traffic flow to be mitigated and provide configurations for emergency and special event situations. The default configuration is four lanes northbound and four lanes southbound, with three northbound and five southbound lanes in the AM peak.

The lanes numbered one through eight from left to right (northbound direction) are as follows:

- lanes one and two are fixed northbound
- lanes three through five are reversible
- lane six is fixed southbound
- lane seven is a 24hr southbound bus lane, though allows access from lane eight for CBD access outside of peaks
- lane eight is officially known as the Cahill Expressway and is fixed as southbound.

4.2.2. Volumes and Patterns

This section outlines the 2016 traffic volumes on key cross-harbour links and identifies traffic patterns of travel across the network as shown in Figure 4.2 to Figure 4.5 for the AM, IP, PM and OP peak respectively.

Figure 4.2: 2016 SMPM AM peak volumes

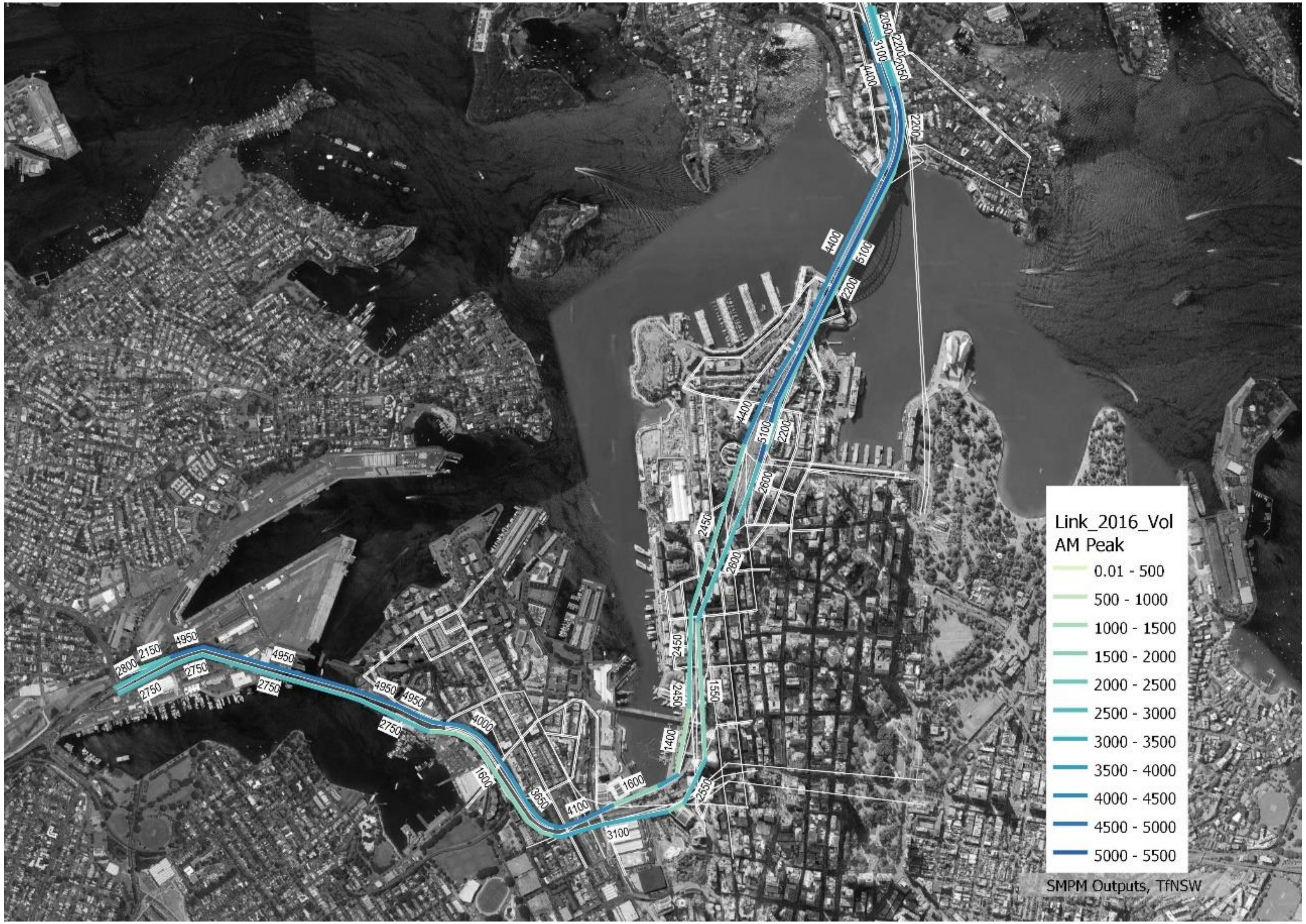


Figure 4.3: 2016 SMPM IP peak volumes

Figure 4.4: 2016 SMPM PM peak volumes

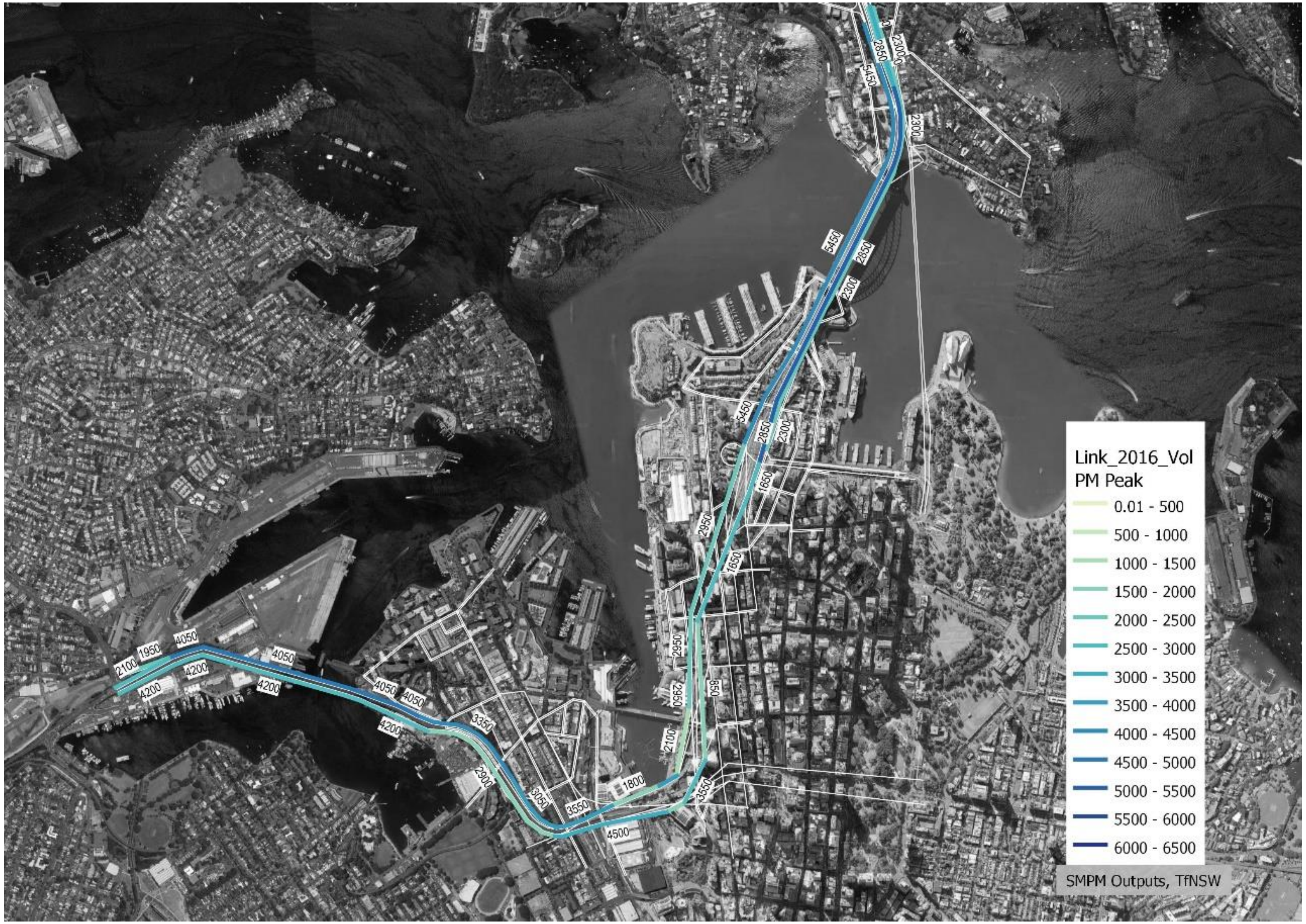


Figure 4.5: 2016 SMPM OP peak volumes

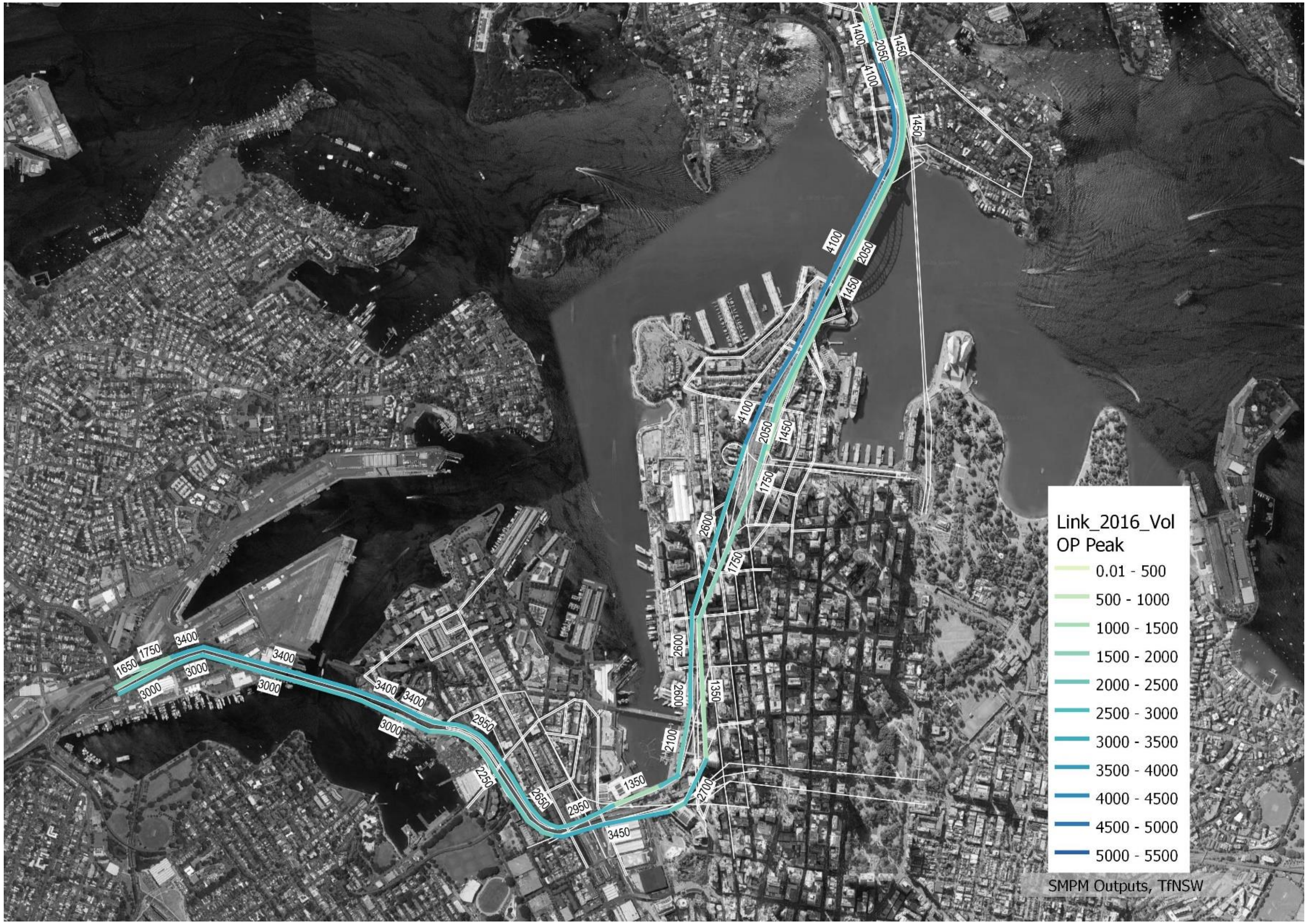


Table 4.2 shows traffic volumes at key points of the study area.

Table 4.2: 2016 SMPM all vehicle flows at key locations, 2016

	Direction	AM Peak (veh/ h)	IP Peak (veh/ h)	PM Peak (veh/ h)	OP Peak (veh/ h)
Anzac Bridge	Eastbound	4,950	4,150	4,050	3,400
	Westbound	2,750	3,300	4,150	3,000
Sydney Harbour Bridge	Northbound	4,400	4,450	5,450	4,100
	Southbound	7,300	4,550	5,200	3,500
Western Distribution between Grosvenor Street and King Street	Northbound	2,450	2,550	2,950	2,600
	Southbound	2,600	2,600	1,650	1,750

4.2.3. Performance

A summary of the network statistics was extracted from the SMPM models such as:

- Demand – total demand (veh/ hr) represents the total vehicles travelled in the network during peak period.
- Vehicle Hours Travelled – VHT (hr) represents the total travel time of all vehicles during peak period.
- Vehicle Kilometres Travelled – VKT (km) represents the total travelled distance of all vehicles during peak period.

Table 4.3 indicate that AM peak is the most congested period following PM peak period among four peaks.

Table 4.3: 2016 SMPM network statistics results, average peak hour

Peak Period	Time	Demand (veh/ hr)	VHT (hrs)	VKT (km)
AM	7am-9am	135,600	48,400	1,500
IP	9am-3pm	123,900	43,300	900
PM	3pm-6pm	133,800	48,000	1,200
OP	6pm-7am	106,000	37,300	700

The 2016 SMPM modelled performance issues within the network for the AM, IP, PM and OP peak are illustrated Figure 4.6 to Figure 4.8 and discussed below.

The following VC ratio plots provide an indication of the congestion within the modelled network during AM, IP, PM, and OP peak periods. Based on VC ration, the results indicate the following:

- During AM and PM peak periods, southbound sections of the Sydney Harbour Bridge reach theoretical capacity.
- Western Distributor and Anzac Bridge operate under capacity in both directions.

Figure 4.6: 2016 AM modelled volumes over capacity ratio (VC Ratio)

Figure 4.7: 2016 IP modelled volumes over capacity ratio (VC Ratio)

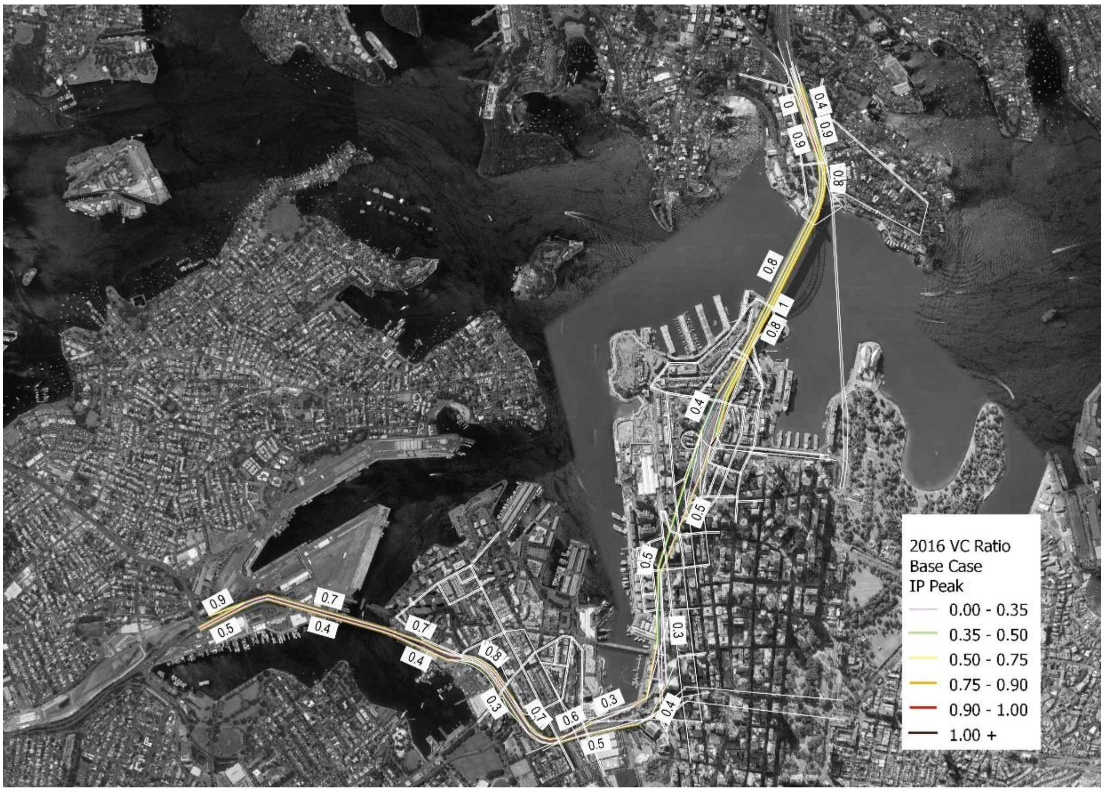


Figure 4.8: 2016 PM modelled volumes over capacity ratio (VC Ratio)

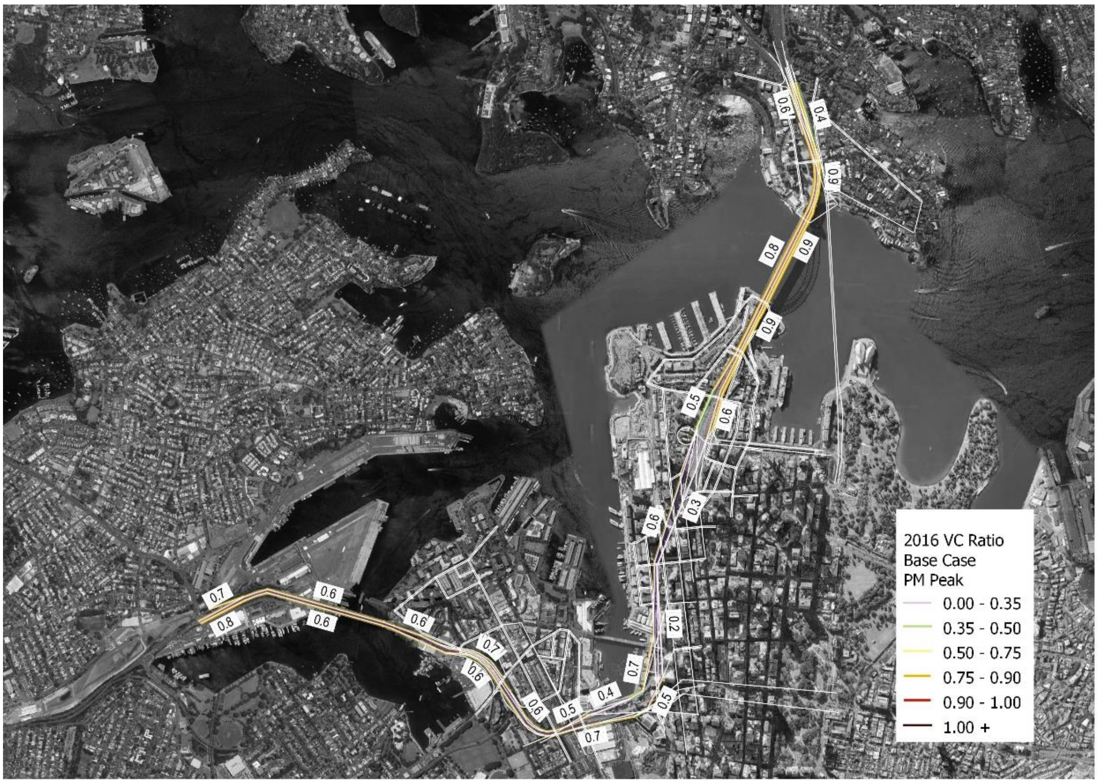


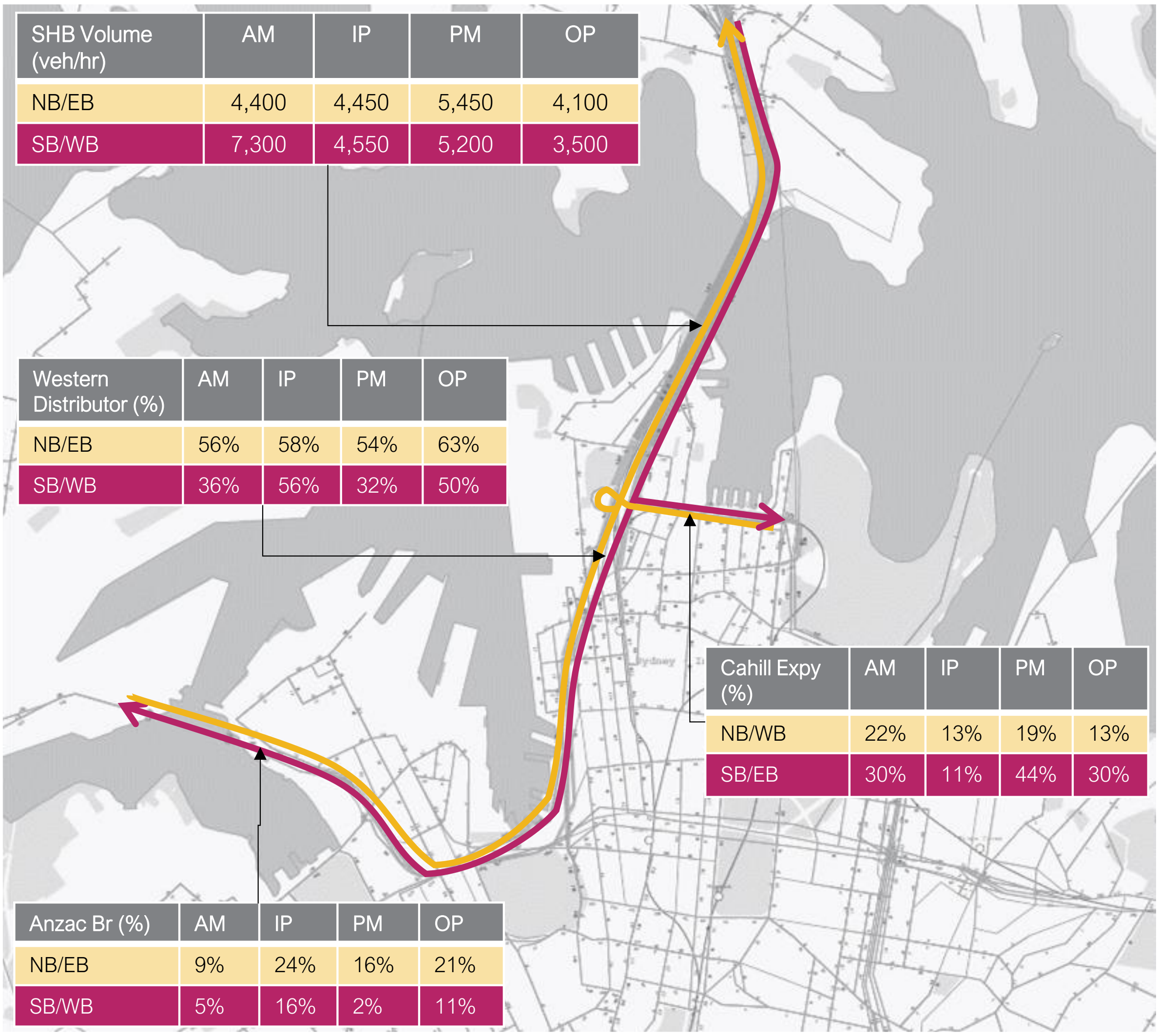
Figure 4.9: 2016 OP modelled volumes over capacity ratio (VC Ratio)

Figure 4.10 and Figure 4.11 illustrate the trip distribution at the Sydney Harbour Bridge and Anzac Bridge as informed by the SMPM Select Link Analysis.

In the AM peak period, 36% of SHB southbound traffic (7,300 veh) travel to Western Distributor heading to the CBD area and 5% of SHB traffic volume continue on its journey to Anzac Bridge.

During PM peak period, 54% of SHB northbound traffic (5,450 veh) come from Western Distributor and 16% of SHB northbound traffic come from Anzac Bridge.

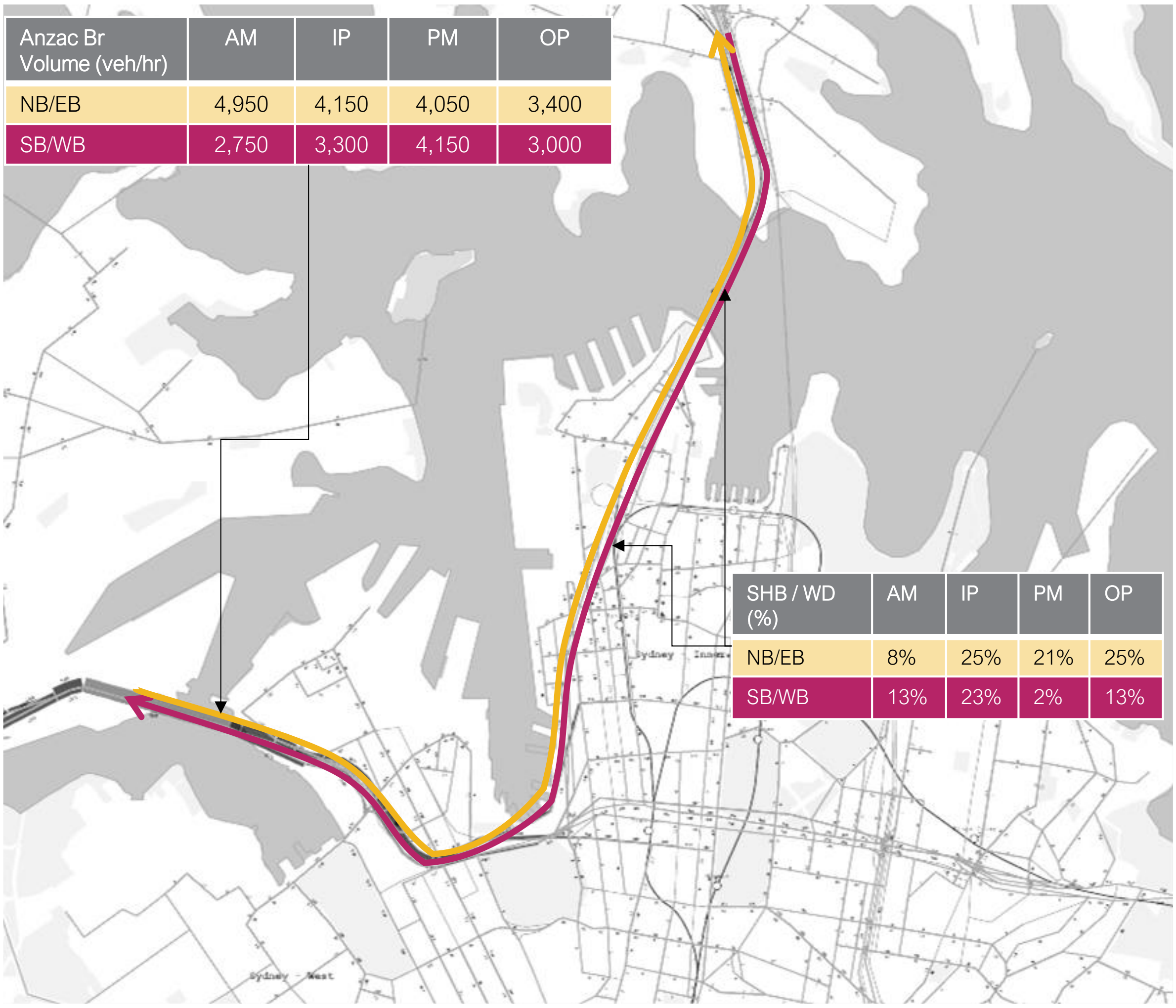
Figure 4.10: 2016 SMPM outputs – traffic from the SHB to key points (trip distribution)



During AM peak period, 13% of Anzac Bridge southbound traffic (2,750 veh) comes from SHB/WD and 8% of Anzac Bridge southbound traffic (4,950 veh) goes to Western Distributor heading to the SHB.

During PM peak period, 2% of Anzac Bridge southbound traffic (4,150 veh) comes from SHB/WD and 21% of Anzac Bridge southbound traffic (4,050 veh) goes to Western Distributor heading to the SHB.

Figure 4.11: 2016 SMPM outputs – traffic from Anzac Bridge to SHB



Anzac Br Volume (veh/hr)	AM	IP	PM	OP
NB/EB	4,950	4,150	4,050	3,400
SB/WB	2,750	3,300	4,150	3,000

SHB / WD (%)	AM	IP	PM	OP
NB/EB	8%	25%	21%	25%
SB/WB	13%	23%	2%	13%

4.3. Freight

4.3.1. Context and Function

TfNSW provides guidance on the functional freight hierarchy for the State road network in Sydney as shown in Figure 4.12. The project corridor is classified as a combination of tertiary and secondary freight routes, providing links within both regional and sub-regional areas, while connecting major business and freight hubs to primary freight routes.

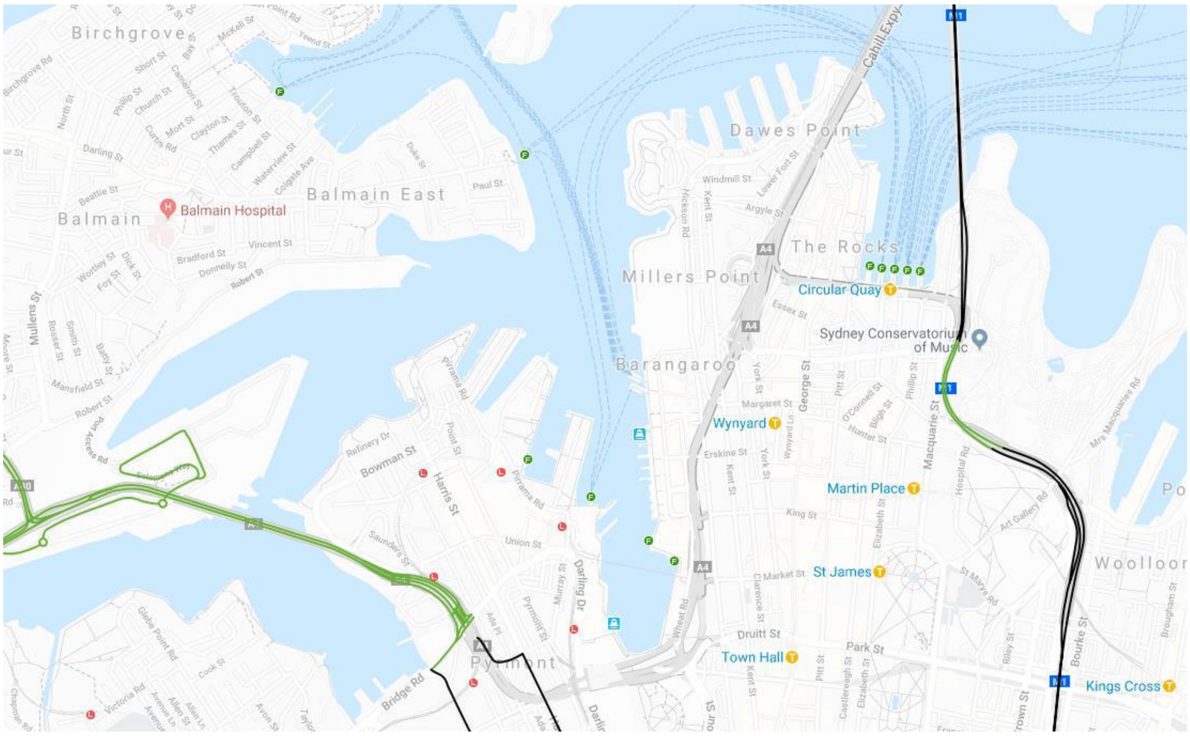
Figure 4.12: Freight hierarchy

Source: Metropolitan Road Freight Hierarchy on the State Road Network Practice Note

General Mass Limit (GML), Concessional Mass Limit (CML) and Higher Mass Limit (HML) routes are illustrated in to Figure 4.13 to Figure 4.15.

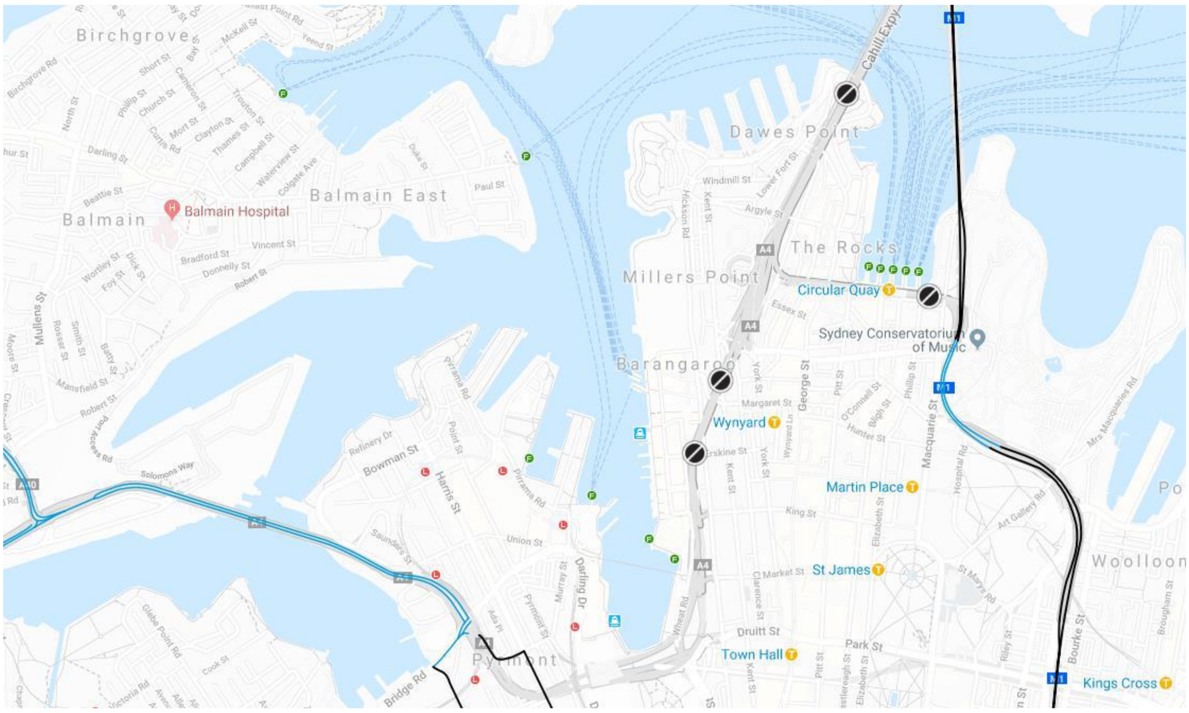
Structures along the Western Distributor and Sydney Harbour Bridge restrict these corridors from use by GML, CML and HML vehicles. Heavy vehicles are mostly limited to the Anzac Bridge and the Sydney Harbour Tunnel - Eastern Distributor corridor. Due to constraints at the Sydney Harbour Bridge, the Sydney Harbour Tunnel provides for the key freight function across the Harbour, though travel conditions apply and is height-restricted – as is the Eastern Distributor corridor. The only interfacing roads that enable movement of these vehicle types are Pyrmont Bridge Road and Harris Street in the Pyrmont area.

Figure 4.13: GML and CML routes



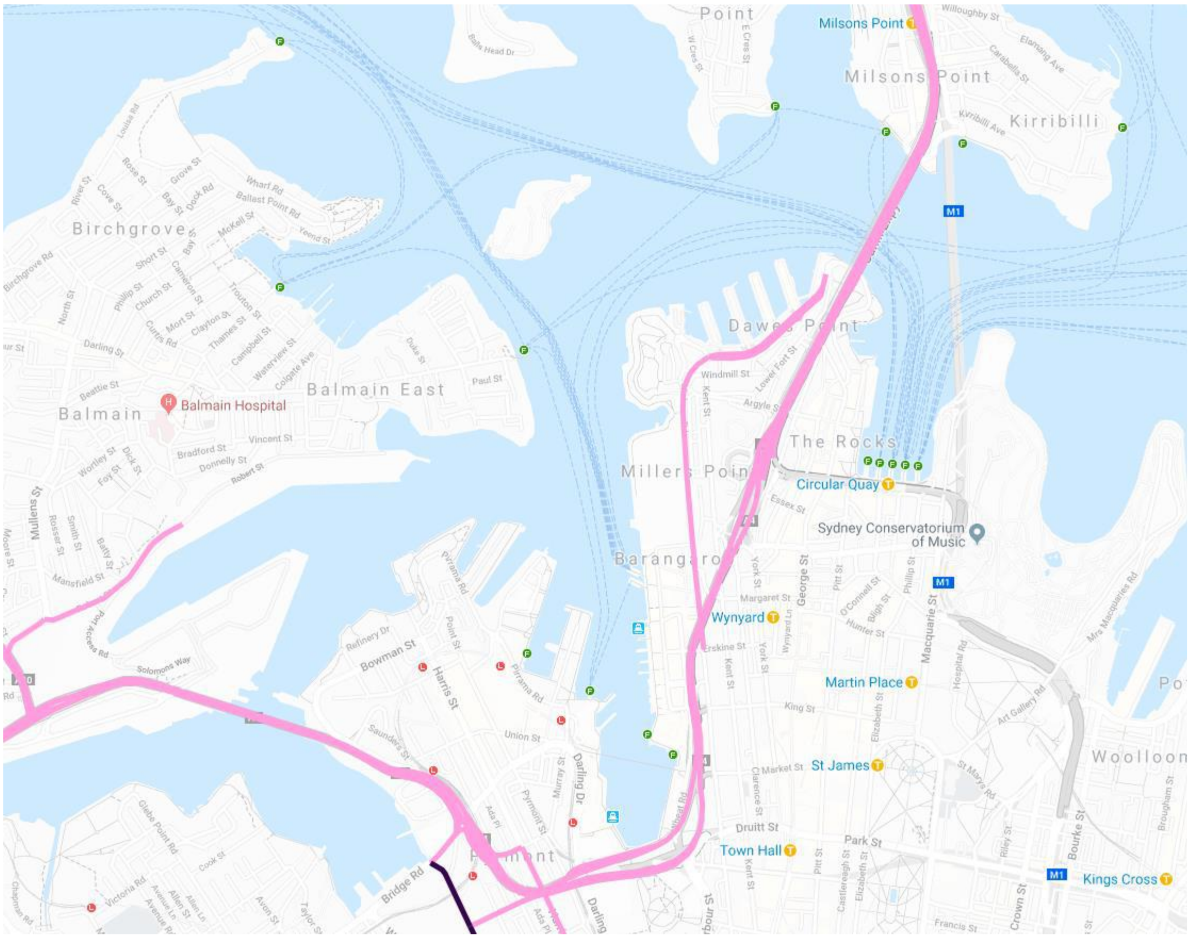
Source: TfNSW, 2016

Figure 4.14: HML routes



Source: TfNSW, 2016

Figure 4.15: 4.6m high vehicle routes



Source: TfNSW, 2016

4.3.2. Volumes and Patterns

Traffic volume data for key cross-harbour links are summarised in Table 4.4. It indicates that more heavy vehicles travel during IP peak period comparing to AM and PM peak.

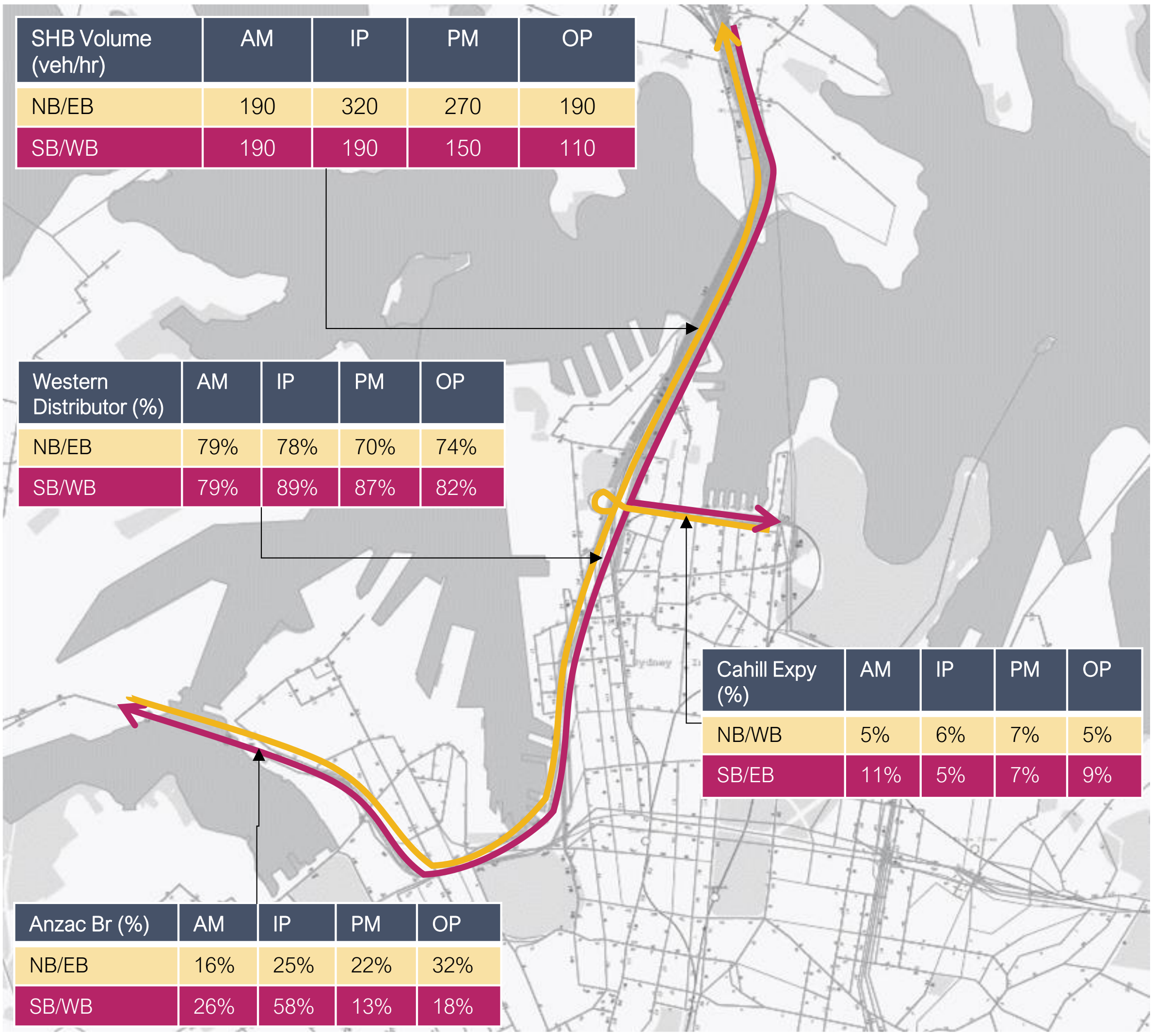
Table 4.4: 2016 SMPM heavy vehicle flows at key locations

	Direction	AM Peak (veh/ h)	IP Peak (veh/ h)	PM Peak (veh/ h)	OP Peak (veh/ h)
Anzac Bridge	Eastbound	210	260	150	130
	Westbound	180	250	130	110
Sydney Harbour Bridge	Northbound	190	320	270	190
	Southbound	190	190	150	110
Western Distributor	Northbound	150	250	190	140
	Southbound	150	170	130	90

Figure 4.16 and Figure 4.17 illustrate the heavy vehicle trip distribution using at the SHB and Anzac Bridge which were extracted from SMPM Select Link Analysis.

During IP peak period, 78% of SHB northbound traffic (320 veh) come from Western Distributor and 25% of SHB northbound traffic come from Anzac Bridge.

Figure 4.16: 2016 SMPM heavy vehicle flows at SHB and trip distribution to key points



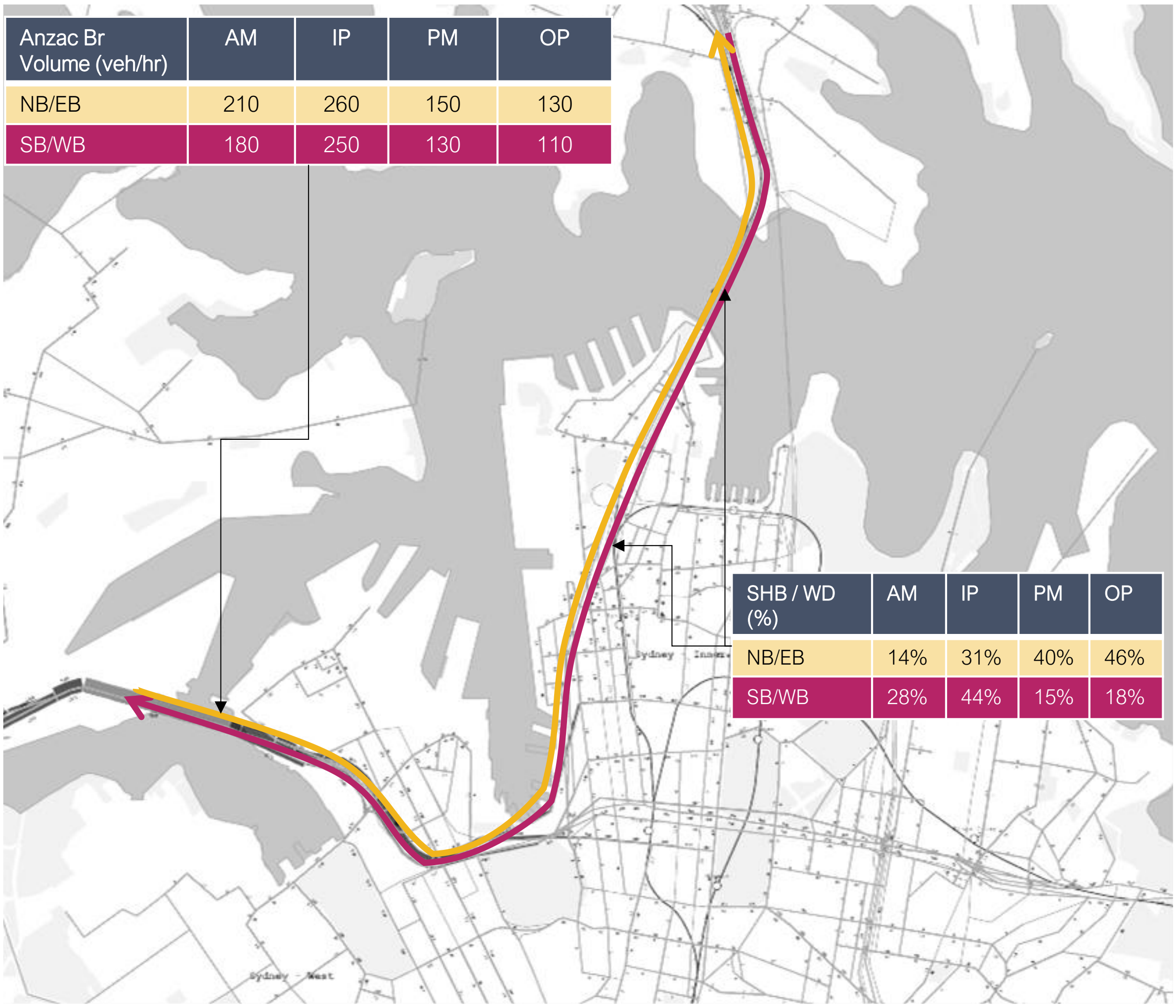
SHB Volume (veh/hr)	AM	IP	PM	OP
NB/EB	190	320	270	190
SB/WB	190	190	150	110

Western Distributor (%)	AM	IP	PM	OP
NB/EB	79%	78%	70%	74%
SB/WB	79%	89%	87%	82%

Cahill Expy (%)	AM	IP	PM	OP
NB/WB	5%	6%	7%	5%
SB/EB	11%	5%	7%	9%

Anzac Br (%)	AM	IP	PM	OP
NB/EB	16%	25%	22%	32%
SB/WB	26%	58%	13%	18%

Figure 4.17: 2016 SMPM heavy vehicle flows at Anzac Bridge and trip distribution to WD/SHB



Anzac Br Volume (veh/hr)	AM	IP	PM	OP
NB/EB	210	260	150	130
SB/WB	180	250	130	110

SHB / WD (%)	AM	IP	PM	OP
NB/EB	14%	31%	40%	46%
SB/WB	28%	44%	15%	18%

4.4. Walking

As the majority of the corridor is a grade separated motorway facility, the corridor has limited interaction with the pedestrian network, except at critical links such as the Sydney Harbour Bridge and Anzac Bridge where all modes converge. Pedestrians are also key where the network intersects with the connecting local street network, most notably in the Sydney CBD and Pyrmont areas. This is particularly evident for the Market Street to Pyrmont Bridge pedestrian connection that traverses along the Western Distributor.

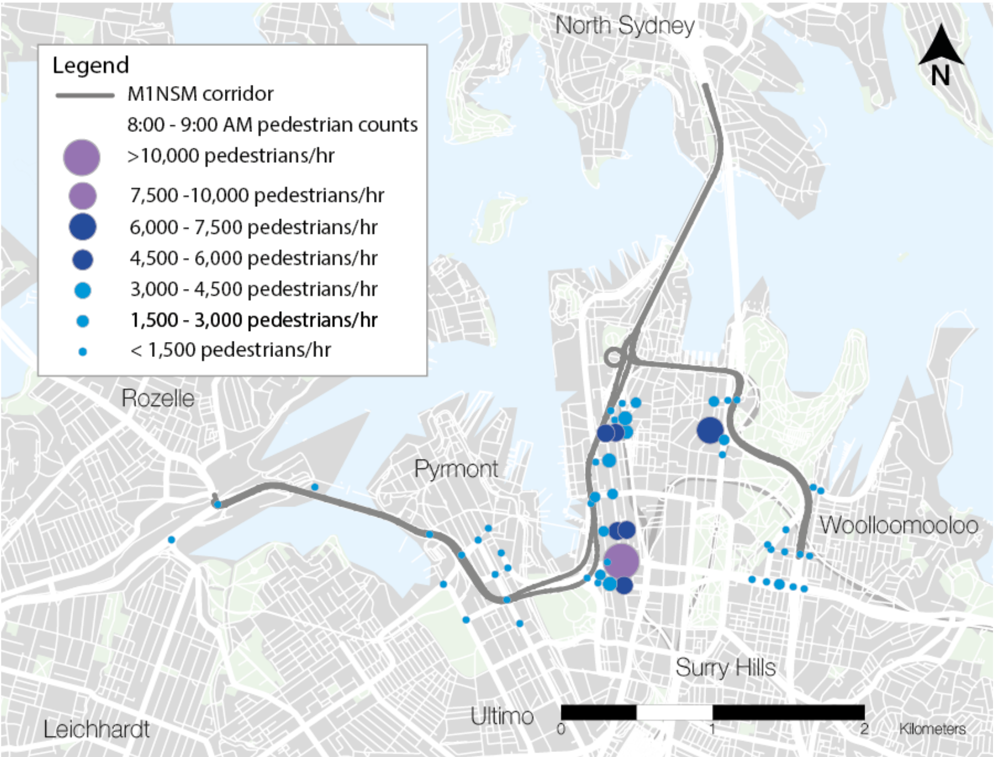
AM and PM peak hour pedestrian activity at key intersections within the study area are illustrated in Figure 4.18 and Figure 4.19. Generally, it is shown that the pedestrian counts are higher in the centre of the Sydney CBD during both peak periods, particularly around Town Hall Station, Wynyard Station, and Martin Place Station. Activity was approximately 1,000-6,000 pedestrian crossing movements per hour at each intersection around those areas. There were generally less than 1,000 pedestrian crossing movements per hour around Woolloomooloo and Pyrmont, and areas around the CBD further from a train station.

The Druitt Street/ Kent Street intersection has been identified as having the highest activity with approximately 10,100 and 10,700 pedestrian crossing movements per hour in the AM and PM peak hour respectively.

Understanding pedestrian activity surrounding the study area is important to consider potential impacts of poor motorway mainline performance – which may result in queues spilling back in to surround streets and intersections. Pedestrian activity is approximately 1,000-2,000 pedestrian movements per hour at intersections near on ramps, including at the:

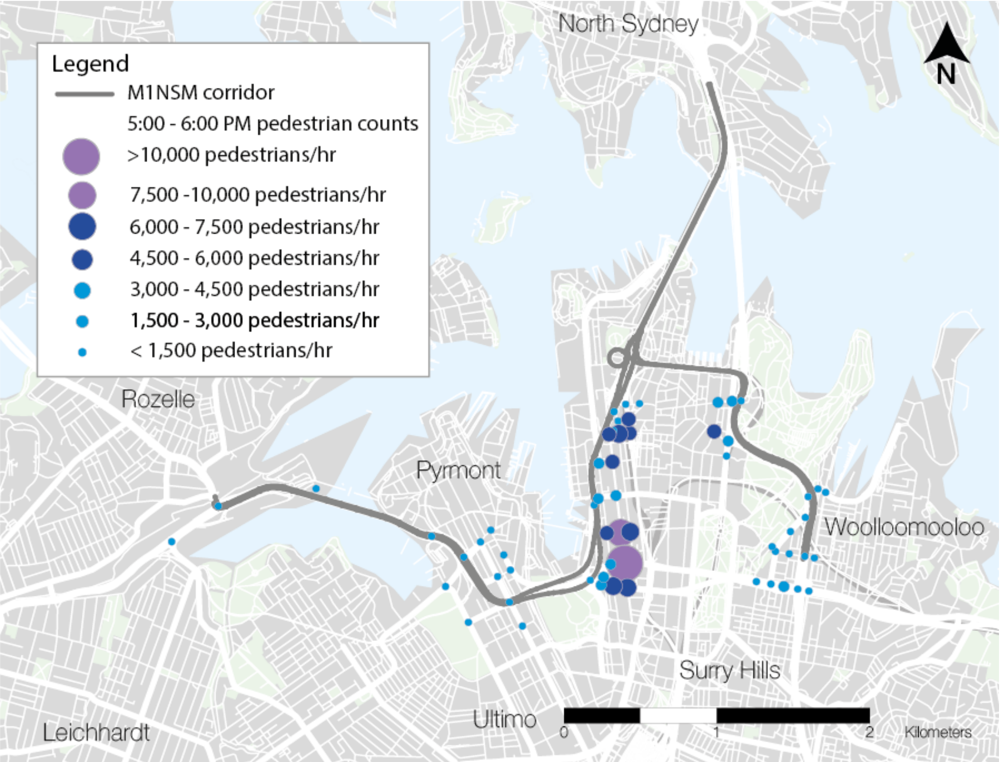
- Market Street/ Sussex Street intersection
- Macquarie Street/ Bent Street/ Shakespeare Place intersection
- Pyrmont Bridge Road/ Bank Street intersection
- Harbour Street/ Day Street intersection.

Figure 4.18: Pedestrian intersection counts for the AM peak



Source: Austraffic, 6th June 2017

Figure 4.19: Pedestrian intersection counts for the PM peak



Source: Austraffic, 6th June 2017

4.5. Cycling

Cycling facilities are shown in Figure 4.20 and illustrate the convergence of key cycling facilities on the corridor at the Sydney Harbour Bridge and Anzac Bridge – each with off-road facilities for cyclists. Other key facilities that interface with or operate through the project area include those through Pyrmont and across the Pyrmont Bridge, along Darling Drive and Kent Street.

The fairly connected network of dedicated facilities means that cyclists travelling along key desire lines from the north and west (via Anzac Bridge and Sydney Harbour Bridge) can traverse the area and access the Sydney CBD with generally limited interaction with traffic – and are hence generally protected from the performance of the motorway corridor for vehicles.

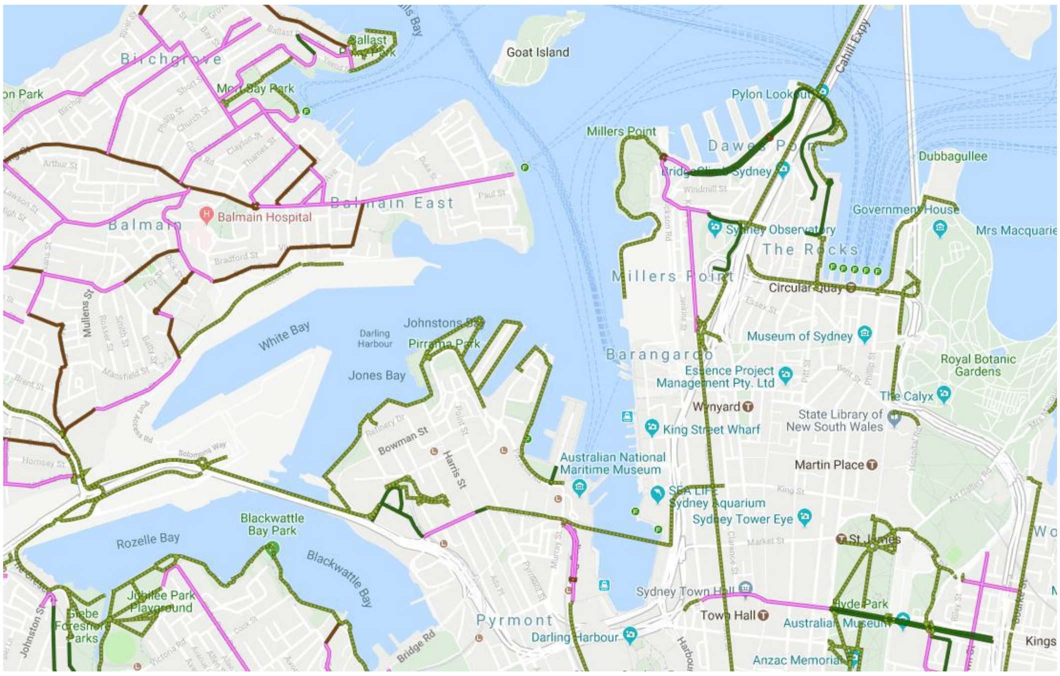
Cyclist activity is identified by a combination of Strava data of cyclists logging trips, and survey counts of on-road cyclists and cyclists crossing at key intersections across the study area. This activity is shown in Figure 4.21 and Figure 4.22 for the AM and PM peak respectively.

Strava data logged for cycling shows a high volume of north-south activity through the Sydney CBD. This is noted along Sussex Street, Kent Street and Clarence Street. East-west connections along King Street, Druitt Street and Liverpool Streets have been identified with some level of regular activity.

This is supported by the peak period cyclists counts which include both on-road and cyclists crossing. High cyclist volumes are shown around intersections with intersecting north-south and east-west cyclist activity and support the Strava data for areas of high cyclist activity.

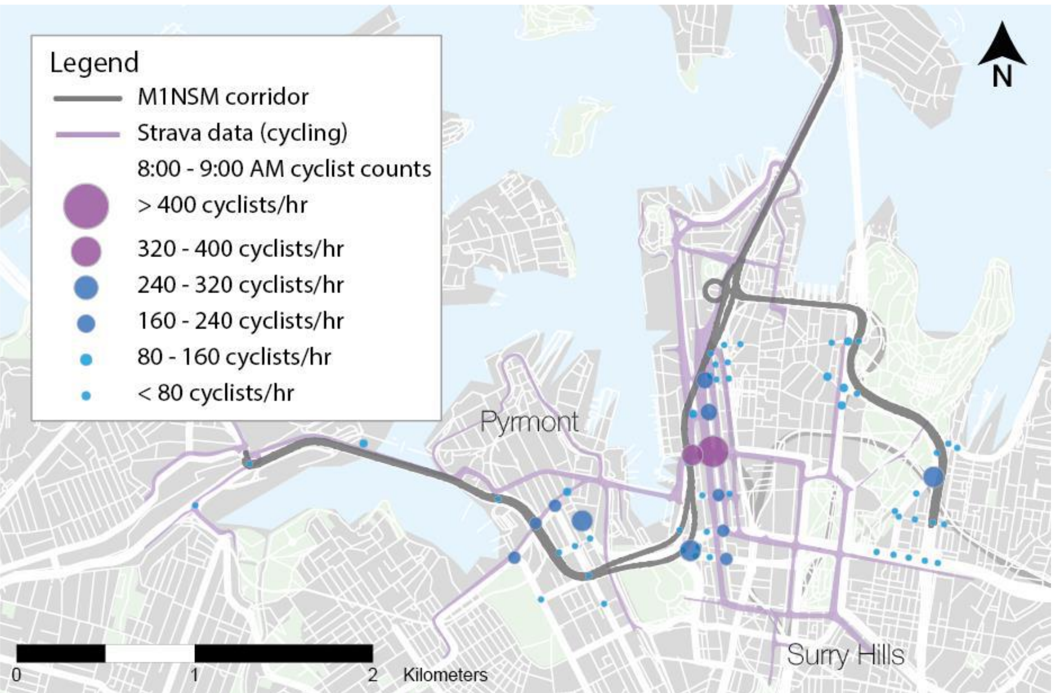
Cycling desire lines are show connecting riders to and from the Sydney CBD between the north via the Sydney Harbour Bridge; the south-east along Oxford Street; towards Pyrmont via the Pyrmont Bridge, and the west via the Anzac Bridge. These desire lines follow quite distinct commuter travel routes to employment areas in the CBD.

Figure 4.20: Cycle network in CBD



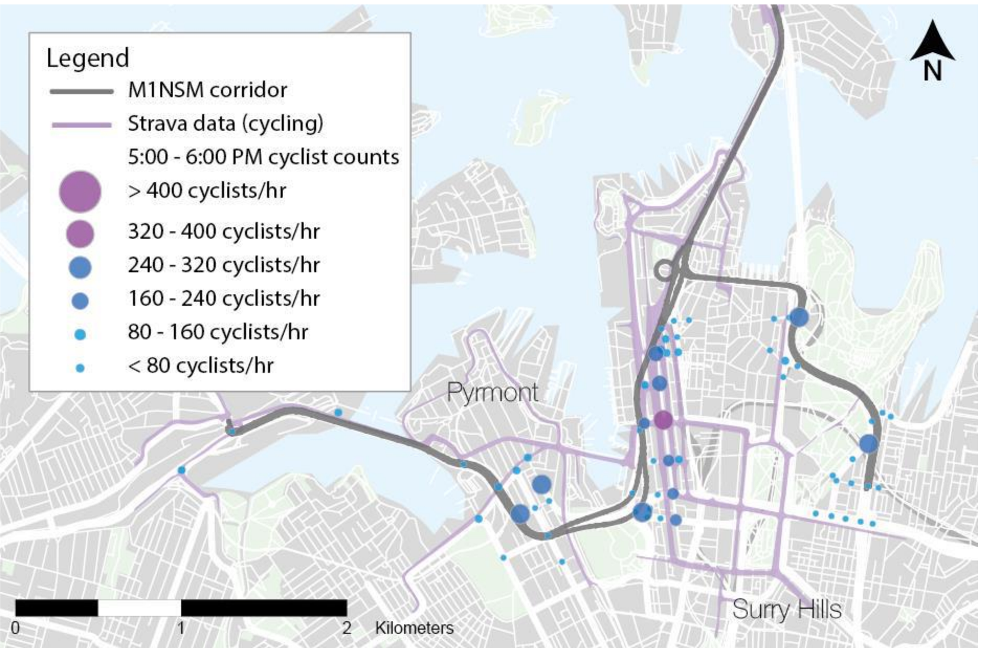
Source: TfNSW Services, 2019)

Figure 4.21: Cyclist infrastructure and activity for the AM peak



Source: Strava, 2018

Figure 4.22: Cyclist infrastructure and activity for the PM peak



Source: Strava, 2018

4.6. Summary

This section summarises the key strategic functions and analysis findings for the existing conditions of the corridor.

Table 4.5: Summary of existing conditions

	Key findings
Road Safety	Road safety presents a key issue for the corridor, yielding 1.5 times the average number of casualty crashes per kilometre per year when compared to the average for a 6U corridor. Incidents on the network occur across the entire corridor, however, a high number of crashes are concentrated around interchanges, and intersections at on and off ramps connecting the corridor to the local road network.
Traffic	The project corridor is broadly classed as a '6U' road – associated with the urban motorway typology. Traffic movement is a key function of the corridor, with high volumes of vehicles throughout a typical day. The southbound traffic at SHB reach its capacity in the morning and evening peaks comparing VC ratio.
Freight	The project corridor is classified as a combination of tertiary and secondary freight routes. The Sydney Harbour Bridge has several vehicle restrictions that result in Anzac Bridge and Sydney Harbour Tunnel having slightly higher heavy vehicle traffic flows. Key noted traffic operational issues also coincide with the freight network.
Walking	Key walking function are generally limited to the separated walking facilities provided on Anzac Bridge and Sydney Harbour Bridge, though corridor operates nearby highly pedestrianised intersections – particularly in the CBD Pedestrian activity is approximately 1,000-2,000 pedestrian movements/hour at intersections in close proximity to key corridor on ramps.
Cycling	The corridor's cycling functions are again primarily at the Anzac Bridge and Sydney Harbour Bridge, connecting regional routes to the city centre. Distinct cycling commuter routes are evident to interact with the project corridor between the CBD and the Harbour Bridge and the Anzac Bridge.

5. FUTURE CONDITIONS WITHOUT PROJECT

5.1. Interfacing Projects

Figure 5.1 illustrates the long term (2056) vision for the transport system in the study area and identifying the key centres driving transport demand in the area. The following discussion is a synopsis of the key projects interfacing with the corridor that comprise part of this vision, and are currently at planning, construction or completion stages. Each of which impact on the transport task of the corridor and/ or its surrounding urban environment. The impacts of each are discussed as relevant to each mode in further detail in the sections following.

The interfacing projects are included:

- WestConnex
- Western Harbour Tunnel and Beaches Link
- Sydney Metro City and Southwest
- Sydney West
- Sydney Harbour Bridge Cycleway.

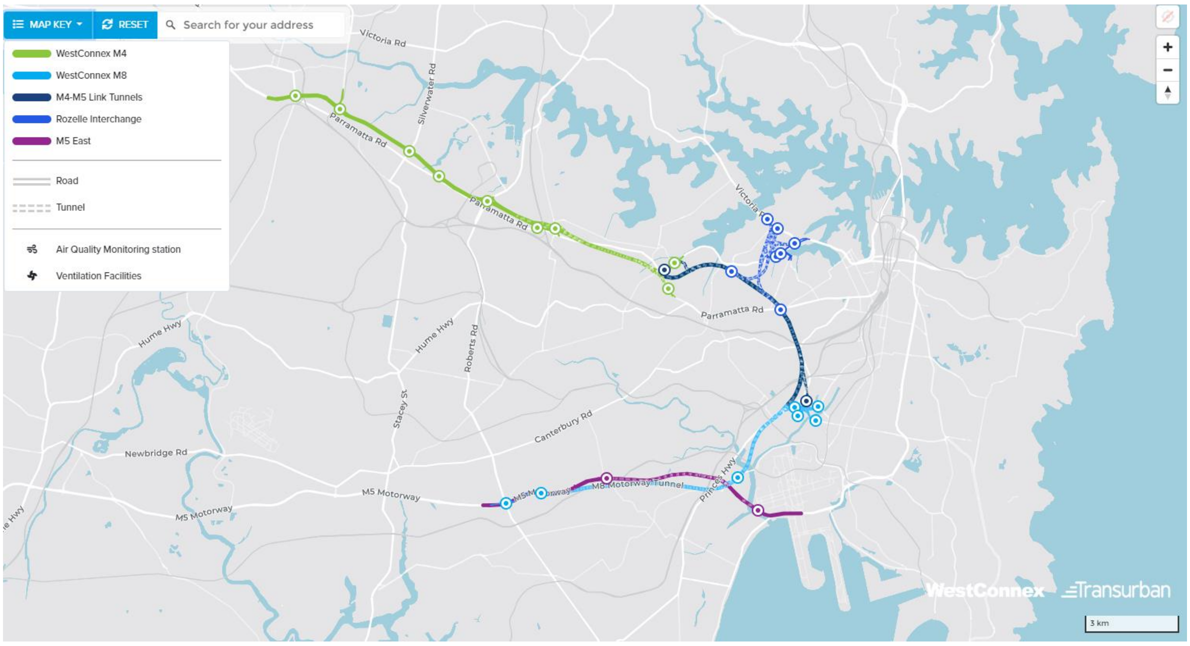
WestConnex

WestConnex is a proposed 33 kilometre motorway linking Sydney's west with the CBD, Port Botany, Sydney Airport and the south west. Specifically, WestConnex will extend the M4 Motorway to the inner city, duplicate the existing M5 East Motorway and allow a new link to Sydney Airport. WestConnex will be delivered in the following stages:

- Stage One: Widening and extension of the M4 Motorway (completed)
- Stage Two: New M5 Motorway from King Georges Road to St Peters (~2020)
- Stage Three: M4-M5 Link between Haberfield and St Peters (~2023).

Of most relevance to the corridor is the combination of Stage 1 (WCX1) and Stage 3 (WCX3) which will combine to provide a motorway-standard facility from Parramatta to the Sydney CBD, directly connecting to the western end of the corridor, and creating a bypass of the currently capacity constrained arterial corridors that feed the Western Distributor from the west (e.g. City-West Link, Parramatta Road). Connecting with Stage 2 (WCX2), the Sydney Gateway (2023) and F6 Extensions Stage A (2024) will connect WestConnex with the Sydney Airport/ Port Botany and southern suburbs respectively.

Figure 5.1: WestConnex project



Source: https://www.westconnex.com.au/explore-westconnex/interactive-map/

Western Harbour Tunnel and Beaches Link

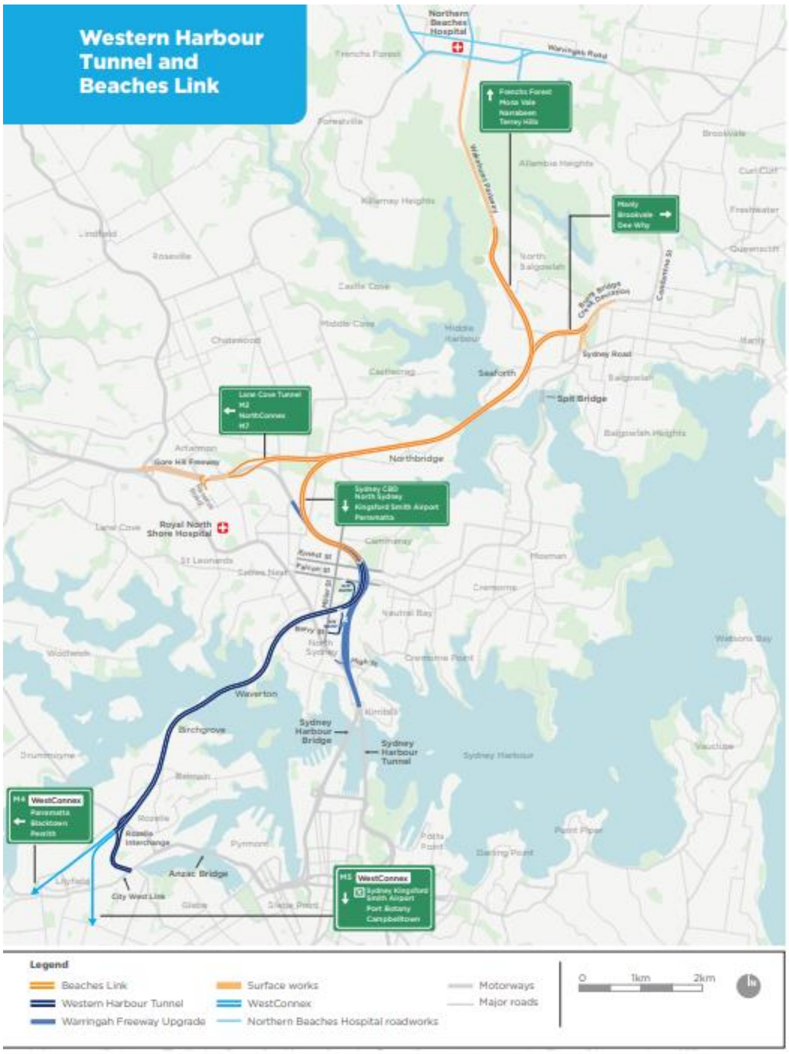
Western Harbour Tunnel (WHT) is a major transport infrastructure project that will extend between the Rozelle Interchange and the Warringah Freeway Upgrade (WFU), under Sydney Harbour. Beaches Link will consist of a new tunnel from the Northern Beaches, under Middle Harbour, connecting to Gore Hill Freeway and the Warringah Freeway.

This new cross-harbour bypass of the CBD would take pressure off the Sydney Harbour Bridge and Sydney Harbour Tunnel. At the west, the project will enable a degree of functional change of the Western Distributor by reducing demand travelling through the corridor. For the east of the corridor, when combined with M4-M5 Link it also enables a dual function with the Eastern Distributor in providing a motorway standard facility from the northern suburbs to the southern suburbs, including to the Sydney Airport.

Future Transport identifies Western Harbour Tunnel and Beaches Link as a committed infrastructure initiative (subjective to final business case and funding) and is currently at community and stakeholder engagement stage for constituent projects of WHTBL:

- Warringah Freeway Upgrade (WFU): EIS and Subsequent submission report publicly displayed;
- Western Harbour Tunnel (WHT): EIS and Subsequent submission report publicly displayed; and
- Beaches Link (BL): EIS exhibition expected from late 2020.

Figure 5.2: Western Harbour Tunnel and Beaches Link



Source: Western Harbour Tunnel and Warringah Freeway Upgrade, your guide to the Environmental Impact Statement, 2020

Sydney Metro City and Southwest

Sydney Metro City and Southwest will extend from Chatswood, under Sydney Harbour, through the Sydney CBD and south west to Bankstown, with capacity to run up to 30 trains per hour in each direction through the city on the new line. The metro represents a major increase in the capacity of Sydney's rail network and is due to open in 2024. It will connect with the recently opened Sydney Metro Northwest, enabling non-stop rail connectivity from Sydney's far northwest the CBD and beyond to the southwest. The project will provide travellers to the CBD and surrounds from the northwest with a higher order transit service option to the current buses and car, enabling a potential shift of people movement off the Sydney Harbour Bridge by bus and car to a new rail tunnel under the harbour.

Sydney Metro West

Announced in 2016 by the NSW Government, Sydney Metro West will connect Westmead with Sydney's CBD via Parramatta, Sydney Olympic Park and the Bays Precinct. It is expected to be delivered in 2030.

The project will enable a new (rail) means of accessing Sydney's dual CBD's (Sydney and Parramatta) from the existing and proposed communities along the corridor. Similar to Sydney Metro City and Southwest, it will provide customers with a rail alternative to the current bus services and private vehicle options currently operating across the Anzac Bridge.

Figure 5.3: Sydney Metro West Corridor

Source: Sydney Metro, 2020

Sydney Harbour Bridge Cycleway

The Sydney Harbour Bridge Cycleway is a proposed dedicated cycleway linking the Sydney Harbour Bridge and the Kent Street cycleway. The project will improve safety and connectivity for cyclists using this part of the M1NSM corridor.

Key features of the cycleway include the:

- Provision of a dedicated two-way cycleway connection from the Kent Street cycleway to the Sydney Harbour Bridge cycleway.
- Removal of the existing steep shared-use bridge with a sharp turn over the Cahill Expressway and construction of a new cycle and pedestrian bridge with improved width and sight lines. Approach ramps to the new cyclist and pedestrian bridge will be provided with easier gradients and sight lines.

The connection will remove the need for cyclists to share public roads and footpaths between the bridge and Kent Street. The Sydney Harbour Bridge cycleway project will provide a dedicated cycleway linking the CBD and the Harbour Bridge. This in turn will provide safety benefits for cyclists using the corridor and encourage more use of the mode to access the city from the north.

Figure 5.4: Sydney Harbour Bridge cycleway

Source: TfNSW, 2019

5.1.1. Urban Development

As identified in Figure 2.3, the study area has two key urban/ land use features – The Bays and the Sydney CBD – which will drive increases in future travel demand within the study area.

The Bays

The Bays consists of 5.5 kilometres of harbourfront, 95 hectares of largely government-owned land and 94 hectares of waterways in Sydney Harbour. The regeneration of The Bays Precinct will deliver a large number of jobs, housing choices, services, retail and education facilities. These in turn will add substantial demand to the local transport system. Whilst a substantial portion of this additional demand is anticipated to use sustainable transport modes, particularly with the proposed Bays Station as part of Sydney Metro West, it will also result in an increase in vehicles using the surrounding road network including buses, taxis and private vehicles.

A large number of these increased vehicle trips will be required to use the corridor – with Pyrmont Bridge Road ramps providing immediate access to the east of the precinct (Sydney Fish Market) and the Anzac Bridge being a key access corridor for the western precinct areas.

The program duration is forecast to be in the order of 20-30 years. The short-term focus of the program is on delivery of the eastern portion of the precinct including predominantly the new Sydney Fish Market. The likely higher-yielding precincts in the west of the precinct (e.g. Glebe Island, White Bay, Rozelle Bay) are not programmed until the long term beyond the 10 years assessment timeframe adopted for the M1NSM project.

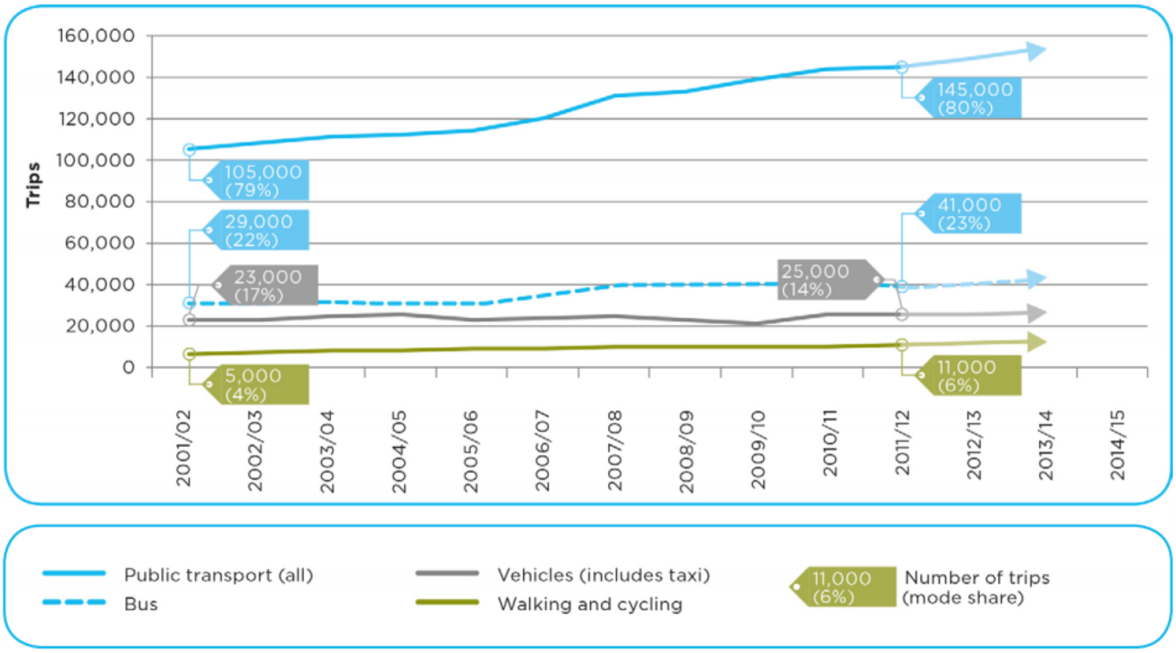
Figure 5.5: The Bays

Source: Source: (http://www.urbangrowth.nsw.gov.au/assets/Uploads/MUTP- UrbanGrowth-NSW-factsheet-The-Bays-Precinct-2017.pdf)

Sydney CBD

Whilst there is no one singular development in the Sydney CBD considered of focal significance to traffic and travel patterns along the corridor, new development across the city centre is forecast to trigger growth of 145,000 daily trips to 775,000 trips by 2031 (City of Sydney, 2013). The Sydney City Centre Access Strategy (NSW Government, 2013) details how people will enter, exit and move in and around the CBD over the next 20 years. The corridor is identified in the Strategy as key to carrying significant volumes of passengers through and around the city centre. It is anticipated that growth in travel to the CBD will increase the volume of people movement along the corridor, particularly by sustainable transport modes – enhancing the importance of bus movement performance in the study area.

Figure 5.6: Trends in travel to the Sydney City Centre - AM peak 1 hour



Source: Sydney City Centre Access Strategy, Transport for NSW, 2013

5.2. Road Safety

A review of the crash history for the corridor showed that road safety presents an issue for the corridor, yielding 1.5 times the average number of casualty crashes per kilometre per year when compared to the average for a 6U corridor. A significant portion of these crashes are considered typical of a corridor with high vehicular movement and congestion with increases in forecast traffic demand and congestion (see Section 4.1), particularly at key existing network performance and safety hotspots, it is anticipated these crash trends and types will continue to be an issue for the corridor. The planned motorway network scenario that will likely have the worst road safety outcome is the period between the completion of WestConnex Stage 3 (~2023) and the completion of Western Harbour Tunnel, when congestion is likely to be highest in the corridor. This will likely exacerbate existing road safety issues on the corridor, particularly on the southern approach to Sydney Harbour Bridge (noting the Southern Toll Plaza may reduce certain crash types such as those related to objects/ hazards) and the Darling Harbour weave section, as well as introduce potential new safety hotspots.

5.3. Traffic

The corridor's primary function as a movement route for traffic is forecast to largely remain the same in the future. As described in Section 5.1 however, there are several planned, committed and under-construction projects that will impact traffic patterns in the area and performance of the corridor.

5.3.1. Volumes and Patterns

Assigned demand on the road network in 2021, 2026, 2031 without WHTBL project are expected to increase to the 2016 SMPM model. WHTBL project is expected to reduce the demand compared to 2016 SMPM model outputs as summarised in Table 5.1.

The main factors anticipated to impact the future traffic function of, and patterns along, the corridor are described below. To understand the step changes in traffic patterns anticipated to be brought about by planned changes in transport and land use, strategic model outputs in the form of difference plots were sourced from TfNSW and are discussed as relevant in the following.

- Relief from Western Harbour Tunnel

  WHT will provide a new western bypass of the Sydney CBD and a new cross-harbour connection, relieving congestion on Sydney Harbour bridge and Harbour Tunnel. This change will alleviate some existing and forecast increasing pressures on the corridor.

- The nett effect on traffic volumes along the corridor

  The forecast result of the cumulative motorway program (refer to section 5.1), and background growth from local and broader land uses to 2031, is a nett increase in traffic volumes on all links of the corridor. This indicates that background growth in traffic volumes may outweigh reductions from the projects identified above.

Table 5.1: Total SMPM traffic volumes of study corridor

Peak	Scenarios	Demand (veh)	Growth p.a. from 2016 Base Model
AM	2016_M3001	135,600	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	139,100	0.5%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	139,800	0.3%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	144,400	0.4%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	130,000	-0.3%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	133,500	-0.1%
IP	2016_M3001	123,900	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	129,900	1.0%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	130,600	0.5%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	133,800	0.5%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	104,500	-1.1%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	106,900	-0.7%
PM	2016_M3001	133,800	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	142,800	1.3%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	145,100	0.8%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	148,900	0.7%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	129,000	-0.2%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	134,000	0.0%

Peak	Scenarios	Demand (veh)	Growth p.a. from 2016 Base Model
EV	2016_M3001	106,000	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	114,800	1.6%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	115,100	0.8%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	119,000	0.8%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	91,800	-1.0%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	94,400	-0.6%

Table 5.2 to Table 5.5 show traffic volumes at key points of the study area for the AM, IP, PM and OP peak respectively. Broadly due to implementation of WHTBL, the traffic volume at key locations on study corridor has been reduced.

Table 5.2: Future SMPM traffic volume at key locations, AM peak

	Direction	2016 (M3001)	2021 (M3068)	2026 (M3068)	2031 (M3068)	2031 with WHTBL (M3348)	2036 with WHTBL (M3351)
Anzac Bridge	Eastbound	4,950	5,500	5,500	5,650	5,300	5,550
	Westbound	2,750	3,400	3,300	3,350	2,950	2,900
Sydney Harbour Bridge	Northbound	4,400	4,600	4,700	4,850	4,800	4,950
	Southbound	7,300	7,550	7,750	8,100	7,550	7,800
Western Distributor	Northbound	2,450	2,750	2,750	2,550	1,650	1,700
	Southbound	2,600	2,750	2,800	2,850	2,350	2,350

Table 5.3: Future SMPM traffic volume at key locations, IP peak

	Direction	2016 (M3001)	2021 (M3068)	2026 (M3068)	2031 (M3068)	2031 with WHTBL (M3348)	2036 with WHTBL (M3351)
Anzac Bridge	Eastbound	4,150	4,700	4,700	4,700	4,050	4,100
	Westbound	3,300	4,100	4,100	4,200	3,750	3,750
Sydney Harbour Bridge	Northbound	4,450	4,800	4,800	5,000	3,550	3,700
	Southbound	4,550	4,850	5,000	5,150	4,600	4,800
Western Distributor	Northbound	2,550	2,850	2,850	2,950	1,250	1,300
	Southbound	2,600	2,800	2,900	3,000	2,200	2,250

Table 5.4: Future SMPM traffic volume at key locations, PM peak

	Direction	2016 (M3001)	2021 (M3068)	2026 (M3068)	2031 (M3068)	2031 with WHTBL (M3348)	2036 with WHTBL (M3351)
Anzac Bridge	Eastbound	4,050	4,750	4,650	4,750	4,050	4,000
	Westbound	4,150	5,550	5,750	5,700	5,500	5,650
Sydney Harbour Bridge	Northbound	5,450	5,800	6,000	6,450	5,450	6,050
	Southbound	5,200	5,450	5,550	5,750	5,550	5,700
Western Distributor	Northbound	2,950	3,300	3,350	3,500	1,800	1,950
	Southbound	1,650	1,900	2,000	2,050	1,900	1,900

Table 5.5: Future SMPM traffic volume at key locations, OP peak

	Direction	2016 (M3001)	2021 (M3068)	2026 (M3068)	2031 (M3068)	2031 with WHTBL (M3348)	2036 with WHTBL (M3351)
Anzac Bridge	Eastbound	3,400	4,100	4,100	4,100	3,500	3,550
	Westbound	3,000	3,950	4,000	4,100	4,050	4,050
Sydney Harbour Bridge	Northbound	4,100	4,450	4,400	4,500	3,100	3,250
	Southbound	3,500	3,700	3,850	4,000	3,300	3,400
Western Distributor	Northbound	2,600	2,900	2,850	2,950	1,400	1,450
	Southbound	1,750	1,950	2,050	2,150	1,500	1,550

Figure 5.7 to Figure 5.10 shows absolute difference plots of traffic volumes with and without WHTBL for 2031 model outputs and indicate the impact of WHTBL on study corridor. Sections with most traffic reduction in the study corridor are along the northbound Western Distributor during all peaks.

Figure 5.7: Difference plots of AM traffic volume between with or without WHTBL project, 2031

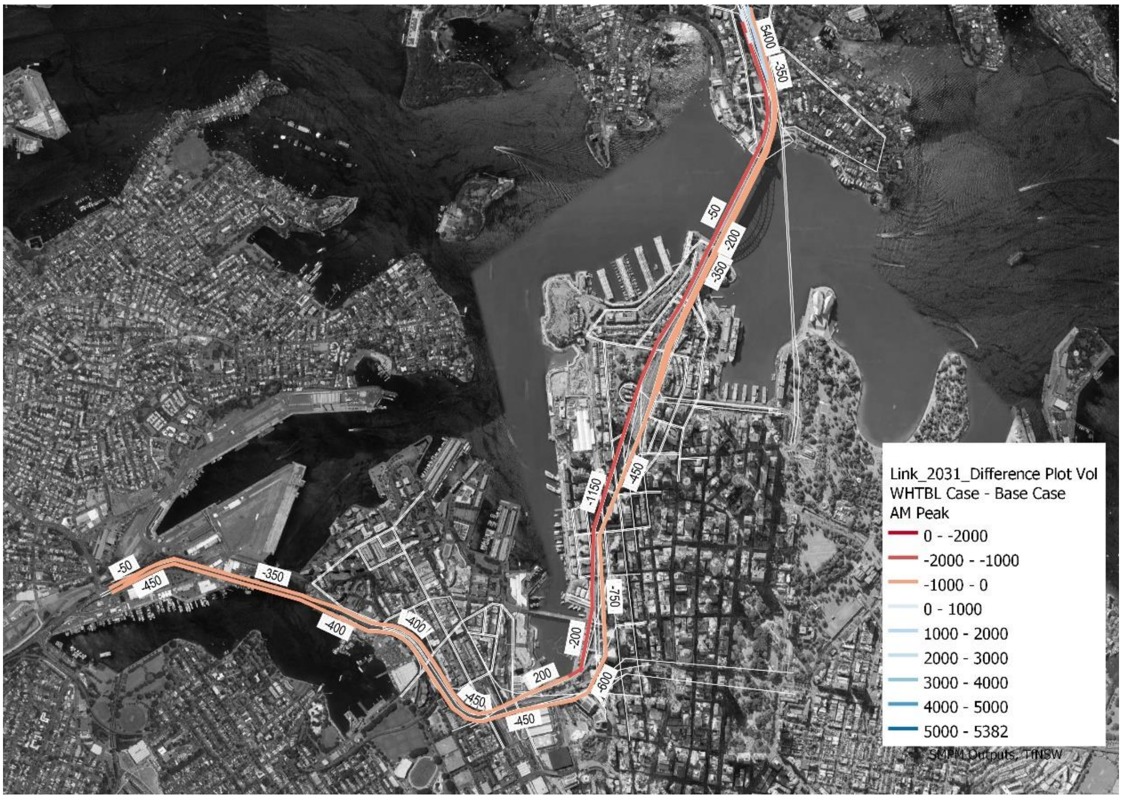


Figure 5.8: Difference plots of IP traffic volume between with or without WHTBL project, 2031

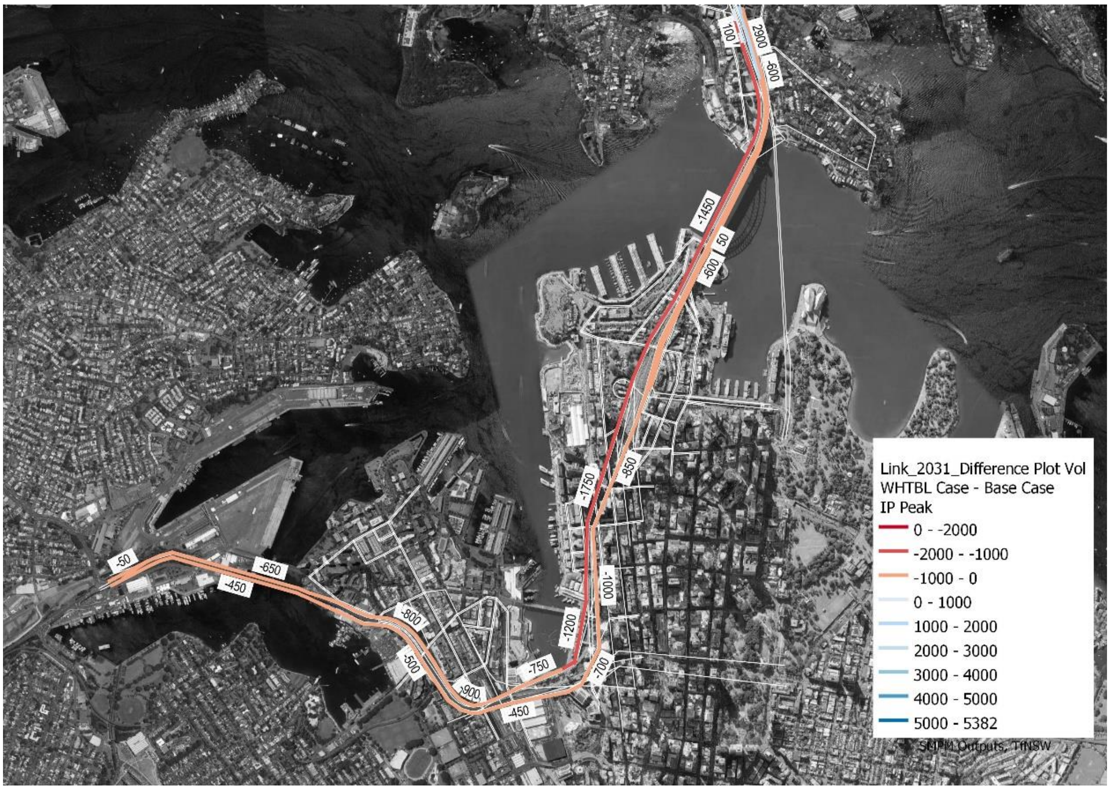


Figure 5.9: Difference plots of PM traffic volume between with or without WHTBL project, 2031

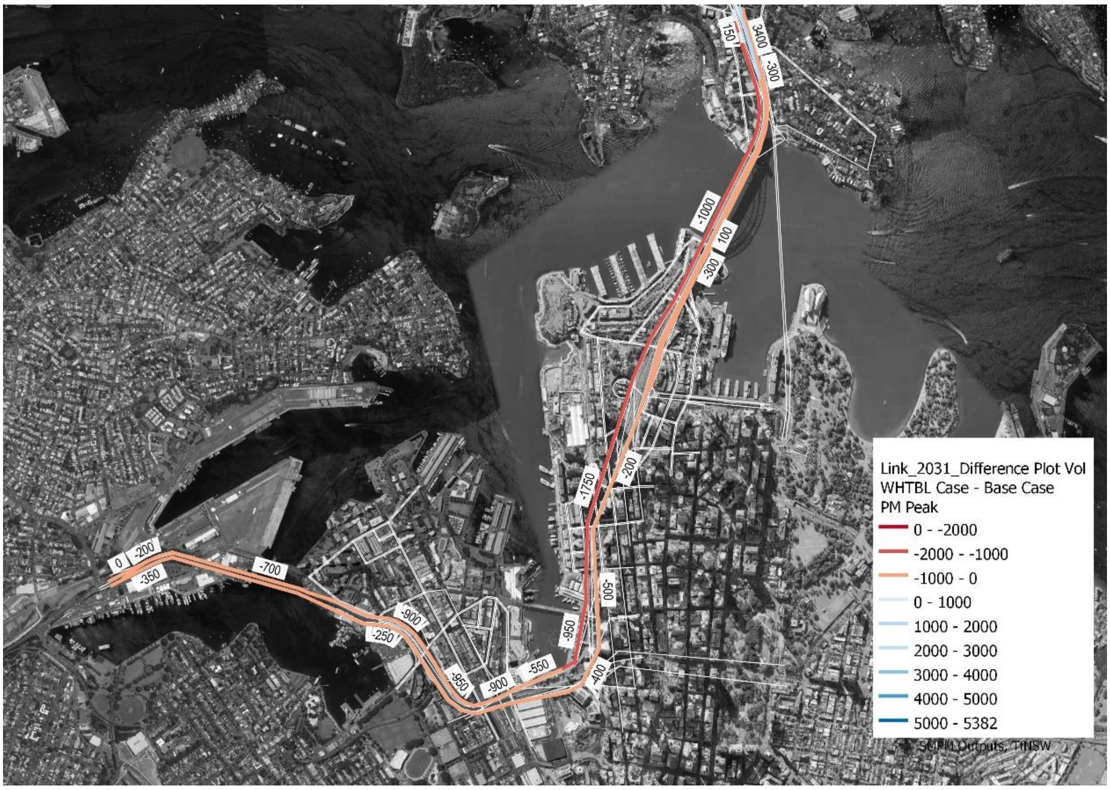
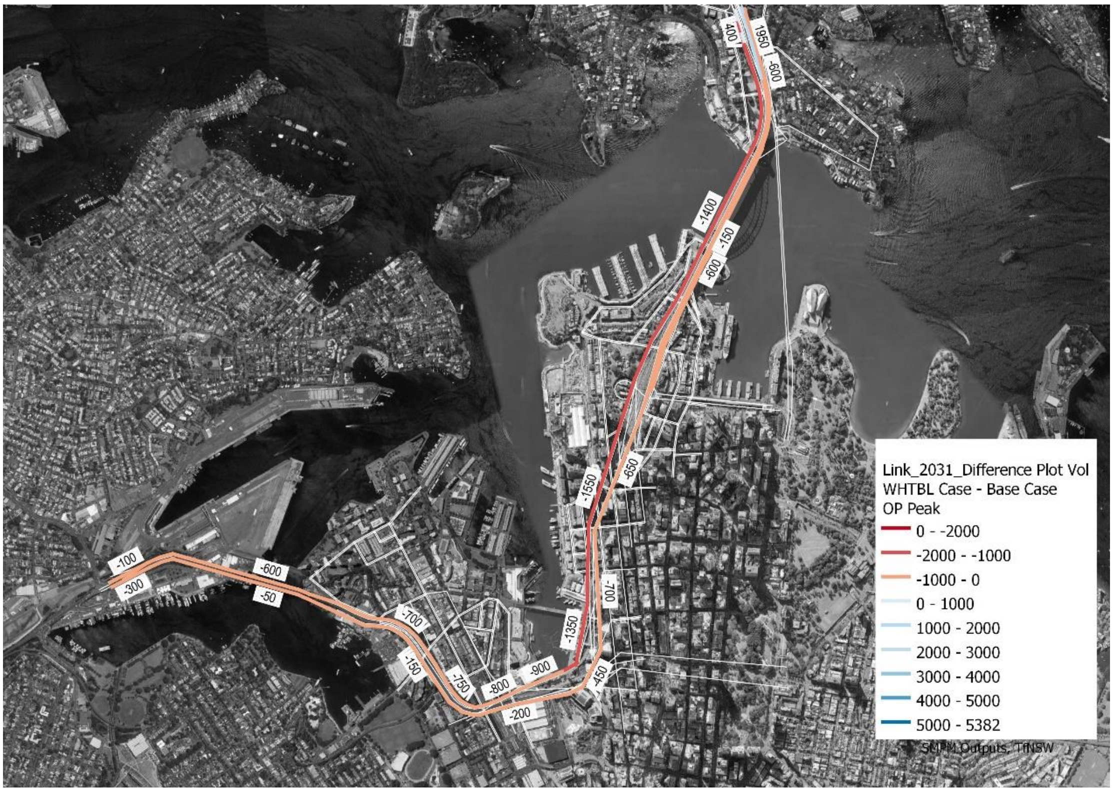


Figure 5.10: Difference plots of OP traffic Volume between with or without WHTBL project, 2031



5.3.2. Performance

The SMPM network statistics for study corridor are summarised in Table 5.6. For most of the analysed peaks, the results show that increase in background traffic volumes though to 2031 will result in a progressive worsening of performance in 2031 Base case compared to 2016 SMPM model outputs. The introduction of the WHTBL project in 2031 results in a reduction in travel times across the analysed corridor during all time periods.

Table 5.6: Performance statistics without project

Peak		VKT		VHT	
		km	Compare to 2016 Base	hours	Compare to 2016 Base
AM	2016_M3001	48,400		1,500	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	50,500	4.3%	1,900	26.7%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	50,900	5.2%	2,000	33.3%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	52,600	8.7%	2,300	53.3%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	47,300	-2.3%	1,400	-6.7%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	48,500	0.2%	1,600	6.7%
IP	2016_M3001	43,300		900	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	46,400	7.2%	1,200	33.3%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	46,700	7.9%	1,200	33.3%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	48,000	10.9%	1,300	44.4%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	37,200	-14.1%	800	-11.1%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	38,200	-11.8%	800	-11.1%
PM	2016_M3001	48,000		1,200	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	52,400	9.2%	1,500	25.0%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	53,500	11.5%	1,600	33.3%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	55,100	14.8%	1,700	41.7%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	47,400	-1.3%	1,200	0.0%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	49,400	2.9%	1,300	8.3%
EV	2016_M3001	37,300		700	
	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	40,800	1.8%	800	14.3%
	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	41,000	1.0%	800	14.3%
	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	42,300	0.8%	900	28.6%
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	32,700	-0.9%	600	-14.3%
	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	33,600	-0.5%	600	-14.3%

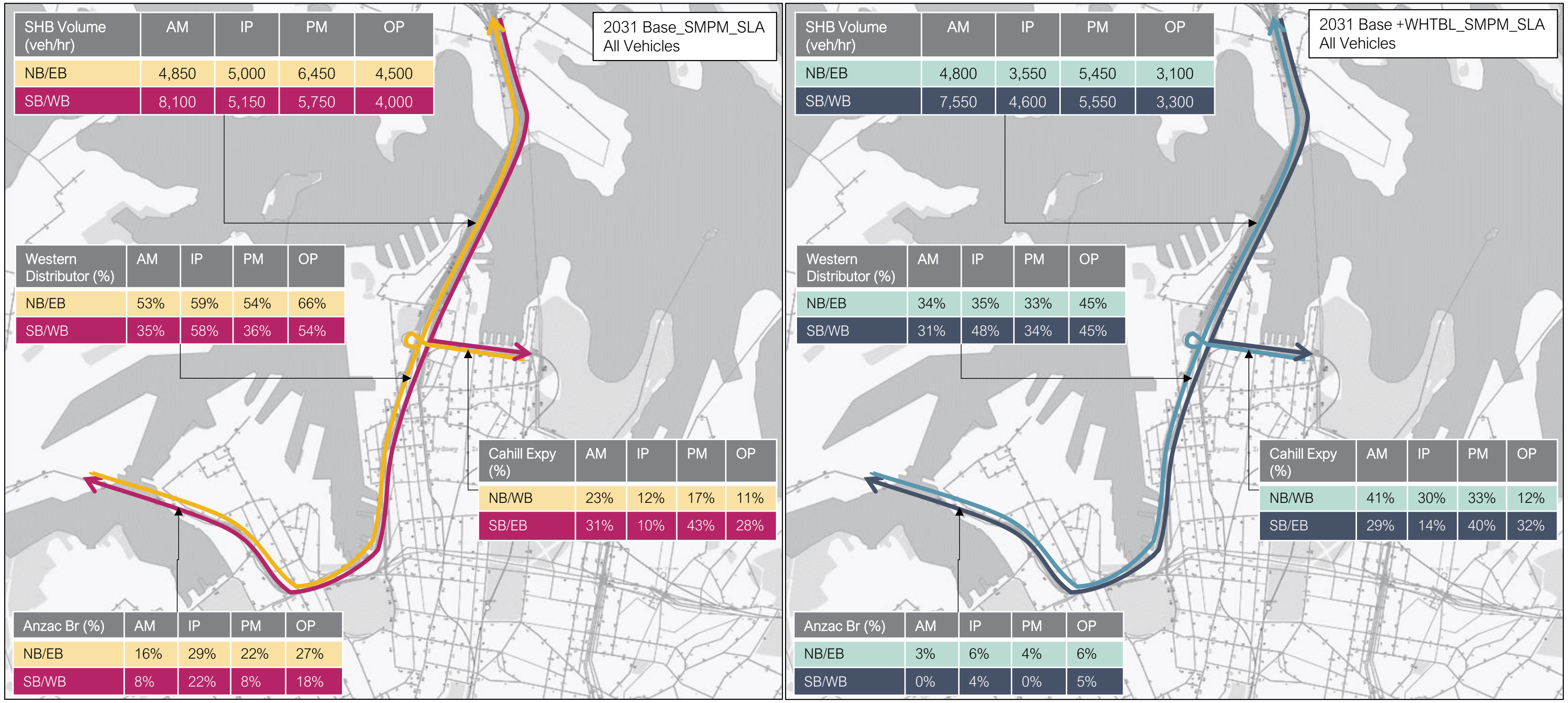
Table 5.7 summarise the assigned volume, VKT and VHT with or without WHTBL project in 2031. The WHTBL project are expected to relieve the congestion on the SHB.

Table 5.7: WHTBL impact : performance statistics without project

Peak	Scenarios	Demand		VKT		VHT	
		vehicles	WHTBL Impact (%)	km	WHTBL Impact (%)	Hours	WHTBL Impact (%)
AM	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	144,400		52,600		2,300	
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	130,000	-10%	47,300	-10%	1,400	-39%
IP	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	133,800		48,000		1,300	
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	104,500	-22%	37,200	-23%	800	-38%
PM	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	148,900		55,100		1,700	
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	129,000	-13%	47,400	-14%	1,200	-29%
OP	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	119,000		42,300		900	
	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	91,800	-23%	32,700	-23%	600	-33%

Figure 5.11 illustrate changes of trip distribution using at the SHB and Anzac Bridge due to WHTBL projects in 2031. Th results show a significant reduction in through trips between Anzac Bridge and SHB.

Figure 5.11: WHTBL Impact – Changes of traffic patterns from SHB to key points, 2031



The 2036 SMPM modelled performance within the network for the AM, IP, PM and OP peak are illustrated in Figure 5.12 to Figure 5.15 and discussed below. The following VC ratio plots provide an indication of the congestion within the modelled network during AM, IP, PM, and OP peak periods. It appears that although the WHTBL project is expected to improve the performance of the study corridor, some sections(in particular the Sydney Harbour Bridge) are still expected to operate over capacity during the AM and PM peak periods in 2036.

Figure 5.12: 2036 AM modelled volumes over capacity ratio (VC Ratio)

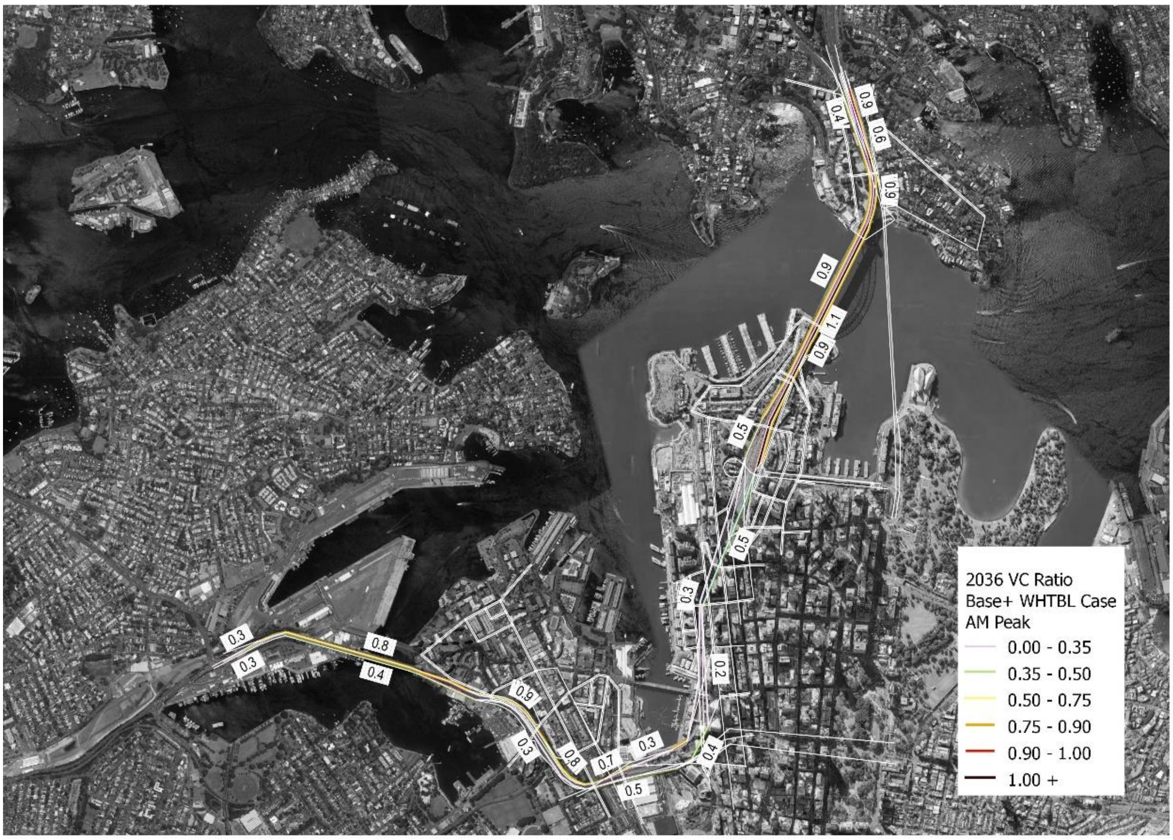


Figure 5.13: 2036 IP modelled volumes over capacity ratio (VC Ratio)

Figure 5.14: 2036 PM modelled volumes over capacity ratio (VC Ratio)

Figure 5.15: 2036 OP modelled volumes over capacity ratio (VC Ratio)

5.4. Freight

The completion of WestConnex and Western Harbour Tunnel will create an integrated network around the CBD better able to support high volumes of freight movement. When complete, WestConnex and Sydney Gateway will effectively extend the M4 corridor to Port Botany and boost capacity on the M5 corridor, better connecting Port Botany and freight precincts in western Sydney. Western Harbour Tunnel will enable freight movements to bypass the Sydney CBD and the M1NSM corridor, benefiting freight customers.

5.5. Walking

By 2036 it is expected that 280,000 people will live in the City of Sydney and 570,000 people will work there (City of Sydney, 2017). This forecast growth in the CBD will generate an increased number of pedestrians in the vicinity of the corridor, particularly with The Bays Precinct development. Whilst the corridor will retain its high movement function in the future, the corridor interfaces with key walking routes between the CBD and Pyrmont/Balmain/Rozelle and North Sydney.

City of Sydney's Walking Strategy and Action Plan 2015-2030 (2017) outlines a need to provide greater priority, safety and amenity for pedestrians. In order to derive the best outcomes for pedestrians, projects and initiatives within this Plan will need to integrate with the corridor and its interfaces with the local network.

It should be noted that the Circular Quay Precinct Renewal (CQPR) project is located adjacent to the Cahill Expressway segment of the corridor. This project aims to integrate land use and infrastructure planning to create a more vibrant place outcome for Circular Quay. This will include a modern transport interchange which may impact or affect the transport operation around Circular Quay interchange

5.6. Cycling

Rapid growth in the number of people cycling to the CBD is expected to continue and will be supported by the completion of the city centre cycleway networks. The city gateways at either end of the corridor, Anzac Bridge and Sydney Harbour Bridge, are important to allowing cyclist access to the CBD. Whilst the number of cycling trips is anticipated to increase throughout the City of Sydney in the future, utilisation of the corridor as part of the cycling network is not expected to increase significantly.

The *Cycling Strategy and Action Plan 2018-2030* (City of Sydney, 2018) is considered the key planning document for cycling in the area, and generally proposes to continue investment in and reinforce the identified established routes – completing missing links or improving facilitates. Cycling routes are to ideally be separated from vehicles, buses and pedestrians in order to provide safer and more direct access for cyclists, and to reduce conflicts.

The new cycleway connection will join the southern end of the existing Sydney Harbour Bridge cycleway to create a connection to the cycling network on Kent Street. Currently, cyclists have no dedicated facilities on the southern approach to the Harbour Bridge, instead share space with pedestrians on the western side of the corridor, ramping up gradually to be level with the Harbour Bridge. The SHB cycleway project will resolve this issue by providing a dedicated cycleway linking the CBD and the Harbour Bridge. This in turn will provide safety benefits for cyclists, pedestrians and motorists, as well as support the future growth in cyclist traffic travelling between Sydney CBD and the lower north shore.

5.7. Summary

Summary of the key network performance issues driving the potential need for investment are summarised in Table 5.8.

Table 5.8: Summary of issues driving a need for investment

Corridor	Category	Existing	Future
All	Road safety	A review of the crash history for the corridor showed that road safety presents an issue for the corridor, yielding 1.5 times the average number of casualty crashes per kilometre per year for a 6U corridor. Crash hotspots are located at the Pyrmont Bridge Road interchange, the Harris Street / Fig Street interchange and at the southern approach to Sydney Harbour Bridge.	With congestion forecast to generally be retained or exacerbated it is anticipated existing crash trends and types will continue to be an issue for the corridor, reaffirming the need to invest in initiatives that will improve road safety.
Western Distribution Corridor			
Northbound	Traffic, Freight, bus	• Corridor on SHB nearly reaches its capacity.	• Traffic congestion is likely to worsen until 2031 at completion of WHTBL projects • Once WHTBL projects completed, the traffic using study corridor is expected to be reduced, in particular through trips. • Even though WHTBL projects is expected to relieve congestion pressure on the study corridor, some sections (in particular the Sydney Harbour Bridge) are still expected to operate over capacity during AM and PM peak periods in 2036.
Southbound	Traffic, Freight, bus	• Corridor on SHB reaches its capacity during AM and PM peak.	

6. PROJECT DESCRIPTION

Austroads outline smart motorways as comprising an integrated package of intelligent transport systems (ITS) interventions, including speed and lane use management, traveller information (using variable message signs) and network intelligence (such as from vehicle detection equipment). Through these systems, smart motorways aim to maximise the capacity of an asset, manage traffic flows and improve road safety. They also have the ability to generate additional benefits for road users such as better travel reliability and real-time information. Benefits of smart motorways have proven to vary depending on contextual application, but typically include:

- reductions in travel time, particularly in peak periods
- improved mean speed deviation and journey time reliability
- improved road safety through reductions in network congestion
- reductions in greenhouse gas emissions.

6.1. M1NSM Smart Motorway Features

Key features of the project include:

- automatic vehicle and hazard detection
- expanded CCTV coverage
- variable speed limit signs
- integrated Speed and Lane Use Management Signs (ISLUS)
- dynamic directional signage
- managed Motorway System (MMS)
- supporting infrastructure including gantries, communication and power network.

7. FUTURE CONDITIONS WITH PROJECT

The project is likely to result in a variety of traffic and transport benefits and impacts within the study area. Each are highlighted and discussed as relevant in the sections following.

7.1. Road Safety

Smart motorways have been demonstrated to improve both the number and severity of crashes through the mechanisms identified as follows.

- Improved management of traffic speeds

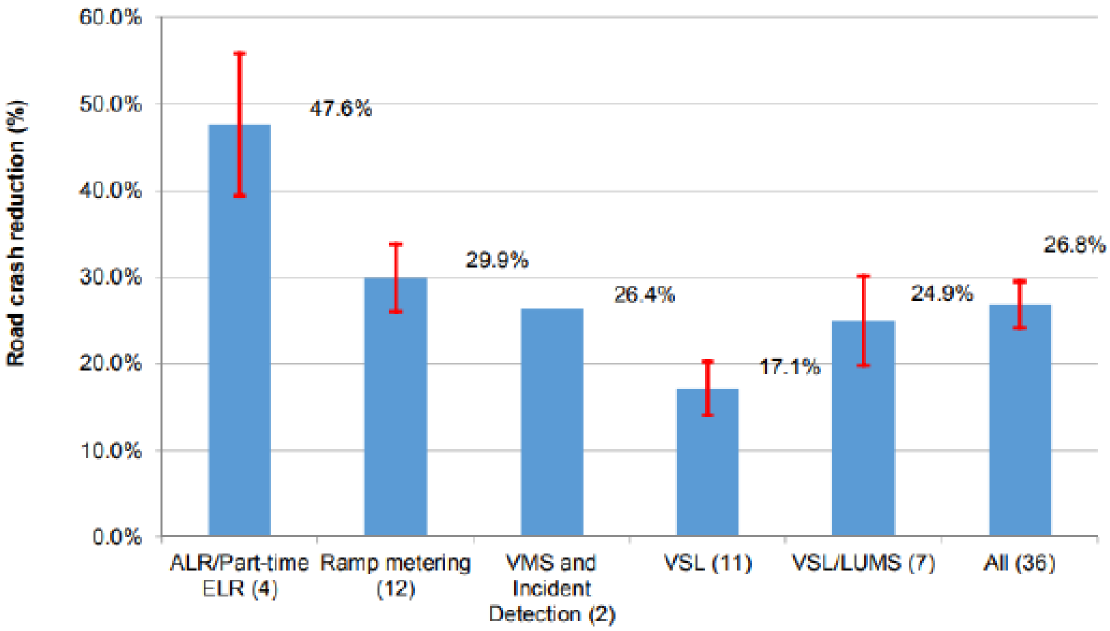
  The improved management of traffic speeds on approach to and through the corridor will yield a safer environment for all vehicles. It provides the opportunity for traffic flow to remain at a constant rate, reducing the speed differential between broken down flow at pinch point locations and approaching traffic - reducing the potential for and severity of sudden crashes.

- Improved wayfinding and overall network control

  The provision of improved wayfinding, especially at key decision-making points, will potentially reduce last-minute lane-changing and thereby the number of manoeuvring crashes.

  Research published by the Australian Transport Research Forum (ATRF) summarises the crash benefits recorded across 36 case studies of smart motorways in Australian and internationally. The research identified that smart motorway technologies can reduce crash rates by approximately 27% (*Economic benefits of Smart Motorway applications*, ATRF, 2017).

Figure 7.1: Crash benefits of 36 smart motorway case studies in Australia, USA, UK, Germany, Netherlands



Source: ATRF, 2017

7.2. Traffic

7.2.1. Traffic patterns

The project case is based on the SMPM data (cars and heavy vehicles) to establish a baseline with improvements based on evidence of Smart Motorway benefits on other similar facilities to quantify changes under the project. With proposed smart Motorways, it was assumed that there would be no route/mode shift changes. Therefore, travel speeds and travel times have been reduced by in line with the proposed improvements.

7.2.2. Performance

Table 7.1 and Table 7.2 summarise the weighted travel time improvements and associated speed. With implementation of the proposed smart motorway, the vehicle hour travelled (VHT) on the corridor has been improved by approximately 13%. The PM peak results show a greater level of improvement compared to the AM peak.

Table 7.1: Vehicle Hour Travelled (VHT) improvement

Item no.	Model run	AM	PM	IP	AM & PM	All day (5am - 8pm)
1	2016_M3001	12.61%	14.33%	12.84%	13.37%	13.48%
2	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	13.88%	14.02%	13.75%	13.94%	13.91%
3	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	13.97%	14.04%	13.79%	14.00%	13.96%
4	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	14.10%	14.10%	14.05%	14.10%	14.09%
5	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	12.16%	13.33%	11.07%	12.70%	12.50%
6	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	12.56%	13.44%	11.65%	12.96%	12.80%

Source: SMPM Traffic Modelling Results, Project Case, KPMG

Table 7.2: Speed improvement (weekday average)

Item no.	Model run	AM	PM	IP	AM & PM	All day (5am - 8pm)
1	2016_M3001	12.99%	16.51%	14.66%	14.73%	15.16%
2	2021_M3068 - 2021 WCX 123+ Gateway + M6(A)	15.15%	16.23%	15.92%	15.69%	15.90%
3	2026_M3068 - 2021 WCX 123+ Gateway + M6(A)	15.19%	16.21%	15.95%	15.71%	15.91%
4	2031_M3345 - 2021 WCX 123+ Gateway + M6(A)	15.18%	16.23%	16.35%	15.72%	16.04%
5	2031_M3348 – 2031 WCX123 + Gateway + M6(A) + WHT + BL; w 2-way toll on ED	12.63%	15.31%	12.55%	13.96%	13.92%
6	2036_M3351 – 2036 WCX123 + Gateway +M6(ABC) + WHT + BL; w 2-way toll on ED	12.78%	15.40%	13.27%	14.09%	14.21%

Source: SMPM Traffic Modelling Results, Project Case, KPMG

7.3. Walking

The corridor does not have a high walking function currently or in the future. As such, the project does not include measures pertaining to improving walking facilities on the corridor. It is noted however, that the corridor interfaces with a number of intersections and locations key to the local CBD walking network. As a result, it is essential that programs and initiatives targeting pedestrians at these interfacing locations are integrated with the corridor successfully.

7.4. Cycling

The project does not directly propose cycling infrastructure improvements since utilisation of the corridor as part of the cycling network is not expected to increase significantly and therefore this has not been included in the estimation of traffic benefits.

8. CONSTRUCTION IMPACT

Construction activities described in the Constructability Report Draft[1] are expected to have a potential impact on road users along the corridor. This section outlines the proposed construction works as well as a review of likely transport impacts and key construction traffic management principles.

8.1. Overview

8.1.1. Scope of works for the gantries

As shown in Figure 8.1, the proposed Project, M1 North Smart Motorway (M1NSM), includes the installation of 17 new overhead gantry structures with ISLUS also located on the King Street overpass (northbound) and footbridge (southbound), upgraded infrastructure on 11 existing gantry structures, improved CCTV coverage and installation and upgrade of information display systems such as lane use management signs and variable messaging.

Figure 8.1: Proposed gantry locations

Source: MINSM CJC Constructability Report Draft, July 2020

[1] M1 North Smart Motorway Initial Constructability Report, 2 July 2020

For the purposes of developing a concept-level construction approach and program, the road works have been grouped into four different zones broken down as per Table 8.1.

Table 8.1: Construction zones

Zone	Description
1	Anzac Bridge to Harris Street
2	Harris Street to Market Street
3	Market Street to Sydney Harbour Bridge
4	Sydney Harbour Bridge

Source: MINSM CJC Constructability Report Draft, July 2020

8.2. Construction Traffic Management

The proposed works will have impacts on the Western Distributor, local roads, and pedestrian paths. The various short and long-term road closures set out associated with the project works.

Majority of the construction works will be undertaken during night works, given the confined work zones and the requirement to minimise impact to the traffic network. There will be minimal day works, such as site setup and ITS conduit installation, in accessible, non-impactful area.

Expected construction traffic management are:

- viaduct Road closures where a traffic movement is lost
- viaduct Lane closures where capacity is reduced but movements are maintained
- local Road closures

The estimated total viaduct road closures will vary depending on the scope of works, viaduct lanes and available working room. Table 8.2 summarise the estimated road closures.

A number of potential detours have been identified to facilitate the viaduct road closures for standard light and heavy vehicles. These detours for each full viaduct closure are described in Appendix B: Construction Method Statement of M1 North Smart Motorway Initial Construction Report dated 2 July 2020. High mass limits (HML) and restricted access vehicles (RAV) routing is not considered as part of the traffic detour assessment. It is assumed that HML and RAV will detour via the Sydney Harbour Bridge tunnel, Eastern Distributor, Cleveland Road and Paramatta Road, by passing the entire project corridor.

Table 8.2: Estimated viaduct road closures

Road	Closures for gantry construction	Other closures for existing gantry removal, pavement etc	Total viaduct Road closures
Western Distributor Eastbound	16	6 (gantry removal) & 7 (pavement mill and resheet)	29
Western Distributor Westbound	33	2 (gantry removal) & 9 (pavement mill and resheet)	44
Pyrmont Bridge Road Northbound Exit Ramp	4		4

Road	Closures for gantry construction	Other closures for existing gantry removal, pavement etc	Total viaduct Road closures
Pyrmont Bridge Road Southbound Exit Ramp			
Pyrmont Bridge Road Northbound Entry Ramp	2		2
Pyrmont Bridge Road Southbound Entry Ramp	4		4
Allen Street Northbound Exit Ramp			
Pyrmont Street Northbound Entry Ramp	6		6
Harris Street Northbound Entry Ramp	6		6
Harris Street Southbound Exit Ramp	2		2
Druitt Street Southbound Entry Ramp	3		3
Druitt Street Northbound Exit Ramp (dedicated bus lane on same ramp as Southbound Exit Ramp)	3		3
Harbour Street Northbound Entry Ramp			
Harbour Street Northbound Exit Ramp			
Harbour Street Southbound Exit Ramp	7	3 (pavement mill and resheet)	10
Cross-City Tunnel to Western Distributor			
Market Street Southbound Entry Ramp		4 (pavement mill and resheet)	4
King Street Northbound Exit Ramp			
Wheat Street Northbound Exit Ramp			
Clarence Street Northbound Entry Ramp (west side)	1		1
Clarence Street Northbound Entry Ramp (east side)	4		4
York Street Southbound Exit Ramp (west side)	4		4
York Street Southbound Exit Ramp (east side)			
Kent Street Northbound Entry Ramp			

Source: Table9, M1 North Smart Motorway, Initial Construction Report, 2 July 2020

A large number of viaduct lane closures are estimated as summarised in Table 8.3. There will be between 4 and 6 viaduct lane closures per gantry location in addition to those for the gantry construction works described in the CMS (refer Appendix B: Construction Method Statement of M1 North Smart Motorway Initial Construction Report dated 2 July 2020) for the site investigation and establishment works. The viaduct lane closure will vary depending on the scope of works, viaduct lanes and available working room.

Table 8.3: Estimated viaduct lane closures

Road	Closures for gantry construction	Other closures for site investigation, SAT etc	Total viaduct lane closures
Western Distributor Eastbound	60	30	90
Western Distributor Westbound	56	30	86
Pyrmont Bridge Road Northbound Exit Ramp		5	5
Pyrmont Bridge Road Southbound Exit Ramp	2	5	7
Pyrmont Bridge Road Northbound Entry Ramp		5	5
Pyrmont Bridge Road Southbound Entry Ramp		5	5
Allen Street Northbound Exit Ramp		5	56
Pyrmont Street Northbound Entry Ramp		5	5
Harris Street Northbound Entry Ramp		5	5
Harris Street Southbound Exit Ramp	1	5	6
Druitt Street Southbound Entry Ra	1	5	6
Druitt Street Northbound Exit Ramp (dedicated bus lane on same ramp as Southbound Exit Ramp)		5	5
Harbour Street Northbound Entry Ramp		5	5
Harbour Street Northbound Exit Ramp	1	5	6
Harbour Street Southbound Exit Ramp	2	5	
Cross-City Tunnel to Western Distributor	9	5	14
Market Street Southbound Entry Ramp	2	5	7
King Street Northbound Exit Ramp	2	5	7
Wheat Street Northbound Exit Ramp		5	5
Clarence Street Northbound Entry Ramp (west side)	3	5	8
Clarence Street Northbound Entry Ramp (east side)		5	5
York Street Southbound Exit Ramp (west side)	2	5	7
York Street Southbound Exit Ramp (east side)	4	5	9
Kent Street Northbound Entry Ramp		5	5

Source: Table10, M1 North Smart Motorway, Initial Construction Report, 2 July 2020 +

It is estimated that there will be lane and road closures of local roads below the viaducts across Zone 1, 2, and 3 during the construction works. These local road closures will have less impact on the traffic impact than the viaduct lane and road closures. There will also be a loss of carparking along these local roads to facilitate the works. The local road closures relating to the gantry construction and ITS conduit installation are summarised in Appendix B: Construction Method Statement of M1 North Smart Motorway Initial Construction Report dated 2 July 2020.

9. CONCLUSION

This Traffic and Transport Report is one of several documents that have been prepared to provide pertinent technical information and analysis required to both inform and append to the Review of Environmental Factors (REF) for the Project.

This report provides details of the methodology, assumptions and results from a holistic traffic and transport assessment that has been undertaken to identify existing issues along the corridor and establish future traffic and transport conditions in the study area with and without the project.

The following presents a summary of the findings of the assessment.

Road Safety

A review of the crash history for the corridor yielded that road safety is a substantial issue for this corridor, with crash rates that 1.5 times higher than the Sydney-wide average for a class 6U road. With substantial increases in forecast traffic demand and congestion at key operational performance and safety hotspots, it is anticipated these crash trends will continue to be an issue for the corridor in the future.

The smart motorway initiatives proposed have been proven effective in reducing crashes and improving road safety via several mechanisms. Whilst new crash types may be generated particularly at ramp meter signals and local road networks upstream – where traffic speeds are generally slower and present lower crash severity risk - nett safety benefits as a result of the project are likely.

Road Network Performance

The base case network results show that its performance is progressively worse comparing 2016 model outputs. Despite congestion relief from Western Harbour Tunnel in 2031, the M1NSM corridor operates over capacity.

SMPM model results undertaken for the M1NSM project indicate that benefits of smart motorway initiatives can improve substantially for general traffic in terms of congestion and travel time reliability. The VHT on the corridor has been improved by approximately 13%. The PM peak period has higher impact of the improvement comparing to AM peak.

Opportunity for further investigation

The opportunity is presented to further investigate 'trade-offs' across the smart motorway (i.e. further sensitivity testing of higher or lower impact of the speed improvement) to ensure network performance and benefits are maximised particularly for bus movements – critically, to ensure bus passenger movements.

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