M1 Western Distributor Smart Motorway

Review of Environmental Factors

May 2021

March 2021 | Version: 1

Blank Page

Document controls

Approval and authorisation

Title:	M1 Western Distributor Smart Motorway Review of Environmental Factors
Accepted on behalf of transport for NSW by:	Haris Mandic Project Manager
Signed:	
Dated:	27.05.2021

Document status

Document status	Date	Prepared by	Reviewed by
Draft 1	19.11.2020	S. Hill	Transport for NSW
Draft 2	01.03.2021	S. Hill	Transport for NSW
Draft 3	13.05.2021	J. Zeng	Transport for NSW

- The proposal corridor is a missing piece in a broader integrated motorway management solution.

Proposal objectives

The objectives of the proposal are:

1. Increase network resilience – Provide an increased ability to actively control and remotely monitor the road transport network to reduce the impact of incidents on the performance of the road network surrounding Sydney's busiest transport corridor
2. Improve travel time and reliability – Provide faster journeys and reduced variability in travel times for current and future users of the proposal corridor
3. Improve traffic safety – Reduce the risk of crashes, and facilitate more efficient response to incidents
4. Enhance the road user experience – Provide smoother journeys and enhanced journey decision-making for road users
5. Optimise transport asset utilisation and investment – Ensure the efficient use of the asset and optimise the benefits of current and future infrastructure investments.

Options considered

Two options were considered for the proposal:

- Option 1 Do nothing – The existing infrastructure and largely manual motorway management regime would be maintained
- Option 2 Smart motorway – This option involves implementation of ITS devices (ISLUS, VSLS, dynamic direction signs, vehicle detection and automated incident detection), static directional signs, CCTV and some lane configuration changes along the corridor.

Statutory and planning framework

The proposal is development for a road and is being carried out by or on behalf of a public authority. Under clause 94 of State Environmental Planning Policy (Infrastructure) 2007, the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and development consent from the relevant local councils is not required.

Transport for NSW is the determining authority for the proposal. This REF fulfils obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Community and stakeholder consultation

Broader community engagement was not considered necessary during the planning phases of the proposal as most works are confined to existing motorway structures. Environmental impacts of the proposal and potential community or stakeholder interest are assessed to be minor and limited respectively.

Community engagement would be conducted prior to construction commencement to notify local residents and stakeholders of the proposal and any construction-related impacts.

Environmental impacts

Specialist investigations have been carried out to identify, assess, manage and minimise the proposal's potential impacts. The following outlines the proposal's main impacts on the environment and surrounding community. The safeguards and mitigation measures identified in this REF would help minimise the expected adverse impact.

Traffic and transport

There is the potential for some delays during construction associated with lane closures and temporary diversions. These would be short-term and works requiring lane closures would generally occur at night to minimise impacts on traffic. Access for pedestrian and cyclists would be maintained during construction, with the potential for minor diversions over short periods.

During operation, the proposal has the potential reduce both the number and severity of crashes through:

- Improved management of traffic speeds
- Better incident detection and management
- Improved wayfinding and overall network control.

Traffic analysis indicates that with the implementation of the proposed smart motorway, the vehicle hours travelled (VHT) on the corridor would be improved (i.e. reduced) by about 13 per cent. There would also be an improvement to travel speeds.

Landscape character and visual

During construction, temporary visual impacts may include visible construction activities such as demolition and excavation works, installation works involving cranes and hoists, construction compounds and finishing works (e.g. concrete sawing, joint installation, line marking, kerb and gutter construction, and installation of safety barriers, street lighting, landscaping and sign posting).

The impact of the proposal on landscape character varies from negligible to moderate–high. The more visually sensitive landscape character zones, such as those with residential, social, tourism, recreational and/or historical land uses or significance have a high sensitivity compared to the more commercial landscape character zones. The visual magnitude of the proposal varies from negligible to moderate as there are locations where there would be no new elements and locations where new gantry structures are proposed.

The areas in which the gantries are proposed to be located is in a city environment that is highly developed and modified. However, there are some areas that are scenic in nature with heritage items and significant view corridors. As it is a city environment, there are existing signs, light poles and other road furniture along and close to the proposal corridor.

In general, the proposed gantries would have a higher magnitude of change due to the larger scale of the structure and illuminated LED signage. Furthermore, where proposed gantries replace existing structures, the visual impact is lower and where there are no existing structures or signage, the visual impact is higher. The visual impact is also higher in areas where adjoining land uses are more visually sensitive, such as areas with residential buildings or areas with heritage significance.

Non-Aboriginal heritage

The proposal would not adversely affect the heritage values of the Sydney Harbour Bridge and it would retain its historical, aesthetic, technical, social and associational values.

The proposed works within the statutory curtilage of Sydney Harbour Bridge (which includes its approaches and pylons) involve new dynamic signage replacing existing static signage on existing gantries, located at various locations on the bridge and approaches. Although this introduction of new fabric to the bridge would be clearly visible, because the gantries and

signage already exist in these locations and the proposed signage is not substantially larger than the existing, the impact of these works has been assessed as minor.

Works proposed near the bridge and in its wider visual catchment include a new gantry (Gantry 18), signage, directional devices and incident detection equipment. These are generally located such that significant views are retained. Some distant views on the southern approach to the bridge would be impacted by the proposed Gantry 18; however, these approach views are less iconic and still retained north of the gantry, and therefore the impact has been assessed as minor.

Noise and vibration

During construction, gantry works, paving / asphalting works, and road operation of the compound are expected to generate the highest noise impact, with the likely exceedance of noise management levels at some receivers. Construction noise and vibration at each works location would be short-term and mitigation measures have been proposed to reduce impacts on sensitive receivers.

The proposal would not attract higher traffic volumes to the proposal corridor or reduce the distance between traffic and sensitive receivers. The benefits of the smart motorway included improved traffic flow may reduce the amount of congestion-related noise pollution including compression braking and honking though this may be balanced by the increased noise produced by improved travel speeds. It is not expected that road traffic noise levels would increase by more than 2 dBA and therefore operational noise mitigations have not been considered.

Construction plant would be selected to ensure minimum safe working distances set by the Construction Noise and Vibration Guideline (Roads and Maritime Services, 2016) are complied with where possible, in relation to cosmetic damage, heritage structures and human response to vibration. If minimum safe working distances cannot be complied with, additional measures including vibration monitoring would be implemented.

Justification and conclusion

The proposal is needed to improve traffic and incident management and enhance corridor messaging and wayfinding on the M1 corridor between Milsons Point and Pyrmont.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some visual, heritage, construction noise and traffic impacts. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts.

Contents

Tables

Figures

Appendices

1 Introduction

1.1 Proposal identification

Transport for NSW proposes to introduce intelligent technology, known as a smart motorway system, to the M1 corridor between Milsons Point and Allen Street in Pyrmont (the proposal and the proposal corridor). Key features of the proposal would include:

- New gantries at 12 locations
- Integrated Speed and Lane Use Sign (ISLUS) on 11 new gantries and on the King Street overpass (northbound), and the King Street footbridge (southbound) (13 in total)
- Dynamic directional signs collocated on five of the new ISLUS gantries, on two existing Sydney Harbour bridge gantries, on the King Street footbridge and on a new gantry near the reversible Clarence Street / Grosvenor Street entry / exit ramp (nine in total)
- New, pole mounted, Variable Speed Limit Signs (VSLS) (11 in total) to provide speed limit information for vehicles entering the M1 corridor
- Removal of redundant static directional signs and gantries
- New static directional signs (three in total) at the Fig Street / Harris Street intersection, near Gantry 12 and on Gantry 13
- Retention of existing lane control signs and replacement of existing VSLS with new VSLS on existing Sydney Harbour Bridge gantries
- Wayfinding infrastructure including directional signs, lane allocation signs, advance exit signs and exit direction signs that allow strategic placement of key messages and repeater messages to optimise lane selection and lane changes
- Smart motorway hazard and vehicle detection system covering the full elevated motorway and sections without a shoulder/emergency lane
- Closed circuit television camera infrastructure (CCTV) to achieve full coverage across the corridor
- Minor changes to lane alignments, asphalt resurfacing and line marking changes along the Western Distributor
- Cables, pits, conduits, in pavement inductive loops and cabinets to support intelligent transport systems (ITS).

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Chapter 3 describes the proposal in more detail.

The proposal is needed to improve traffic and hazard management and enhance corridor messaging and wayfinding.

The proposal corridor is integral to the function of Sydney's road network and activity in the CBD and surrounding suburbs. This critical part of the road network is the principal corridor serving the economically important Sydney CBD and North Sydney CBD, as well as being a conduit to knowledge and innovation precincts located in Ultimo and surrounds. The corridor is used every day by private transport customers as well as the public transport network with buses travelling from the Northern Beaches, North Shore, North Western Sydney, Inner West and Central Western Sydney. Commercial vehicles servicing the CBDs are also reliant on the distributive function the corridor serves. The corridor is a mixture of tertiary and secondary freight routes.

A large part of the proposal corridor is on elevated structures and land uses alongside the proposal corridor are typical of a highly urbanised global city centre. Within the Sydney CBD the edges of the corridor comprise a mix of commercial, residential and mixed-use buildings, often tall towers or large cultural buildings. The western section of the corridor in Pyrmont traverses a mixture of predominantly commercial and residential land uses. Public spaces occur along the corridor in the form of city plazas, major pedestrianised thoroughfares or green open space (including Bradfield Park and Dawes Point Park) and quality views are available from the corridor to Sydney Harbour and a range of iconic landmarks including the Anzac Bridge and the Sydney Harbour Bridge.

The proposal is in the North Sydney and City of Sydney local government areas and extends on to the suburbs of Milsons Point, Dawes Point, The Rocks, Sydney and Pyrmont.

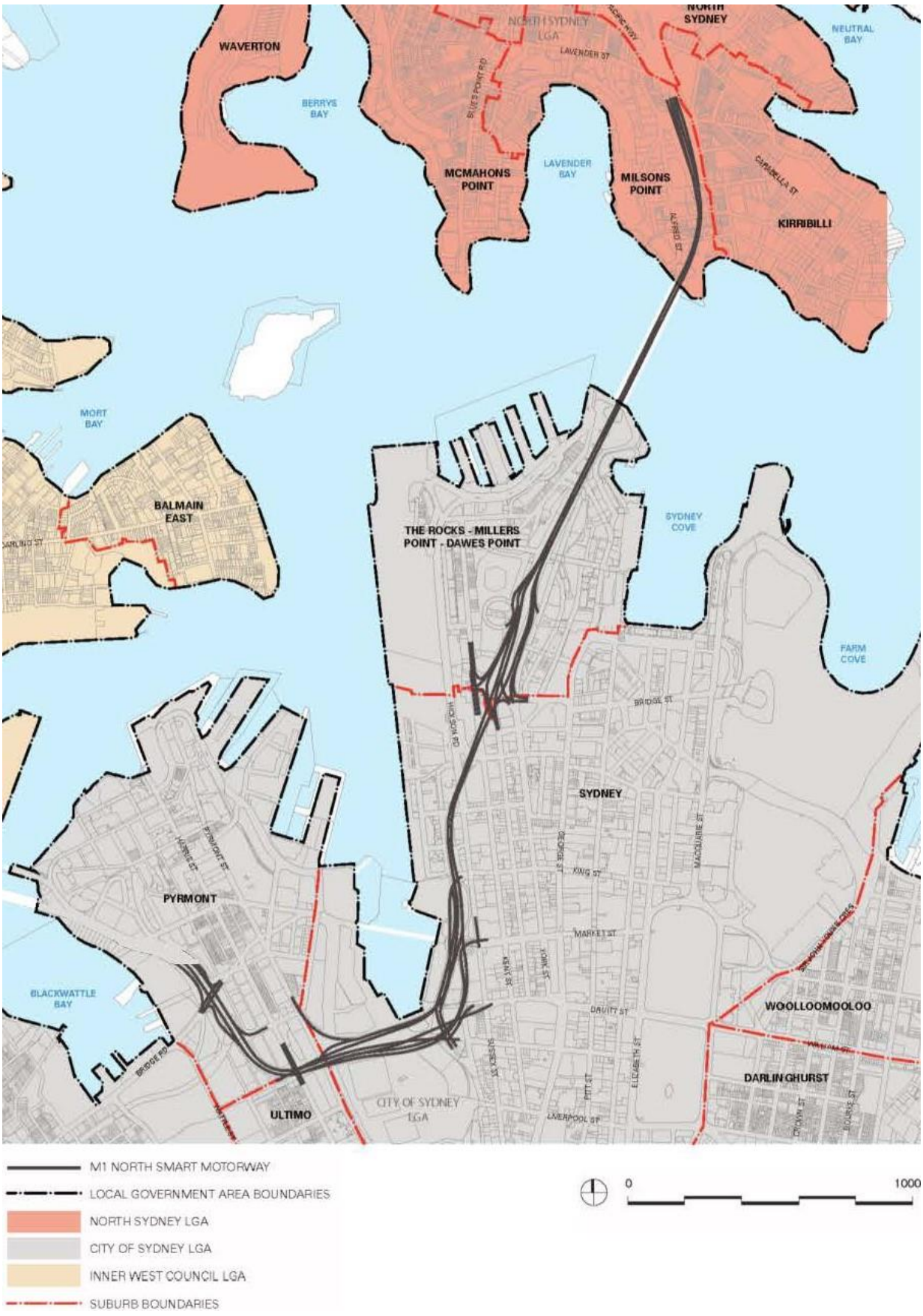


Figure 1-1: Location of the proposal

Figure 1-2: The proposal

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Hills Environmental on behalf of Transport for NSW, Greater Sydney Project Office. For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Is an EIS required? guidelines) (DUAP, 1995/1996), Roads and Related Facilities EIS Guideline (DUAP 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of:

- Section 5.5 of the EP&A Act including that Transport for NSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- The potential for the proposal to significantly impact any other matters of national environmental significance or the environment of Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of the Agriculture, Water and the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2 Need and options considered

2.1 Strategic need for the proposal

2.1.1 Need for the proposal

The proposal corridor presents several challenges and opportunities that need to be addressed. These are:

- The corridor is prone to congestion – Vehicle volumes are at levels where there is limited spare capacity during the peak hours, and increasingly across the day. Travel speeds during the morning and evening peak are up to 37 kilometres per hour slower than signposted speeds. Slower travel times not only affect private motorists – they also impact buses and commercial vehicle customers with late-running and less reliable journeys. The proposal would help address congestion by allowing better coordination of ITS devices in response to recurrent congestion, crashes and incidents. It would also present an opportunity to manage the network more dynamically to respond to prevailing traffic levels.
- The complexity of the proposal corridor reduces the road user experience – The proposal corridor has multiple entry and exit points, many of which are close to one another. This issue coupled with difficult wayfinding creates indecision for many customers and many drivers demonstrate risky merging behaviour to get into the correct lane. These actions add not only add to the stress of driving but also affect traffic flow and increase the risk of crashes. The proposal would help address these issues by improving wayfinding through the provision of dynamic directional signs at strategic locations along the corridor.
- There is limited resilience to cope well with incidents and current incident detection is a manual process – The proposal corridor lies at a critical juncture on Sydney's road network providing connections to major employment centres and other busy arterial roads. In an average week, the proposal corridor records one crash, and these crashes are most likely to occur during the height of the morning or evening peak period. Breakdowns and other incidents such as debris on the road are a further issue. With few alternative routes, there is always the risk that the impact of an incident will quickly propagate congestion across the broader road network. The ability to respond to incidents quickly is currently limited by a slower manual process and the deployment of traffic management resources can be inefficient (e.g. more resources are deployed to an incident than needed). The proposal would help address this issue through the provision of an automated incident detection and management system.
- There is limited capacity to cope with future growth – Planned developments and planned transport projects near the proposal corridor will increase travel demand within the proposal corridor. Growth in activity around the proposal corridor means traffic volumes in 2031 are predicted to be higher than today, even with Western Harbour Tunnel, Beaches Link and WestConnex Stage 3B. Over the next 10 years, road users on the Sydney Harbour Bridge could expect to travel around 35 kilometres per hour below the speed limit in the morning peak while those on the Anzac Bridge will be around 25 kilometres per hour below the speed limit. Further growth in activity near the Sydney CBD requires additional capacity on the roads feeding into it, particularly for bus and commercial vehicle traffic that will rely on this capacity. The proposal is expected to help traffic flows and would reduce congestion by improving responses to crashes and incidents. This means more transport customers would be able to travel on the corridor while the physical capacity remains unchanged.
- The proposal corridor requires investment in technology to effectively utilise available capacity – The proposal corridor travels largely on elevated structures, near multi-storey

buildings and a variety of traffic generating developments. There are few, if any, options to increase the capacity through building new road capacity. Smart motorway technologies provide an opportunity to increase the proposal corridor's capacity quickly and cost-effectively.

- The proposal corridor is a missing piece in a broader integrated motorway management solution – While the delivery of WestConnex Stage 3B, the Western Harbour Tunnel and Beaches Link would provide some relief on the Corridor, the provision of smart motorway technologies is vital in getting the most out of these other investments. The integration of motorway operations between the proposal corridor and these new motorways would help optimise speeds and flows across all these roads, and minimise unnecessary incident-related queuing into the tunnels, during normal operations as well as during major incidents.

2.1.2 Strategic plans and policy

The proposal is consistent with a number of strategic plans and policy documents as outlined in the following sections.

Future Transport 2056

The NSW Future Transport Strategy 2056 (Transport for NSW, 2018) outlines a clear framework to address transport challenges in NSW over the next 40 years and is an update of the NSW Long Term Transport Master Plan released in 2012. It integrates planning for roads, freight and all other modes of transport and sets out initiatives, solutions and actions to meet NSW transport challenges.

Future Transport 2056 outlines six state-wide outcomes to guide investment, policy and reform and service provision. They provide a framework for planning and investment aimed at harnessing rapid change and innovation to support a modern, innovative transport network. The proposal would directly support the following outcome:

- Safety and performance – Every customer enjoys safe travel across a high performing, efficient network – The proposal supports this outcome improving traffic and hazard management and enhancing corridor messaging and wayfinding
- A strong economy – The transport system powers NSW's future $1.3 trillion economy and enables economic activity across the state – The proposal supports this outcome by improving traffic management within the Global Economic Corridor and Global Sydney.

Future Transport 2056 includes a number of future directions to investigate. The proposal directly is directly aligned with the following:

- Deliver 'smart' motorways and work with industry and innovators on new technologies that can improve the road user experience.

Movement and place framework

Future Transport Strategy 2056 introduces the movement and place framework which aims to allocate road space in a way that improves the liveability of places.

The framework identifies the need to prioritise different customer groups, depending which street environment they are travelling. These environments are described in Figure 2-1. The corridor currently focuses on a motorway (movement emphasis) that is strategically important for the movement of goods and people.

The planned construction of Western Harbour Tunnel and Beaches Link would change the mixture of road users travelling across the Harbour. Transport customers, particularly freight, would be able to bypass the CBD and avoid the complex road network enabling the corridor to transition from a bypass, access and distribution function to one that focuses on access and

distribution to the CBD and surrounding suburbs – considered a 'Movement Corridor' in the Movement and Place Framework.

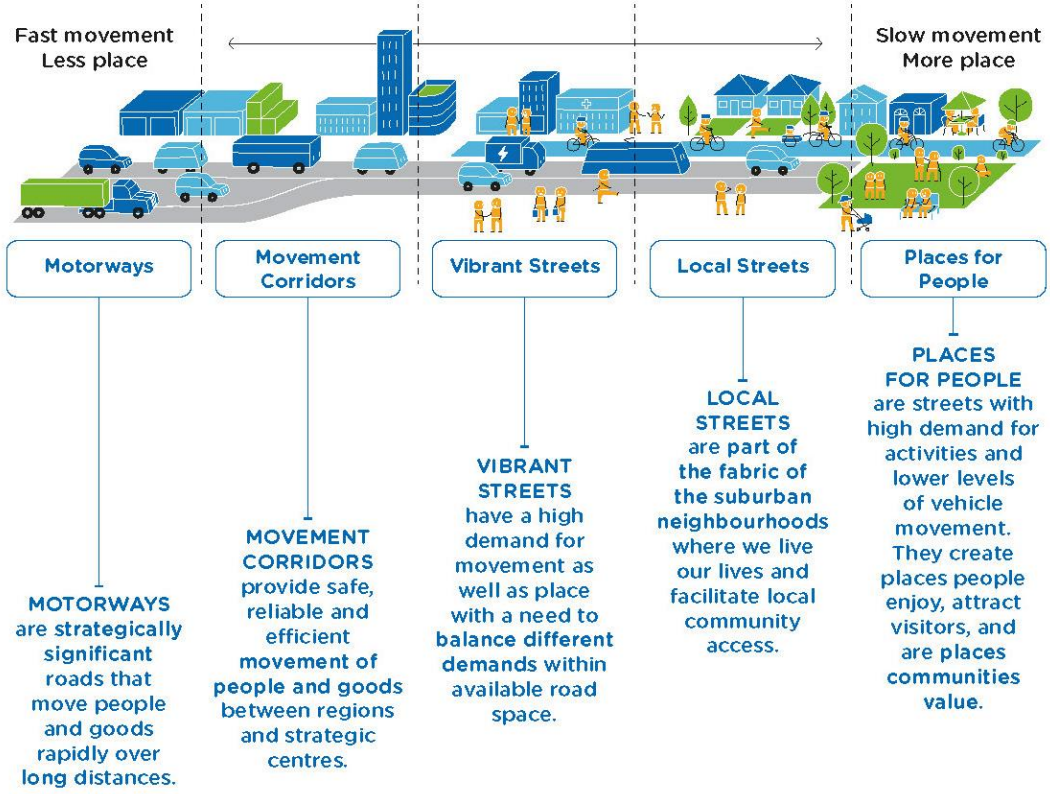


Figure 2-1: Movement and place framework

Future Transport Technology Roadmap

The Future Transport Technology Roadmap 2016 (Transport for NSW, 2016) was developed to set out a vision for a technology-enabled transport future and:

- Clearly identify the strategies we will implement, the initiatives we will take and the investments we will make to put innovation and technology at the centre of how we operate.
- Explain how those initiatives and investments will deliver service outcomes that better reflect customers' personal preferences and priorities
- Set the direction for Transport for NSW and Transport Cluster agencies, as well as signal to industry how we will do business in the future.

The roadmap identifies five key technology strategies needed to personalise transport. These strategies are to:

- Personalise customer interactions.
- Transform the mass transit network.
- Foster shared, demand-responsive services.
- Enable connected and automated vehicle platforms.
- Create intelligent transport networks, managed with data.

The rollout of smart motorways, and therefore the proposal, is directly aligned with the fifth strategy identified above.

Greater Sydney Regional Plan

The Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018) envisages three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and leisure opportunities. The plan includes a structure plan that emphasises how the principal spatial elements of the city are interconnected and integrated to best deliver in four critical areas:

- integration of the mass transit network with the economic corridors, centres, transit-oriented development, urban renewal and health and education precincts
- connectivity between the rail freight and strategic road networks and the trade gateways and industrial areas
- integration of the green grid network with residential neighbourhoods retention of the integrity of the values of the Metropolitan Rural Area and the Protected Natural Area.

The plan includes ten directions with related objectives, strategies and actions. The proposal directly aligns with the direction of 'A city supported by infrastructure' and the following related objectives:

- objective 1 Infrastructure supports the three cities
- objective 2 Infrastructure aligns with forecast growth – growth infrastructure compact.

The proposal also supports the following identified directions:

- a city supported by infrastructure
- a well-connected city.

Eastern City District Plan

The Eastern City District Plan (Greater Sydney Commission, 2018) is a 20-year plan to manage growth in the context of economic, social and environmental matters to achieve the 40-year vision of Greater Sydney. It is a guide for implementing the Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018), at a district level and is a bridge between regional and local planning.

Eastern City District Plan sets a number of planning priorities, objectives and actions. Those supported by the proposal are:

- Planning Priority E1 planning for a city supported by infrastructure
    - Objective 1 Infrastructure supports the three cities.
    - Objective 2 Infrastructure aligns with forecast growth – growth infrastructure compact.
    - Objective 3 Infrastructure adapts to meet future needs.
    - Objective 4 Infrastructure use is optimised.

The proposal aligns with all the above objectives, but directly supports objectives 3 and 4 through the use of new technology to adapt existing infrastructure to meet future needs.

Road Safety Plan 2021

The Road Safety Plan 2021 (Transport for NSW, 2018) outlines how the NSW Government will work towards the State Priority Target of reducing fatalities by 30 per cent by 2021 (compared to average annual fatalities over 2008–2010). It also aligns the Towards Zero vision with Future Transport 2056, which aims to have a NSW transport network with zero trauma by 2056.

The proposal is consistent with the directions set out in Road Safety Plan 2021 because it would reduce crashes and the frequency of incidents on the motorway (including secondary

incidents) through an increased ability to actively control and remotely monitor the road transport network and an improved response to incidents.

Connected and Automated Vehicles Plan

The Connected and Automated Vehicles Plan (Transport for NSW, 2019) sets out 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 connected and automated vehicles 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 Connected and Automated Vehicles Plan identifies that the M4 Smart Motorway, as an example of an initiative which 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.

State Infrastructure Strategy 2018-2038

The State Infrastructure Strategy 2018-2038 (Infrastructure NSW, 2018) 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 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, which is reproduced below:

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.

Sydney City Centre Access Strategy

The Sydney City Centre Access Strategy (Transport for NSW, 2013) plans 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 (including the proposal corridor) for both service and private vehicles.

Sydney's Bus Future

Sydney's Bus Future (Transport for NSW, 2013) is the NSW Government's long term plan to redesign the bus network to meet customer needs now and into the future. This strategic plan was published in December 2013 and is consistent with the NSW Long Term Transport Master Plan (Transport for NSW, 2012).

Sydney's Bus Future identifies three rapid bus routes through the M1 corridor, including Mona Vale to CBD, Castle Hill to CBD via the M2 Motorway, and Parramatta to CBD via Ryde. Rapid bus routes form the backbone of the network and should offer fast and reliable travel between major centres. Furthermore, the Northern Beaches B-Line – a Bus Rapid Transit System from Mona Vale to the Sydney CBD is now operating.

A road network that can support more reliable trips through better traffic and hazard management would contribute to achieving the strategic goals of these rapid bus routes.

NSW Freight and Ports Strategy

The NSW Freight and Ports Strategy (NSW Government, 2013) targets specific challenges associated with the forecast doubling of the NSW freight task by 2031. Providing a network

that minimises congestion will support economic growth and productivity and encourage regional development. In this context, the strategy identifies the need to develop and maintain capacity for freight on the road network. The proposal provides an opportunity to respond to this need.

The proposal corridor is identified as a part secondary and part tertiary freight route, one of the functions of which is to provide links within regions for significant flows of freight.

Objectives of the NSW Freight and Ports Strategy relevant to the proposal include:

- Delivery of a freight network that efficiently supports the projected growth of the NSW economy.
- Balancing freight needs with those of the broader community and the environment.

Actions of the strategy and task actions relevant to the proposal include:

- Action 1D - Improve productivity of the road freight network
  - Task 1D-4 Incorporate freight considerations into managed motorways access decisions.
- Action 2B – Develop and maintain capacity for freight on the road network
  - Task 2B-2 Prioritise road infrastructure investments.

The proposal is considered consistent with the objectives, actions and tasks referenced above. It would improve the reliability of travel on a road that is an important freight route.

NSW Freight and Ports Plan

The NSW Freight and Ports Plan (NSW Government, 2018) is aligned with NSW Future Transport Strategy 2056 (Transport for NSW, 2018) and has the aim of providing a network to move goods in an efficient, safe and environmentally sustainable manner, providing successful outcomes for communities and industry. One of the aims of the plan is to ensure safe, efficient and sustainable freight access to places. The proposal is consistent with this aim because it would assist the safe and efficient freight movements along a secondary freight route.

2.2 Limitations of existing infrastructure

Limitations of existing infrastructure at the proposal site include:

- Existing ITS devices on the project corridor are outdated and not fully integrated
- Incomplete CCTV coverage of the proposal corridor
- Limited provision and flexibility of existing directional signage is an impediment to effective wayfinding
- Lane configurations on the Western Distributor exacerbate weaving movements leading to congestion and increasing the risk of incidences (these limitations are discussed further in Section 3.2.3.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal are:

1. Increase network resilience – Provide an increased ability to actively control and remotely monitor the road transport network to reduce the impact of incidents on the performance of the road network surrounding Sydney's busiest transport corridor

2. Improve travel time and reliability – Provide faster journeys and reduced variability in travel times for current and future users of the proposal corridor
3. Improve traffic safety – Reduce the risk of crashes, and facilitate more efficient response to incidents
4. Enhance the road user experience – Provide smoother journeys and enhanced journey decision-making for road users
5. Optimise transport asset utilisation and investment – Ensure the efficient use of the asset and optimise the benefits of current and future infrastructure investments.

2.3.2 Development criteria

The development criteria, in addition to the proposal objectives, are to provide a concept design for the proposal in a way that:

- Minimises potential environmental impacts
- Minimises potential impacts to the community.

2.3.3 Urban design objectives

The urban design objectives for the proposal are provided in Table 2-1.

Table 2-1: Urban design objectives

Objective	Description
Objective 1 Fit sensitively with the existing qualities, characteristics and community of the surrounding highly urban and visually sensitive environments.	• Maintain the integrity of the existing urban character, particularly the physical and visual experience of the motorway and adjacent environments of Pyrmont, Darling Harbour, Sydney CBD, the Rocks, Circular Quay and Royal Botanic Gardens • Maintain and enhance key landmarks along the route such as Anzac Bridge and its Soldier Memorials, the Sydney Opera House, Sydney Harbour Bridge, including significant views and vistas both across and along the corridor, by carefully considering the location of the new ITS elements • Design other major proposal elements, such as retaining or noise walls if required, to fit into their setting and reduce their visual and physical obtrusiveness • Consider the visual experience of pedestrians using major public thoroughfares beneath, along and over the motorway corridor.
Objective 2 Connectivity and legibility	• Consider opportunities to enhance the motorway experience • Consider opportunities to improve the appearance and connectivity under the motorway viaduct spaces, to reconnect adjacent communities and cityscape • Limit the amount of signage and ITS hardware as far as practical to minimise road-side clutter and retain key vistas

Objective	Description
Objective 3 To protect the heritage and cultural attributes of the motorway corridor within the globally recognised City of Sydney	• Minimise the visual impact upon adjacent communities and buildings positioned close to the motorway corridor and motorway structures • Minimise the impact and promote a considered design response to the Sydney Harbour Bridge and Anzac Bridge landmarks • Protect and enhance important views from streets and other public places • Respond sensitively to individual heritage items that occur adjacent to the road corridor. • Respond sensitively to the cultural precincts that occur adjacent to the road corridor • To provide a considered design response for fixing of signage structures on existing bridge structures.
Objective 4 To develop a simple and unified palette of roadside ITS elements.	• Design proposed ITS elements as part of a unified design palette to minimise visual clutter and provide a coordinated visual outcome with details that are contextually appropriate, attractive and easily maintained • Design ITS structures to minimise bulk and massing • Minimise and rationalise signage structures to the minimum technical requirements to minimise visual clutter • Design all gantry, lighting and signage for the proposal to be as unobtrusive as practicable, particularly for areas where the new ITS would introduce new illuminated visual elements • Ensure ITS conduits and cables are concealed from view. Where conduits/cables are unable to be concealed either provide a screening system that will reduce the visual impact and clutter or paint an unobtrusive colour • Use robust, high quality and durable materials appropriate to the urban setting and avoid opportunities for vandalism • Use visually recessive colours for posts and fixings such as Sydney Harbour Bridge Grey.

2.4 Alternatives and options considered

2.4.1 Methodology for selecting the preferred option

The option selection process has built on work carried out over 10 years and has included consideration of strategic alternatives and evaluation of a ‘do nothing’ option and a ‘smart motorways’ option against the proposal objectives.

2.4.2 Identified options

Several strategic alternatives including land use planning changes, travel demand management, alternative transport (public/active transport) and provision of new road capacity were initially considered and evaluated against the proposal objectives.

Following the evaluation of strategic alternatives, the following options were shortlisted for the proposal corridor:

- Option 1 Do nothing – The existing infrastructure and largely manual motorway management regime would be maintained

- Option 2 Smart motorway – This option involves implementation of ITS devices (ISLUS, VSLS, dynamic direction signs, vehicle detection and automated incident detection), static directional signs, CCTV and some lane configuration changes along the corridor.

2.4.3 Analysis of options

Consideration was then given to the performance of Option 1 (do nothing) and Option 2 (smart motorways) against the proposal objectives and development criteria. The results of the options analysis are summarised in Table 2-2.

Table 2-2: Options analysis

	Option 1	Option 2
Proposal objectives		
Increase network resilience – Provide an increased ability to actively control and remotely monitor the road transport network to reduce the impact of incidents on the performance of the road network surrounding Sydney's busiest transport corridor	✗ Incident management remains unchanged and existing impacts of incidents on network performance would likely worsen relative to forecasted traffic growth and associated congestion.	✓ Ability to manage traffic in the event of planned and unplanned incidents would be improved through the use of variable speed limit signs and ISLUS devices. Improved CCTV coverage across the Corridor would also improve visibility for the Transport Management Centre and first responders to crashes or incidents. The use of non-intrusive vehicle and incident detectors would rapidly alert first responders to crashes, breakdowns and debris on the proposal corridor.
Improve travel time and reliability – Provide faster journeys and reduced variability in travel times for current and future users of the proposal corridor	✗ The level of congestion and delays would worsen**.**	✓ A smart motorway would improve traffic flows on the mainline through the use of variable speed limit signs and ISLUS devices that adapt to the prevailing network conditions. The variable speed limit signs and ISLUS devices would draw on inputs from the additional CCTV coverage and vehicle incident detection located along the proposal corridor. The proposed Smart Motorway Control System would interface with the ITS devices on the mainline and on-ramp vehicle detectors to ensure management responses are appropriate.

	Option 1	Option 2
Improve traffic safety – Reduce the risk of crashes, and facilitate more efficient response to incidents	✗ Neither speed management nor wayfinding would improve.	✓ A smart motorway would help improve safety by allowing better management of traffic speeds. 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. A smart motorway would also improve wayfinding, especially at key decision-making points, and this would potentially reduce last-minute lane-changing and thereby the number of manoeuvring crashes. Improved CCTV coverage across the Corridor would also improve visibility for the Transport Management Centre and first responders to crashes or incidents. The use of non-intrusive vehicle and incident detectors would rapidly alert first responders to crashes, breakdowns and debris on the proposal corridor.
Enhance the road user experience – Provide smoother journeys and enhanced journey decision-making for road users	✗ Neither messaging nor wayfinding would be improved.	✓ A smart motorway would enable improved messaging and wayfinding (and as a result, minimised weaving). Dynamic directional signs, a primary tool for driver decision-making would be installed along the mainline and at critical and/or complex junctures of the proposal corridor.
Optimise transport asset utilisation and investment – Ensure the efficient use of the asset and optimise the benefits of current and future infrastructure investments	✓✗ This option would require no investment, however would involve no investment into future infrastructure.	✓ A smart motorway would have marginally more expensive operational costs compared to existing infrastructure and would require upfront costs to construct. This investment is considered to make more efficient use of the existing road infrastructure asset by implementing minor infrastructure upgrades to significantly reduce costs related to traffic delays and crashes. This investment would also allow existing infrastructure to adapt to future traffic demands and conditions.

	Option 1	Option 2
Development criteria		
Minimises potential environmental impacts	✓ There would be no environmental impacts.	✓ There would be some environmental impacts as a result of the proposal however, these impacts have been assessed to be minor and mitigations have been identified.
Minimises potential impacts to the community	✓ There would be no community impacts.	✓ There would be community impacts due to traffic and noise disruptions during construction of the proposal as well as operational visual impacts due to installation of the gantries, however, these impacts are expected to be temporary and minor. The community would experience an overall positive impact due to improved travel time reliability, road user experience and improved road safety.

2.5 Preferred option

The preferred option is the implementation of smart motorway technology (ISLUS, VSLS, incident detection, vehicle detection, and improved signage including dynamic directional signs) on the M1 corridor (Option 2). The preferred option was selected because it best meets the proposal objectives and development criteria by:

- Improving traffic flow and facilitating better management of incidents
- Improving safety through enhanced speed management and better wayfinding
- Optimising the use of an existing road infrastructure asset.

The preferred option is the basis for the proposal, which is described in detail in Chapter 3.

2.6 Design refinements

As part of the concept design development, specific proposals for smart motorway measures were refined and sub-options were developed to address issues at specific locations within the corridor. These are described below.

2.6.1 Refinement of corridor scope

With the further development of the WestConnex Stage 3B (Rozelle interchange), Western Harbour Tunnel and Beaches Link projects, the M1 North Smart Motorway proposal was tailored to better integrate with these projects. Smart motorway functionality is being delivered as part of these other projects and as a result the proposal scope was refined to avoid overlap at the western extent of the proposal corridor in Pyrmont.

Implementation of smart motorway technology on the Cahill Expressway and the northern part of the Eastern Distributor were initially considered as part of the concept design. It was anticipated that improvements to the Cahill Expressway / Eastern Distributor could support the distributive function of the proposal corridor into and out of the Sydney CBD and ease congestion around a critical pinch point where traffic from the Sydney Harbour Tunnel, Cahill Expressway and Eastern Distributor converges just to the east of Sydney CBD.

A review of the scope found that removing the Cahill Expressway and Eastern Distributor from the scope would:

- Avoid potential conflicts with the Circular Quay Renewal proposal
- Make the proposal more affordable.

2.6.2 Refinement of proposed ITS infrastructure

As part of implementing a smart motorway, there are a range of ITS device options that need to be considered. These include:

- Integrated Speed and Lane Use Management Signs (ISLUS) – Generally positioned on gantries over the motorway. Lane use management signs allow lane access to be controlled for both planned events and unplanned incidents while the integrated speed signs provide further control.
- Variable Speed Limit Signs (VSLS) – During normal operations, speed limits are set dynamically to smooth traffic flow and address congestion – resulting in fewer flow breakdowns and rear-end crashes. Variable speed limit signs are also used to overcome crashes and incidents by instructing road users to travel at a slower safe speed.
- Non-intrusive vehicle and incident detection – Used for continuous traffic monitoring and intelligence gathering, enabling network performance to be continually assessed
- In-ground vehicle sensors – Installed at on and off-ramps to estimate the density and speed of traffic entering and exiting the corridor
- Closed Circuit Television (CCTV) – Allow for a live traffic feed and immediate confirmation of any congestion issues or incidents
- Smart motorway control system – Integrated management and control system that provides a single access portal to monitor and control the connected ITS devices to manage motorway traffic
- Dynamic Directional Signage – Digital signs which replace existing static signs to allow directional signage to change by time of day, supporting tidal flow operations for major events and unplanned incidents.

In assessing how each of the ITS device options meets the proposal objectives, a set of operational objectives were developed. These are:

- Better control of corridor traffic flow
- Improved hazard management
- Enhanced corridor wayfinding
- Cost-effectiveness
- Consideration of the proposed locations of ITS devices.

Table 2-3 identifies those ITS devices that were assessed as best addressing the relevant proposal and operation objectives.

Table 2-3: Alignment of proposal objectives, operational objectives and ITS devices

Proposal objective	Operational objective	ITS devices
Increase network resilience	Better control of corridor traffic flow	• Vehicle and hazard detection • VSLS • ISLUS • CCTV

Proposal objective	Operational objective	ITS devices
Efficiency and reliability	Better control of corridor traffic flow	• Vehicle and hazard detection • VSLS • CCTV
Improve traffic safety and incident management	Improved hazard management	• Vehicle and hazard detection • VSLS • ISLUS • Dynamic directional signs • CCTV
Enhance transport and customer experience	Enhanced corridor wayfinding	• Dynamic directional signs

Urban design outcomes (including visual amenity) and heritage were also considered when identifying specific locations where ITS devices could be deployed. Impacts on these two environmental aspects were reduced by:

- Limiting the scope to exclude the ITS infrastructure on the Cahill Expressway and Eastern Distributor, which avoided potential visual and heritage impacts on the Botanic Gardens and the Sydney Opera House
- Limiting the scope to exclude ramp metering and variable message signs on the CBD road network, which minimised the overall level of construction related impacts avoided potential impacts associated with heritage items and areas of visual sensitivity.

2.6.3 Ramp metering and variable message signs

As part of the concept design process implementation of ramp metering and increased ramp storage along with supporting variable message signs (VMS) on the surrounding road network were considered. Ramp metering allows the volume and frequency of traffic entering the motorway to be optimised for the consistent speeds and travel times.

During evaluation it was identified that controlling approaches to the proposal corridor using ramp metering results in vehicles queuing on adjoining streets, with limited opportunities to implement a dedicated vehicle queuing space. It would also have potential impacts on heritage items (with VMS located near heritage items) and would result in additional noise and disruption during construction. For these reasons, ramp metering was not pursued further.

2.6.4 Weaving on the Western Distributor

Two design options were developed to address the weaving movements that currently occur on the Western Distributor between Harris Street/Fig Street/Pyrmont Street and King Street. These are as follows:

- Weaving Option 1 – Clearly define two lanes on the Western Distributor as the primary through traffic route (through changes to line marking), isolating these lanes from local traffic. Under this option the left lane from Harris Street/Fig Street/Pyrmont Street would connect directly to the King Street exit while the right lane from Harris Street/Fig Street/Pyrmont Street would be dedicated to the Sydney Harbour Bridge.
- Weaving Option 2 – Clearly define two lanes on the Western Distributor as the primary through traffic route (through changes to line marking) and provide a down ramp to Harbour Street. Traffic from Harris Street/Fig Street/Pyrmont Street travelling to the Sydney Harbour Bridge would use the left lane and access the Harbour Street down

ramp, use Harbour Street and re-join the Western Distributor further north. Traffic in the right lane from Harris Street/Fig Street/Pyrmont Street would be dedicated to the King Street exit.

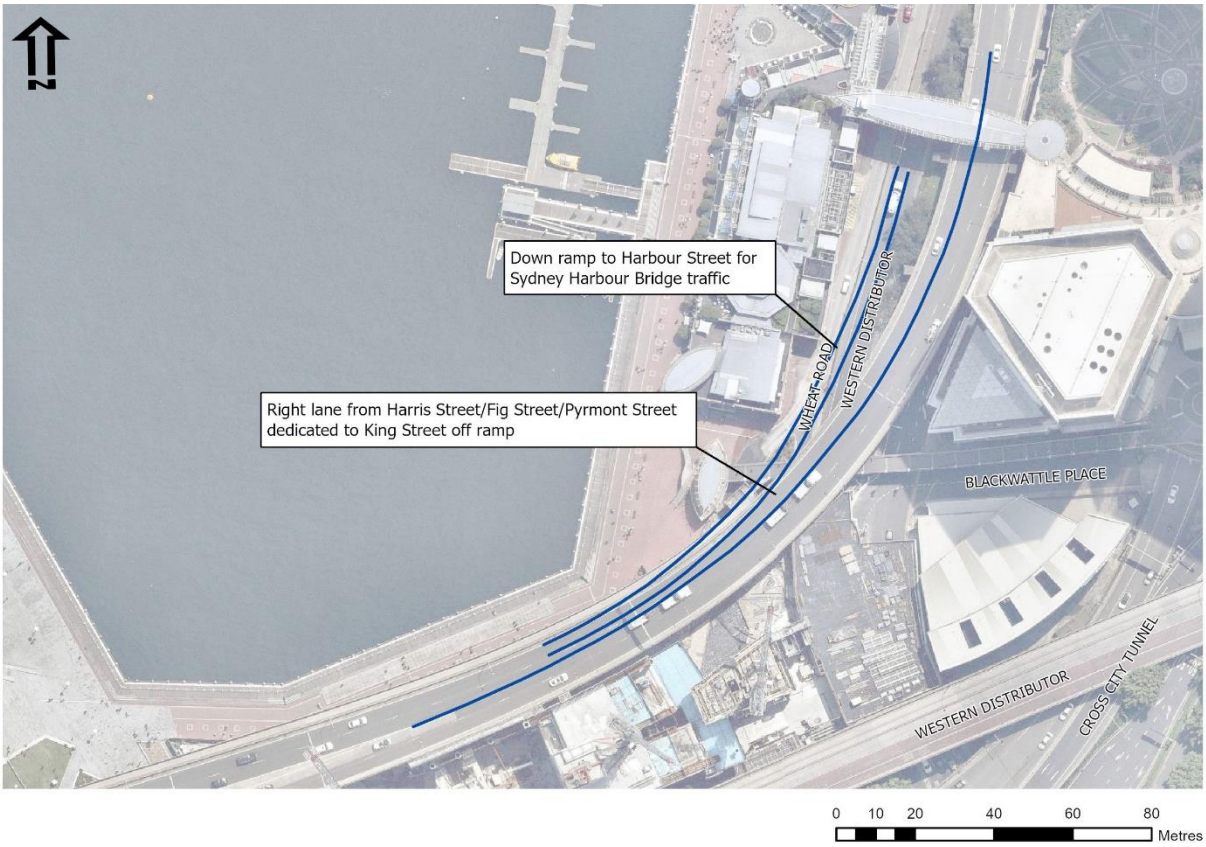


Figure 2-2: Weaving Option 1

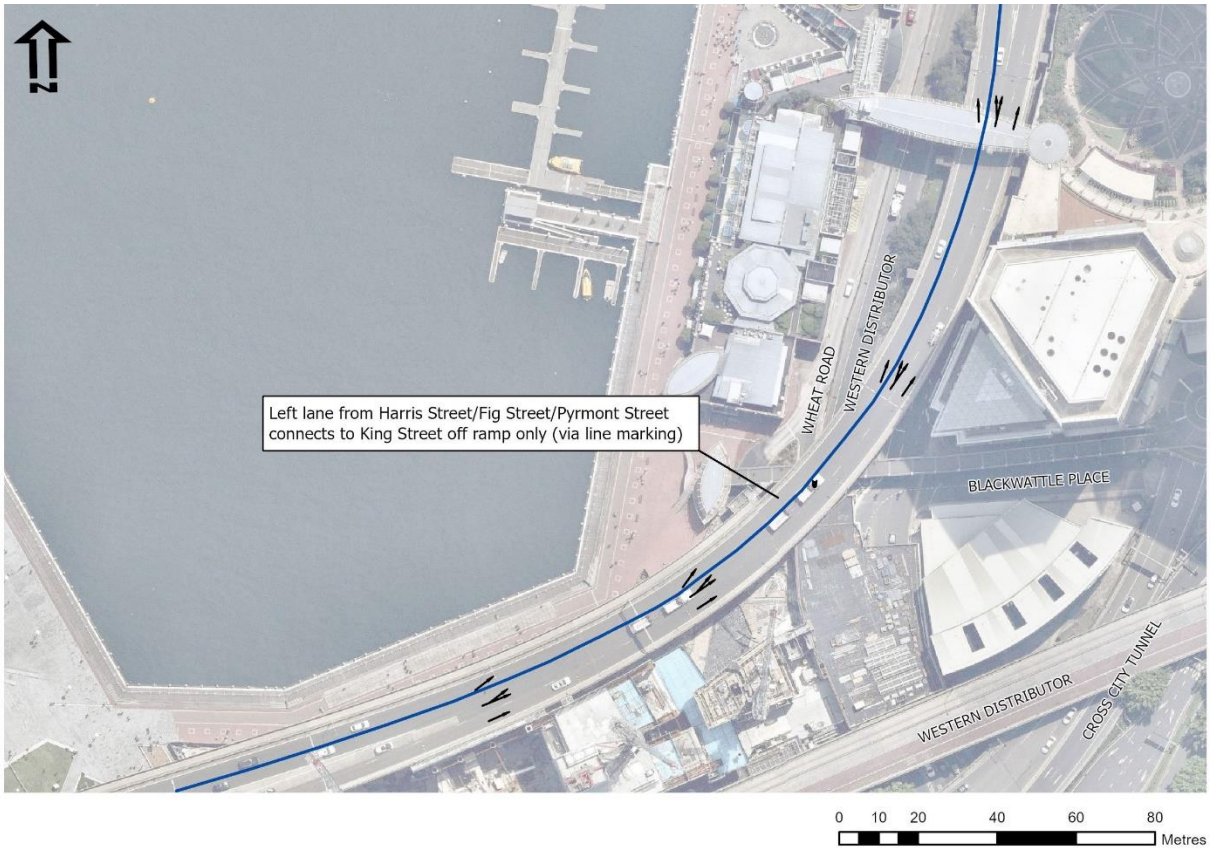


Figure 2-3: Weaving Option 2

Weaving Option 1 is preferred because it allows clear definition of the primary through corridor but does not require modification or augmentation of elevated structures and would not impact on the existing elevated walkway to Darling Harbour that runs along the alignment of Druitt Street. Option 2 would have substantial impacts on pedestrian connectivity.

3 Proposal description

3.1 The proposal

Transport for NSW proposes to introduce intelligent technology, known as a smart motorway system, to the M1 corridor between Milsons Point and Allen Street in Pyrmont (the proposal and the proposal corridor). The proposal is shown in Figure 3-1 to Figure 3-15 and an overview of the proposal is provided in Figure 1-2.

- New gantries at 12 locations
- Integrated Speed and Lane Use Sign (ISLUS) on 11 new gantries and on the King Street overpass (northbound) (refer Figure 3-6), and the King Street footbridge (southbound) (refer Figure 3-6) (13 in total)
- Dynamic directional signs collocated on five of the new ISLUS gantries, on two existing Sydney Harbour bridge gantries (Gantries 24 and 25), on the King Street footbridge (refer Figure 3-6) and on a new gantry near the reversible Clarence Street / Grosvenor Street entry / exit ramp (Gantry 9) (nine in total)
- New, pole mounted, Variable Speed Limit Signs (VSLS) (11 in total) to provide speed limit information for vehicles entering the M1 corridor
- Removal of redundant static directional signs and gantries
- New static directional signs (three in total) at the Fig Street / Harris Street intersection, near Gantry 12 and on Gantry 13
- Retention of existing lane control signs and replacement of existing VSLS with new VSLS on existing Sydney Harbour Bridge gantries (refer Figure 3-10 to Figure 3-14)
- Wayfinding infrastructure including directional signs, lane allocation signs, advance exit signs and exit direction signs that allow strategic placement of key messages and repeater messages to optimise lane selection and lane changes
- Smart motorway hazard and vehicle detection system covering the full elevated motorway and sections without a shoulder/emergency lane
- Closed circuit television camera infrastructure (CCTV) to achieve full coverage across the corridor
- Minor changes to lane alignments, asphalt resurfacing and line marking changes along the Western Distributor (refer Figure 3-3 to Figure 3-6)
- Cables, pits, conduits, in pavement inductive loops and cabinets to support intelligent transport systems (ITS).

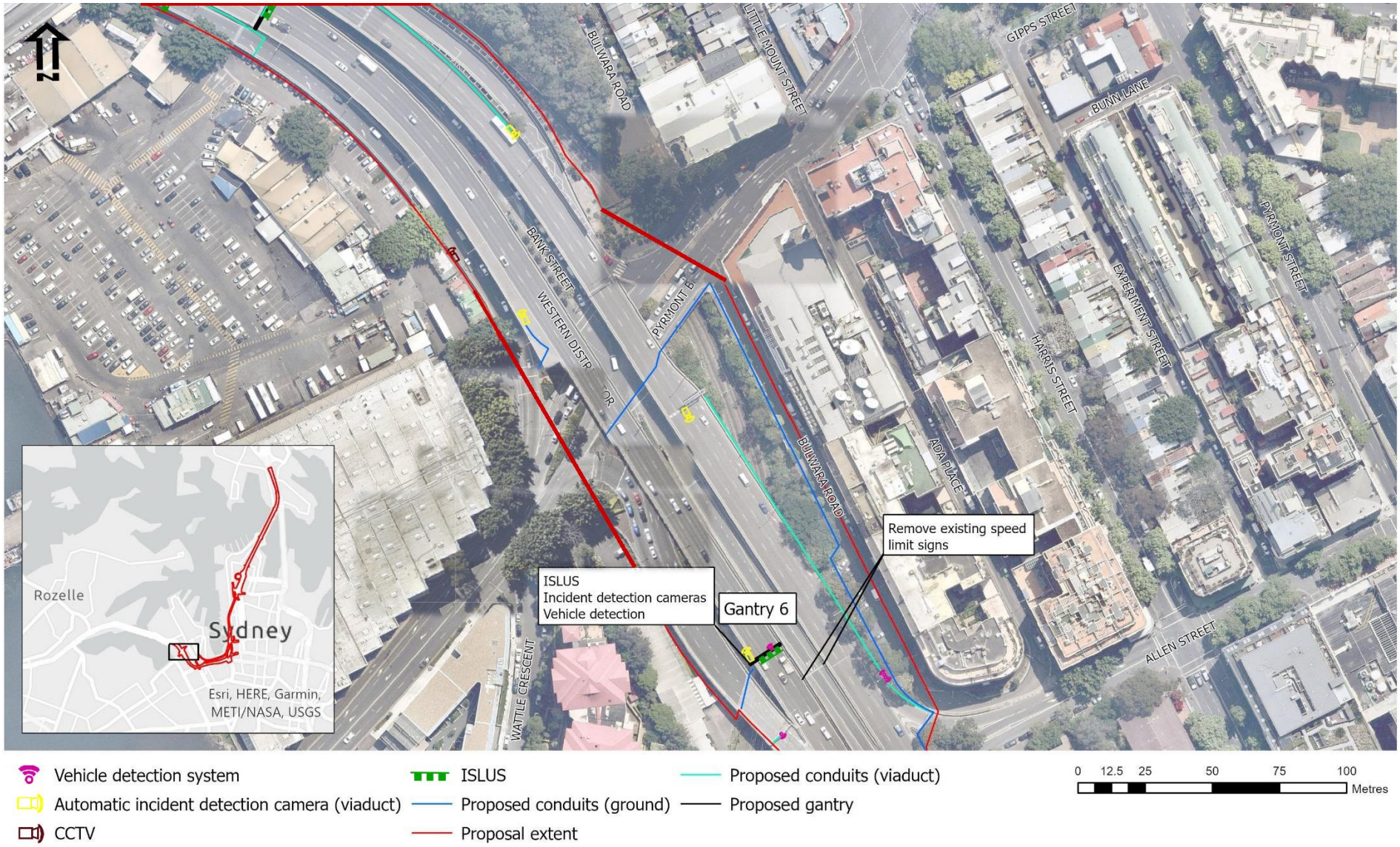


Figure 3-1: Proposal description – map 1

Figure 3-2: Proposal description – map 2

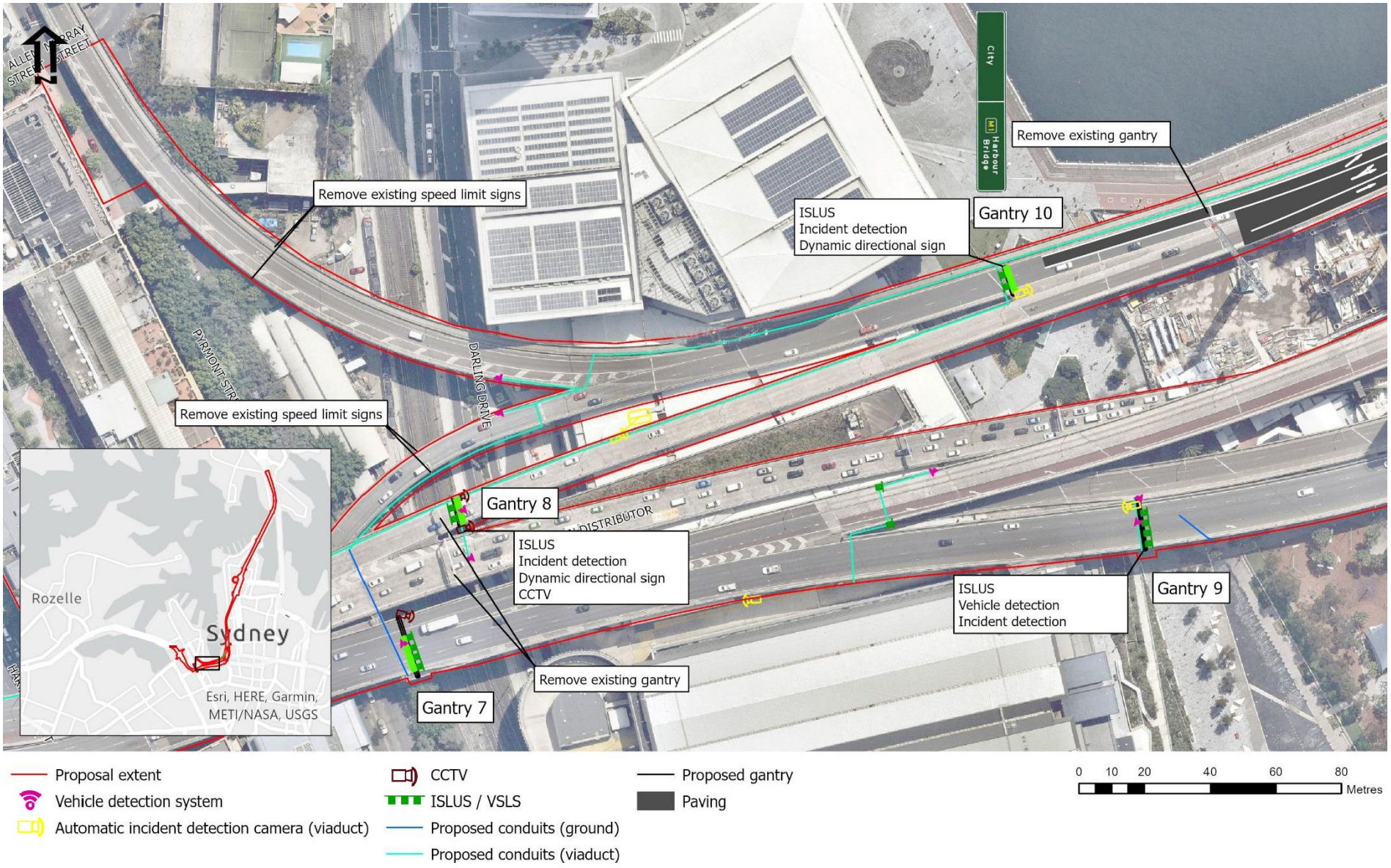


Figure 3-3: Proposal description – map 3

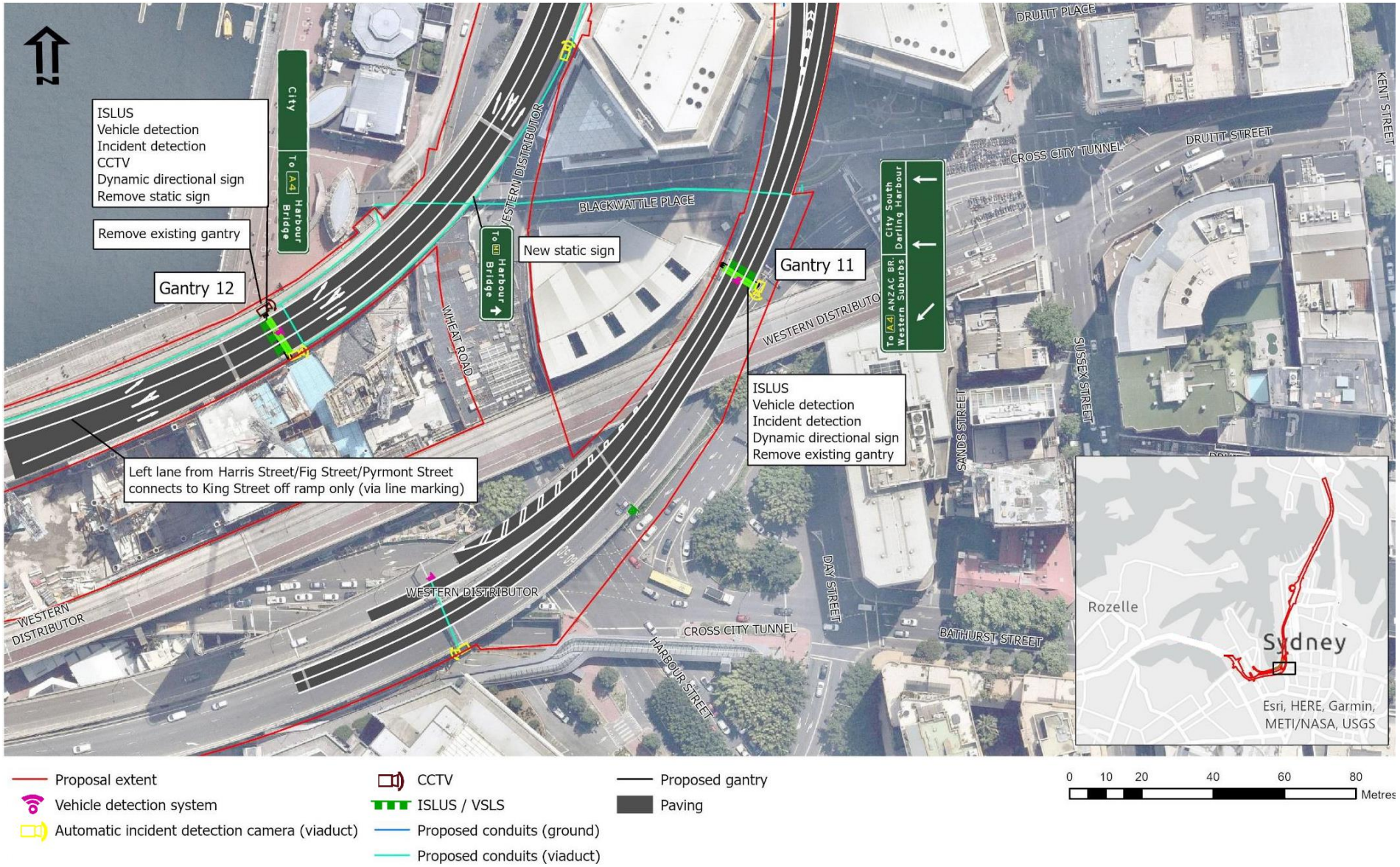


Figure 3-4: Proposal description – map 4

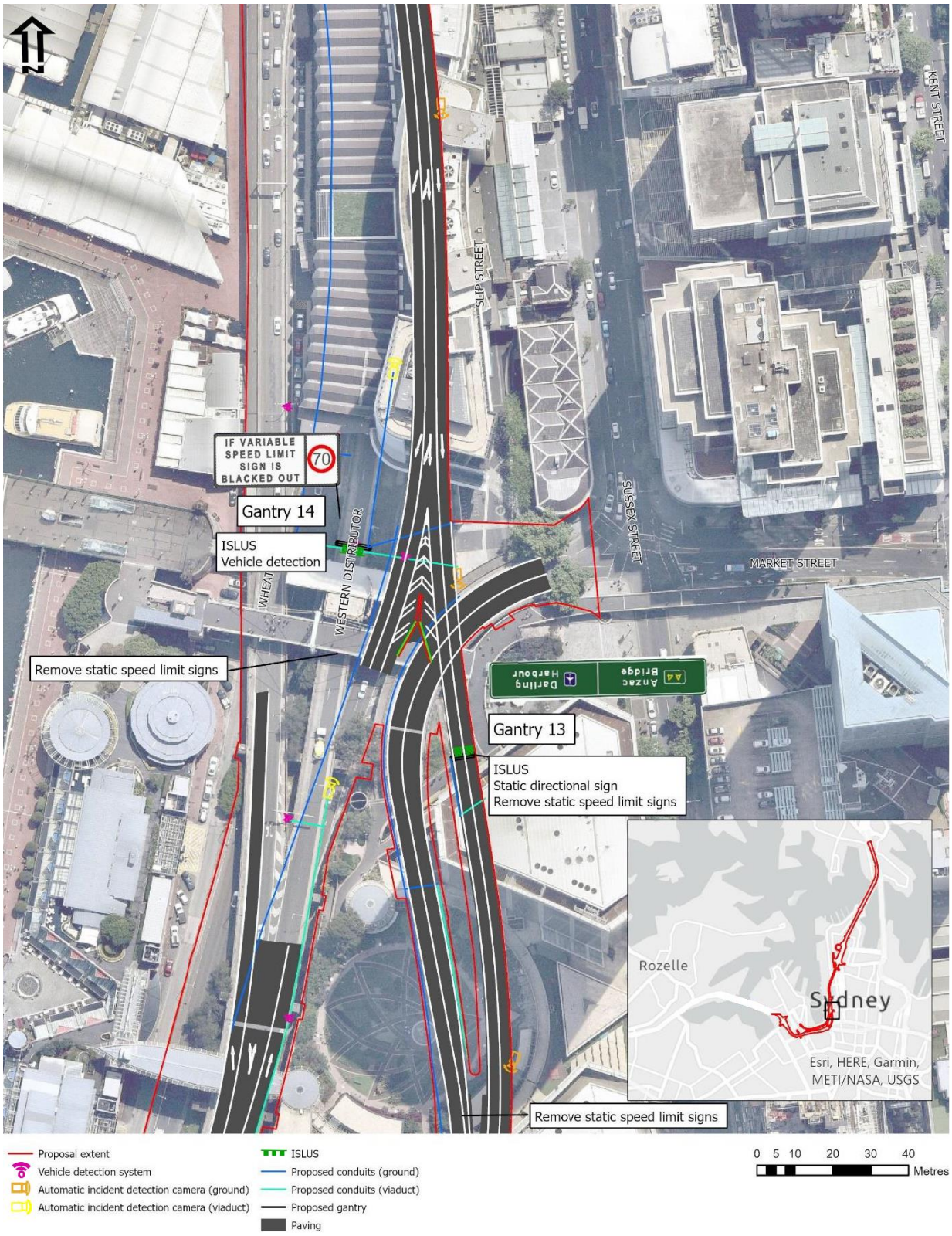


Figure 3-5: Proposal description – map 5

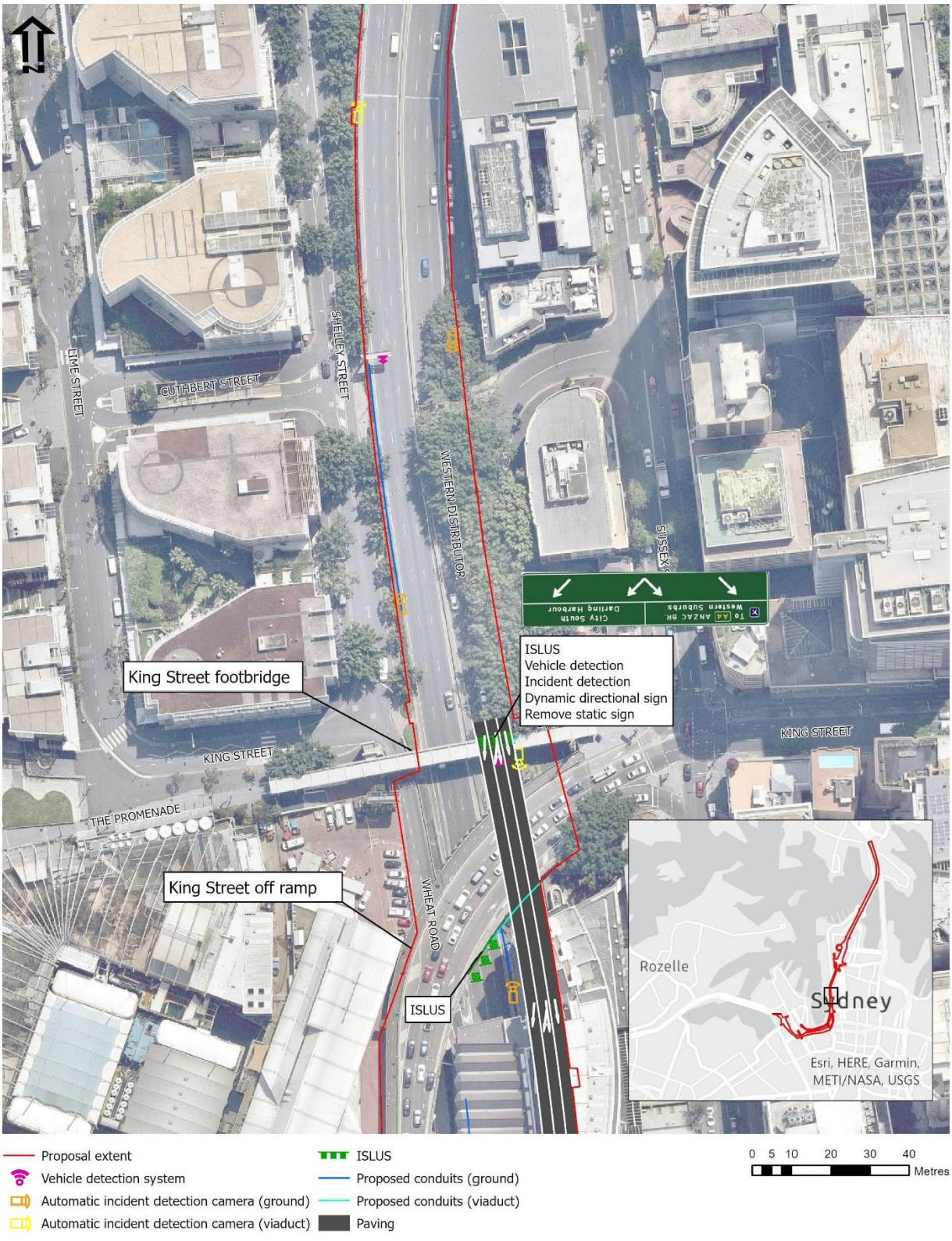


Figure 3-6: Proposal description – map 6

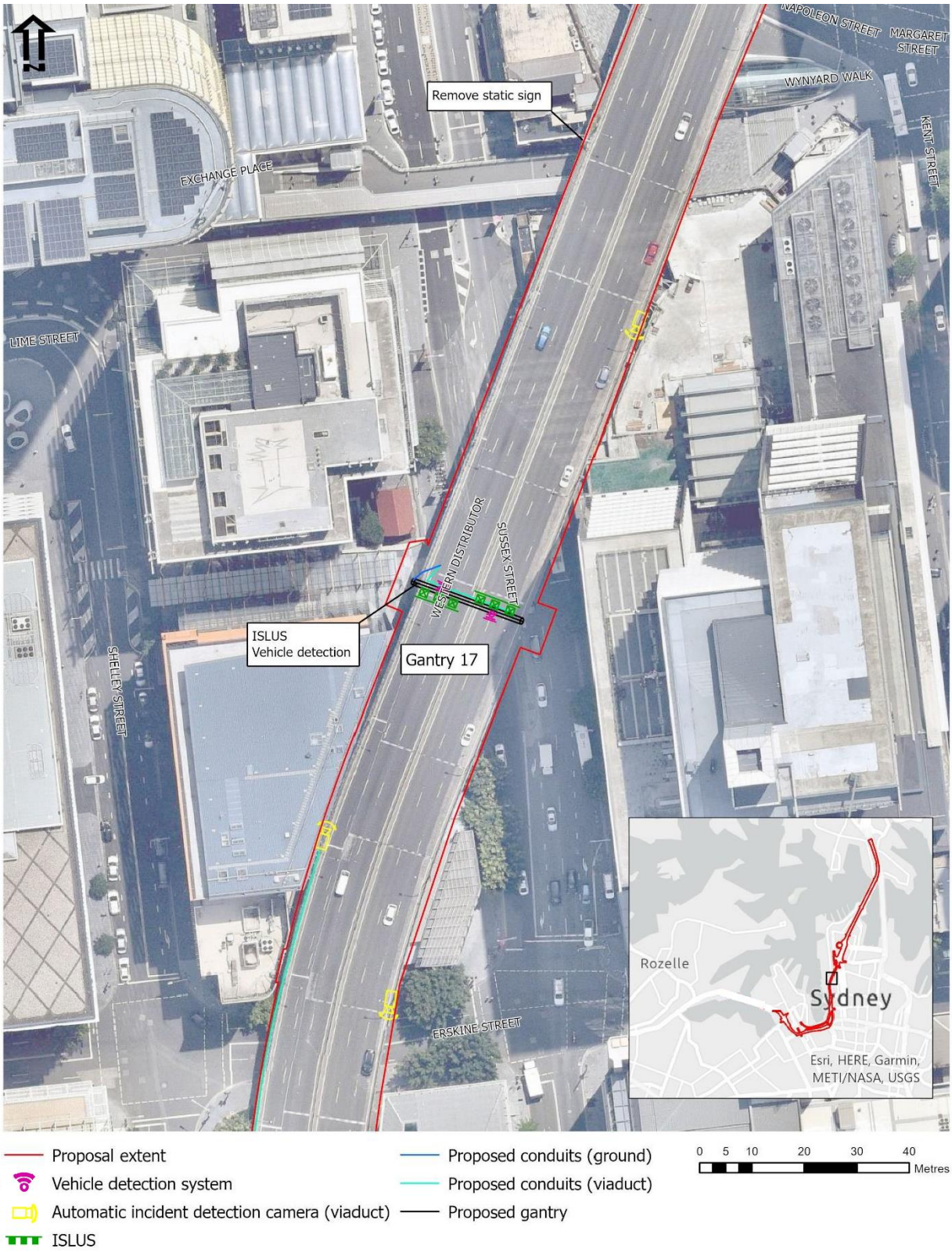


Figure 3-7: Proposal description – map 7

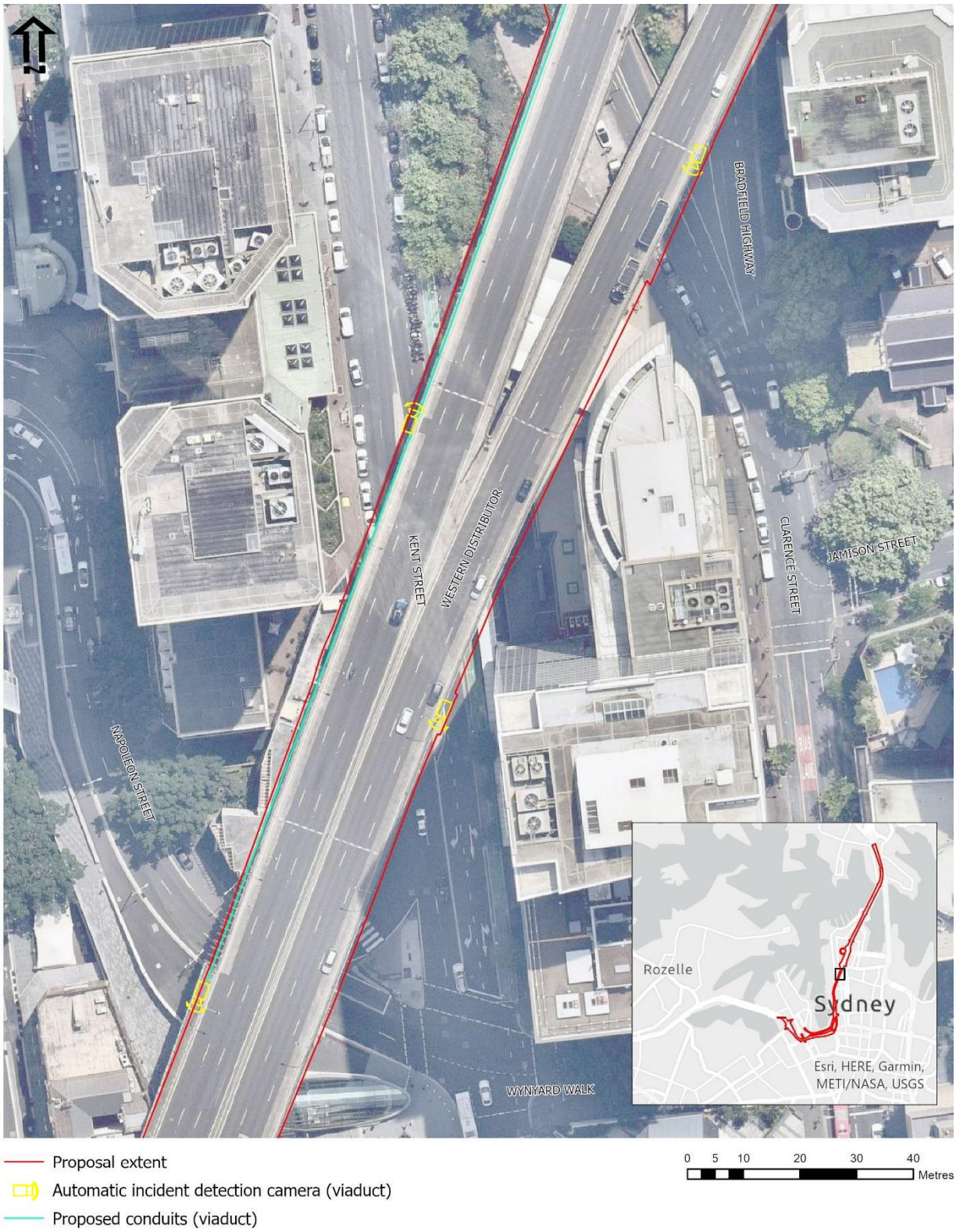


Figure 3-8: Proposal description – map 8

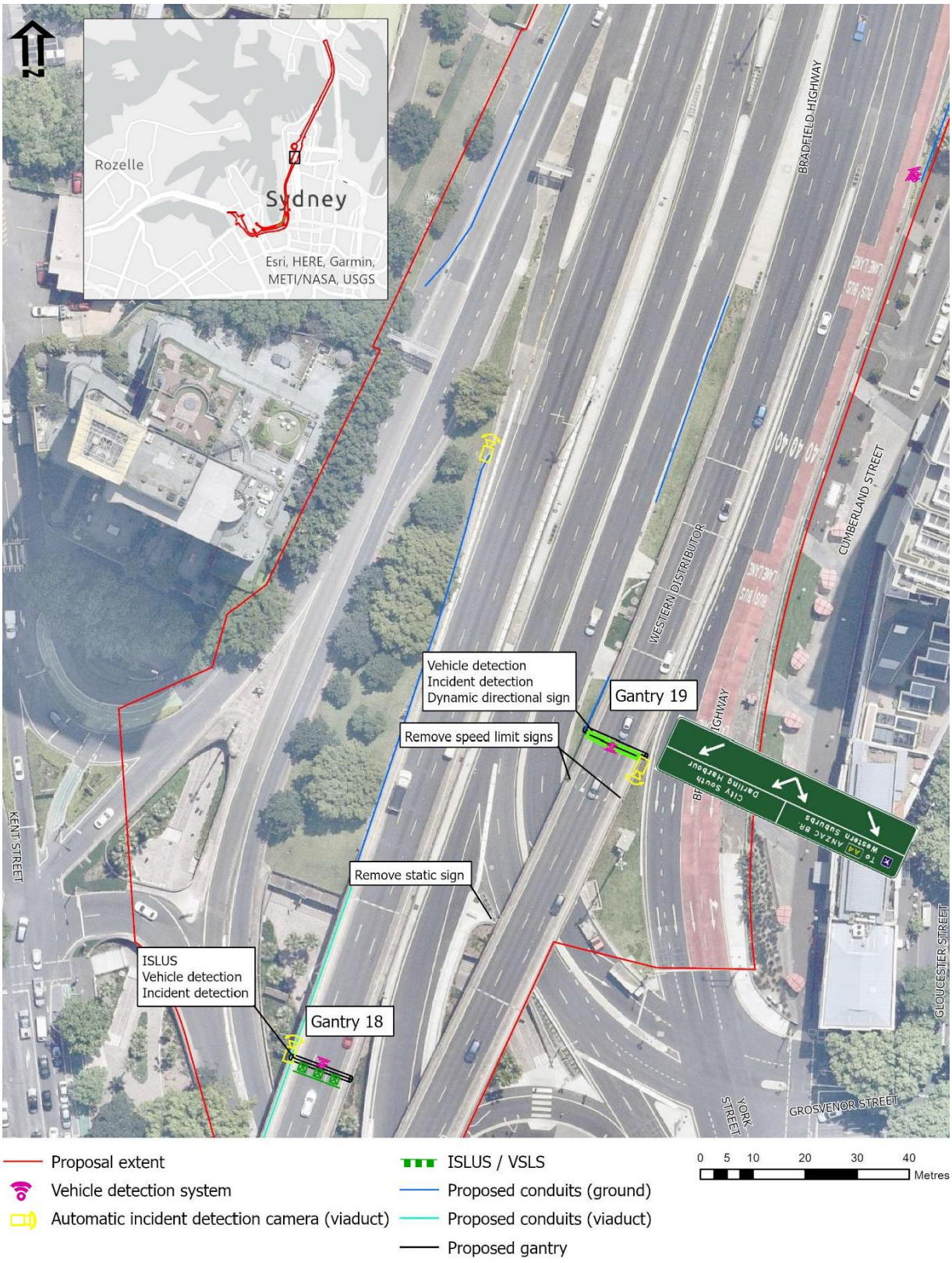


Figure 3-9: Proposal description – map 9

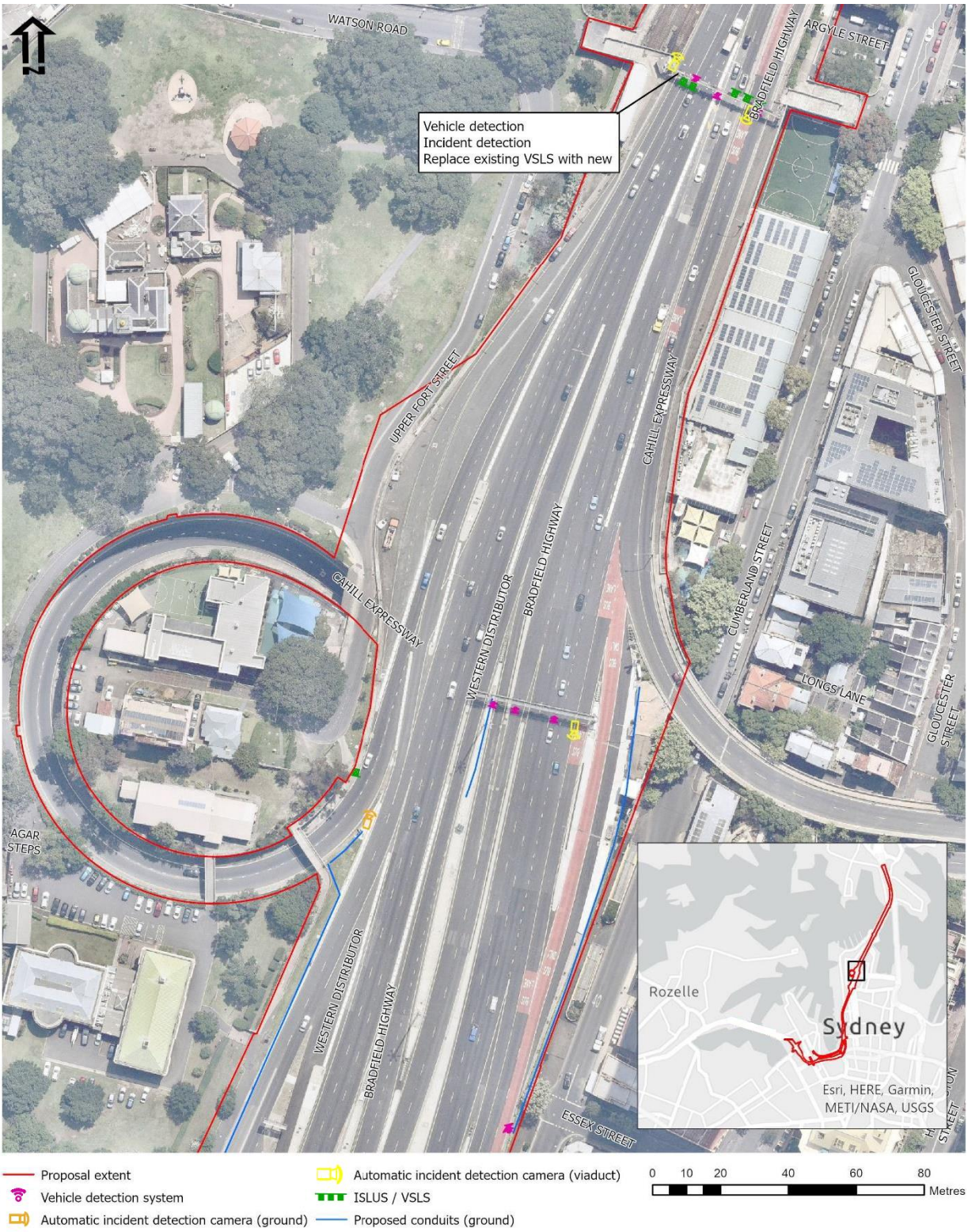


Figure 3-10: Proposal description – map 10

Figure 3-11: Proposal description – map 11

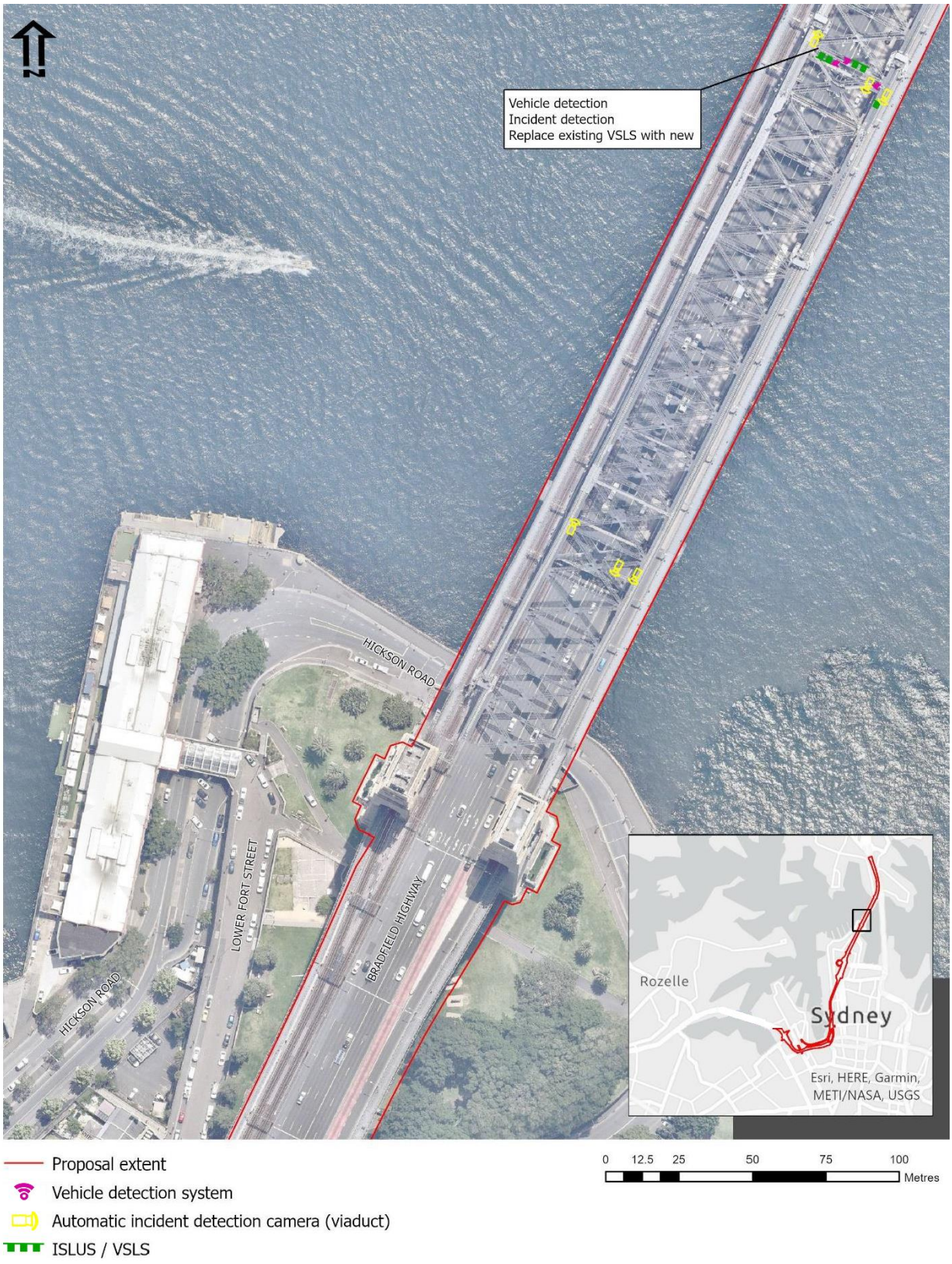


Figure 3-12: Proposal description – map 12

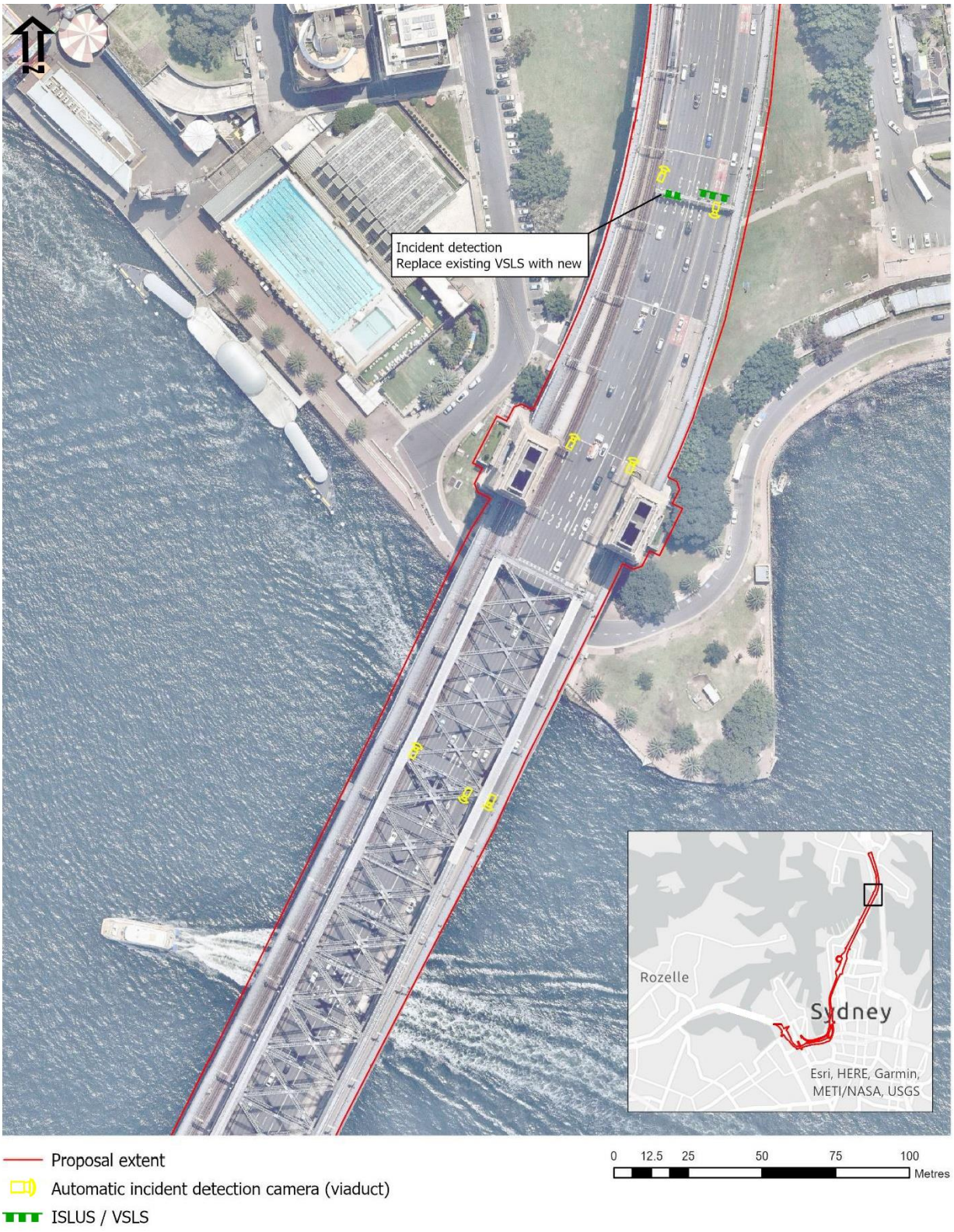


Figure 3-13: Proposal description – map 13

Figure 3-14: Proposal description – map 14

Figure 3-15: Proposal description – map 15

3.2 Design

3.2.1 Design criteria

Design guides and policies used during the development of the proposal included:

- Smart Motorway Guidelines (Roads and Maritime Services, 2015)
- Austroads Guide to Road Design (Austroads, 2009)
- Transport for NSW supplements to the Austroads Guide to Road Design (Roads and Maritime Services, 2015)
- Austroads Guide to Traffic Management Part 10: Traffic Control and Communication Devices (Austroads, 2016)
- Austroads Freeway Design Parameters for Fully Managed Operations (Austroads, 2009c)
- Smart motorway supplements (Roads and Maritime Services, 2017)
- Delineation (Roads and Traffic Authority, 2008).

The concept design for the proposal was prepared in accordance with a design management system certified under AS/NZS ISO 9001:2008 Quality Management Systems.

3.2.2 Engineering constraints

The proposal has several engineering related constraints as detailed in Table 3-1

Table 3-1: Engineering constraints

Constraint type	Description
Elevated structures	• Increased complexity for structural elements • Restricted safe maintenance access • Road width limitations • Working width restrictions • Pavement depth restrictions • Restricted opportunities for new/alternative utilities
Relatively short link lengths	• Limited separation of decision and message influence points • Increased traffic weaving to access corridor and exits
Lack of consistent, suitable shoulder or emergency lane	• Limited safe areas for vehicles to use during incident • Reduced access capacity for emergency vehicles • Reduced access for maintenance • Limited safe cyclist access • Limited opportunity to extend or widen traffic lanes • Working width restrictions • Restricted opportunities for new/alternative infrastructure • Location constraints for utilities/drainage
Complex interfaces with tunnels and motorways	• Increased integration complexity • Limited opportunity to provide road users with early information regarding lane selection for their destinations • Limited opportunity to extend or widen traffic lanes

Constraint type	Description
Short on and off ramps	• Road width limitations • Increased safety risk from queuing traffic on off ramps • Arterial road queuing • Local road queuing
Highly urbanised motorway network	• Limited opportunity to extend or widen traffic lanes • Complex interfaces with local network • Speed differential of merging traffic • Road jurisdictions complexity
Reversible lane systems	• Lane switches provide abrupt changes in directional capacity imposing additional functionality on flow control • Abrupt directional changes impact safe operation
Other major infrastructure projects	• Major impact on traffic flows and demand • Change to configuration of road network on approach to the proposal corridor • Coordination challenges (to address cumulative construction traffic and construction fatigue) associated with the volume of other construction occurring or planned within and near the proposal extent. This includes WestConnex, Sydney Metro West and Western Harbour Tunnel.
Pavements	• Condition of existing pavements
Conduits	• Limited space in conduits • Access to conduits within barriers
Construction traffic management	• Requirement to maintain through traffic and turning movements during construction

3.2.3 Major design features

Gantries

Twelve gantries would be installed or modified to support smart motorway technology along the proposal corridor.

Further detail on the location and type of gantry to be installed at each location is provided in

Table 3-2 and Figure 3-16.

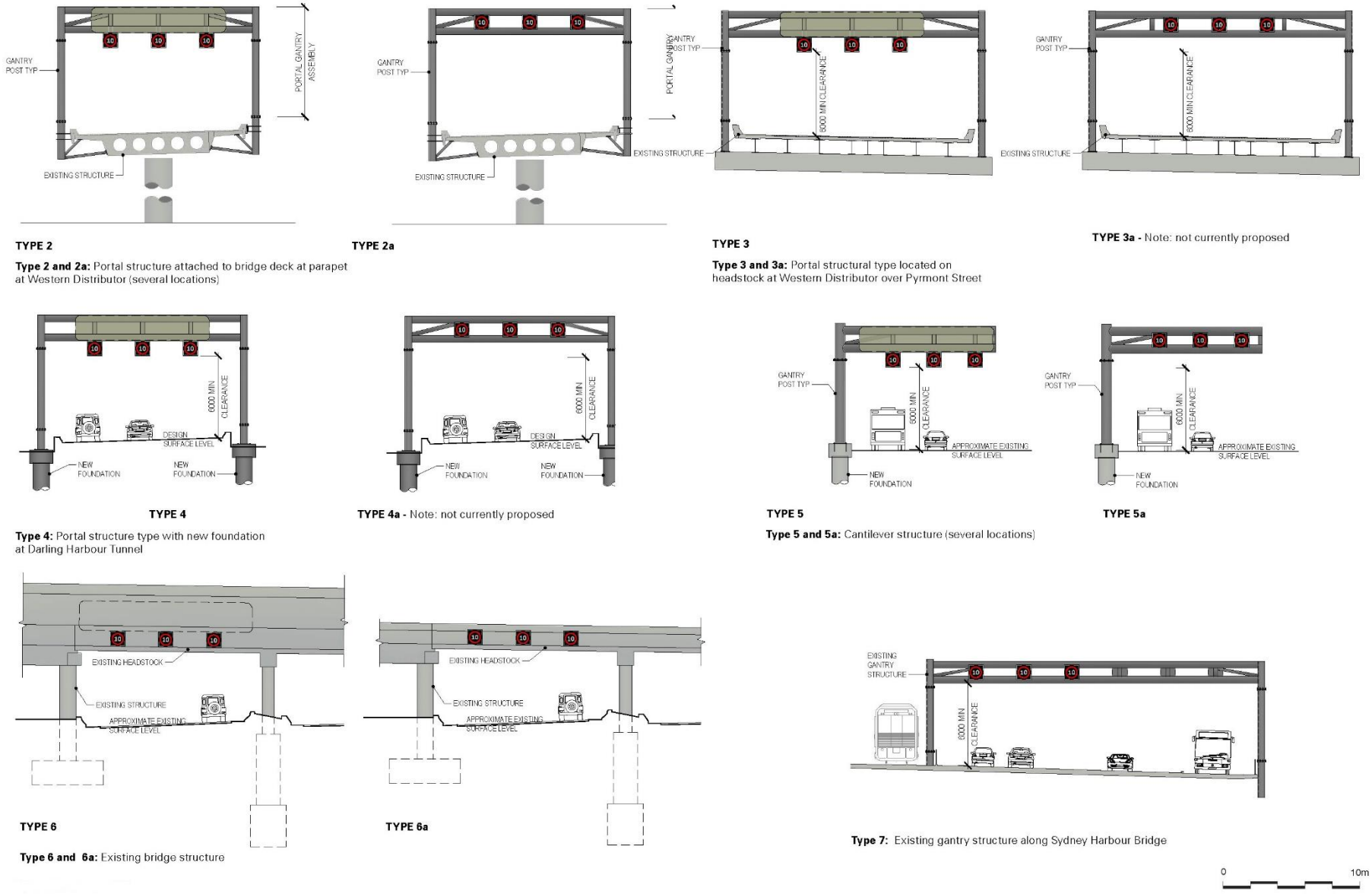
Table 3-2: New or existing gantries included in the proposal

Gantry	Location	Type	Support	Proposed smart motorway technology
6	Western Distributor, CBD near Allen Street eastbound	5a - cantilever	New foundation	ISLUS Incident detection Vehicle detection
7	Western Distributor, CBD - westbound over Pyrmont Street	3 - portal	Headstock	ISLUS CCTV Vehicle detection Dynamic directional sign
8	Western Distributor, CBD - eastbound over Darling Drive	3 - portal	Headstock	ISLUS Incident detection Dynamic directional sign CCTV
9	Western Distributor, CBD - Darling Harbour, westbound	2a - portal	Bridge deck	ISLUS Vehicle detection Incident detection
10	Western Distributor, CBD - Darling Harbour, eastbound	3 - portal	Headstock	ISLUS Incident detection Dynamic directional sign
11	Western Distributor, westbound, south of Regis Darling Harbour Tunnel	6 - portal	New foundation	ISLUS Vehicle detection Incident detection Dynamic directional sign
12	Western Distributor, westbound, adjacent to Cockle Bay	2 - portal	Bridge deck	ISLUS Vehicle detection Incident detection CCTV Dynamic directional sign
13	Western Distributor, westbound, adjacent to Market Street	5 - cantilever	New foundation	ISLUS Static directional sign
14	Western Distributor, CBD - Darling Harbour eastbound adjacent to Market Street	5a - cantilever	New foundation	ISLUS Vehicle detection
15	Connected to bridge carrying King Street ramp over Western Distributor. Over eastbound lanes only.	6a - bracket	Bridge deck	ISLUS
16	Pedestrian footbridge over Western Distributor at King Street	6 - bracket	Bridge deck	ISLUS Vehicle detection Incident detection Dynamic directional sign

Gantry	Location	Type	Support	Proposed smart motorway technology
17	Western Distributor above Sussex Street	2a - portal	Bridge deck	ISLUS Vehicle detection
18	Western Distributor eastbound adjacent to Kent Street	2a - portal	Bridge deck	ISLUS Vehicle detection Incident detection
19	Western Distributor westbound near Grosvenor Street	3 - portal	Bridge abutment	Vehicle detection Incident detection Dynamic directional sign
24	Sydney Harbour Bridge southern approach	Existing portal gantry	Bracket	Dynamic directional signs Incident detection Replace existing VSLS with new
25	Sydney Harbour Bridge northern approach	Existing portal gantry	Bracket	Incident detection Vehicle detection Dynamic directional sign

Note 1: Gantries numbered 1 to 6 and 20 to 24 were removed from the scope during concept design development.

Note: 2: ITS on existing gantries on and immediate adjacent to the Sydney Harbour Bridge (not numbered) main span is limited to vehicle detection, incident detection and replacement of existing VSLS with new. Refer to Figure 3-14 to Figure 3-17.



TYPE 2

Type 2 and 2a: Portal structure attached to bridge deck at parapet at Western Distributor (several locations)

TYPE 2a

TYPE 3

Type 3 and 3a: Portal structural type located on headstock at Western Distributor over Pyrmont Street

TYPE 3a - Note: not currently proposed

TYPE 4

Type 4: Portal structure type with new foundation at Darling Harbour Tunnel

TYPE 4a - Note: not currently proposed

TYPE 5

Type 5 and 5a: Cantilever structure (several locations)

TYPE 5a

TYPE 6

Type 6 and 6a: Existing bridge structure

TYPE 6a

Type 7: Existing gantry structure along Sydney Harbour Bridge

Figure 3-16: Gantry types 1 to 6

Messaging, wayfinding and lane allocation

Improved messaging and wayfinding would be implemented through provision of the following infrastructure at the locations identified in Figure 3-1 to Figure 3-15 and on the signage drawings included in Appendix C. Where required for electronic signs, new power and ITS connections (including cabinets and cabinet extensions) would be established either below ground or affixed to structures.

- ISLUS at 13 locations (on new gantries and existing structures) to communicate variable speed limits and lane allocations (refer to example in Figure 3-17). Structures including an overpass and footbridge are used at a two of these locations.
- VSLS at on ramps at a total of 11 locations to provide speed limit information for vehicles entering the M1 corridor (refer to example in Figure 3-18). Where possible, on ramp VSLS have been co located with ISLUS gantries by extending the mainline gantry over the ramp and mounting a single VSLS over the on ramp lane. Where this is not possible, post-mounted VSLS have been proposed. On the Sydney Harbour Bridge, existing lane control signs will be retained on existing gantries with existing VSLS replaced by new VSLS.
- Directional signage to clearly identify necessary lane selection for intended destinations (refer to example in Figure 3-19). Dynamic directional message signs would be used (at nine locations) where route choices may change due to operational requirements and where provided, would replace static directional signs. Dynamic directional message signs would be integrated into, and controlled by, the motorway management control system. New static signs are proposed at the Fig Street / Harris Street intersection, near Gantry 12 and on Gantry 13 (refer to example in Figure 3-20).

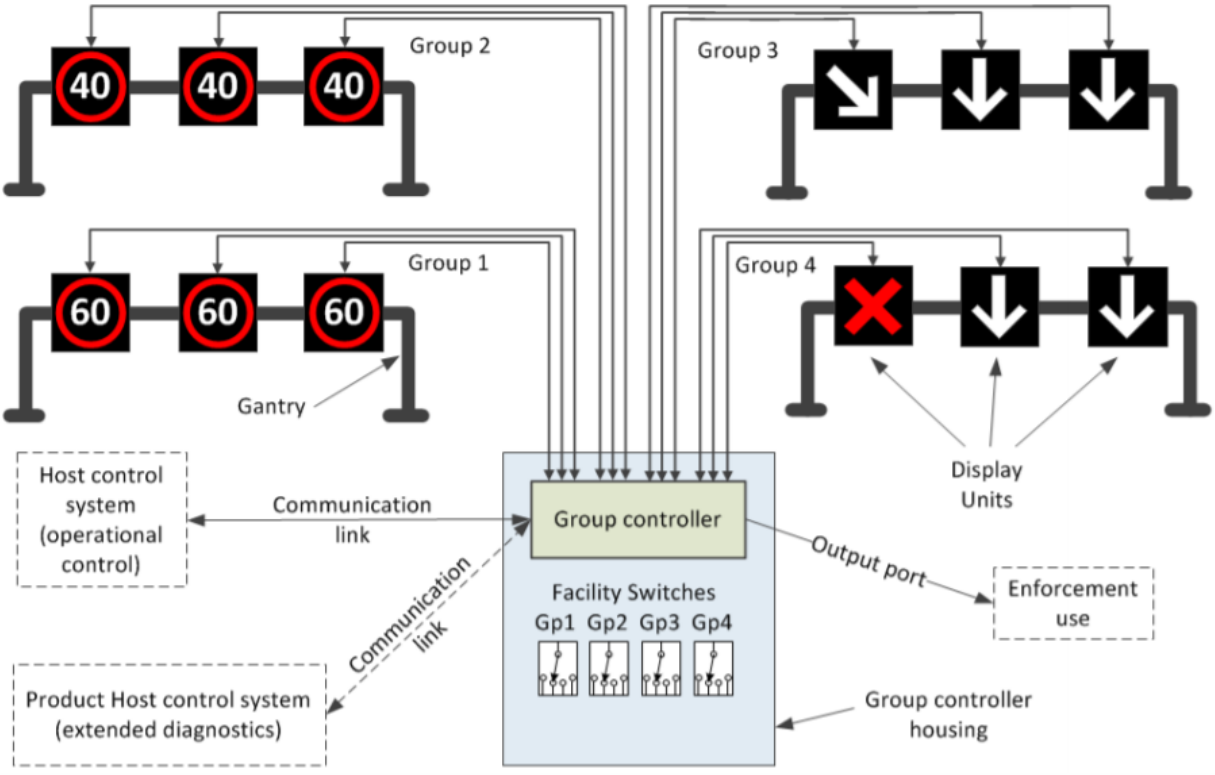


Figure 3-17 Example Integrated Speed Limit and Lane Usage Sign (ISLUS) system schematic

Figure 3-18 Example Variable Speed Limit Sign (VSLS)

Figure 3-19: Typical dynamic directional sign (photomontage Western Distributor)

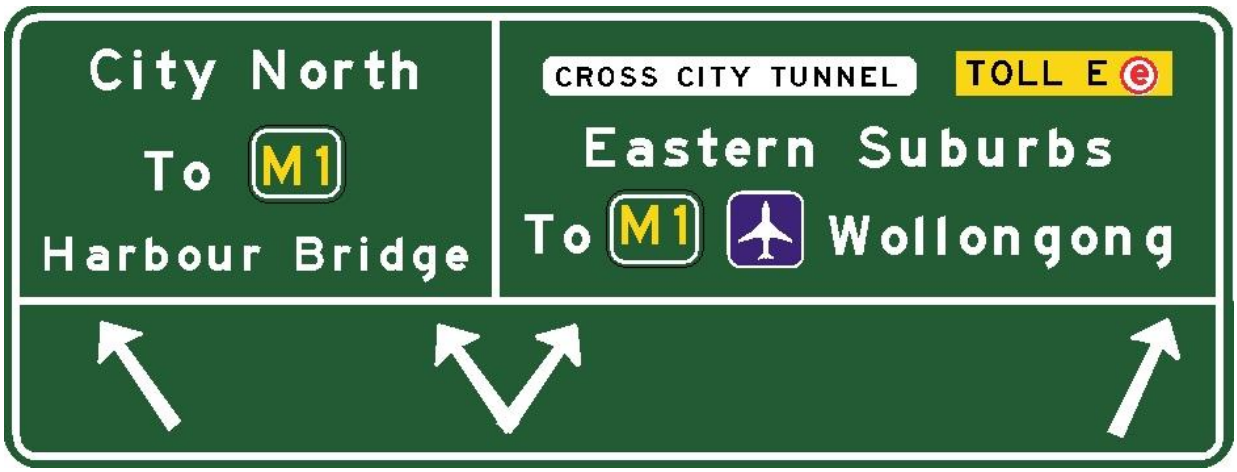


Figure 3-20: Typical static directional sign

Changes to address weaving on the Western Distributor

For northbound traffic using Harris Street/Fig Street/Pyrmont Street, the Western Distributor, and King Street, the following issues were identified:

- Short weaving length (242 metres) and complicated manoeuvres, with Western Distributor traffic bound for King Street off ramp conflicting with Harris Street/Fig Street and Pyrmont Street traffic bound for the Sydney Harbour Bridge
- Right lane from Harris Street/Fig Street and Pyrmont Road merges (zip merge) with left lane of Western Distributor
- Middle lane of weaving area diverges to two lanes at the King Street exit.

The following is proposed to address these issues (refer to Figure 3-3 to Figure 3-5) for northbound lanes between Gantry 10 and Gantry 14:

- Clearly define primary through route, Western Distributor, as two lanes via line marking changes
- Isolate local traffic from the Western Distributor with the left lane from Harris Street/Fig Street and Pyrmont Road connecting directly to King Street off ramp and delineated with a solid white line, while the right lane from Fig Street and Pyrmont Street is dedicated to Sydney Harbour Bridge
- Mark a continuity line along edge of Western Distributor at the merge with Harris Street/Fig Street and Pyrmont Street traffic to show the separation through traffic from turning traffic
- Mark a continuity line at the Western Distributor access to King Street from left lane (at diverge with King Street off ramp)
- Install advance signage and pavement markers within lanes defining intended destinations.

For southbound traffic using the Western Distributor between City South, Darling Harbour, Market Street and Harris Street, the following issues were identified:

- Western Distributor single lane southbound to Anzac Bridge resulting in traffic queue build up during peak periods
- Traffic failing to join back of queue struggle and attempting to enter the queue further down thereby blocking the middle lane (to City South and Darling Harbour)
- Limited signage resulting in ambiguity in wayfinding
- Two lanes from Market Street weaving to the left to access Western Distributor conflicts with main line traffic weaving to the right to access local roads.

The following is proposed to address these issues for southbound lanes (refer to Figure 3-4 and Figure 3-5):

- Clearly define (via line marking) the primary through route, the Western Distributor, as two lanes
- Modify existing static signage to define primary route and adjust pavement arrows to match
- Reduce Market Street on ramp to one lane prior to merge with 2 lanes from Western Distributor
- Implement one lane exit to Darling Harbour, widening again to two lanes after the exit.
- Upgrade signposting and delineation
- Adjust and replace crash protection as required.

Hazard and vehicle detection systems and CCTV

A smart motorway hazard and vehicle detection system is proposed to cover the full elevated motorway and sections without shoulder/emergency lane. The system would automatically detect all hazards occurring on the motorway and pass alerts to the motorway management control system. It would also measure speed, volume and occupancy to required accuracy levels.

Full CCTV coverage is proposed across the whole corridor, with additional coverage at critical locations such as ramp merge and diverge points, and where safe site access for maintenance purposes is not available without extensive traffic management.

Pavement works

Pavement works are required at several locations on the Western Distributor to accommodate new line marking (refer to Figure 3-3 to Figure 3-6). Pavement works would involve:

- Asphalt wearing course on viaducts
- Pavement resurfacing.

3.3 Construction activities

3.3.1 Work methodology

The methods used to construct the proposal would be mostly conventional techniques employed on road projects, adapted to account for project-specific environmental and social constraints. While the detailed construction methodology is yet to be confirmed, the general sequence is presented below.

Site establishment and utilities investigations

The site establishment and utilities investigation stage would include:

- Establishment of construction compound including environmental controls
- Install temporary project signage with signposts
- Set up traffic control including the supply of temporary Variable Message Signs (VMS)
- Survey of existing viaducts
- Potholing for utilities investigation
- Investigation of existing conduits for space proofing and conditions assessment
- General inspection of work areas
- Preparation of concrete surfaces for mounting assemblies
- Utility relocation and/or protection works.

Foundation construction for new gantries

Foundations would need to be constructed for five of the new gantries (05, 06, 11, 13 and 14).

Each of these gantries requires a single pile and pile cap to support a cantilever gantry, except gantry 11, which requires a pile and pile cap on each side of the structure. Construction of each foundation would involve the following indicative sequence of works:

- Site set up (including establishment of traffic and environmental controls)
- Review information on site investigations and any relocations confirming site is clear for foundation works

- Establish temporary ground support and mobilise pile equipment, including rig
- Bore pile(s) within casing, install steel reinforcement, rag bolts and conduits, and pour concrete
- Crop pile, excavate, and install pile cap reinforcement and formwork
- Pour pile cap concrete
- Concrete curing
- Strip formwork and prepare bolts
- Concrete strength development.

The opportunity to undertake foundation works concurrently at multiple locations would be considered during construction planning to reduce the overall duration of this activity.

Mounting assembly construction

Mounting of a new gantry to an existing bridge deck connection is required for gantries 09, 12, 17 and 18. Where possible most of the mounting assembly installation would occur from below the viaduct to minimise impact to traffic. The following is an indicative sequence of works:

- Site set up (including establishment of traffic and environmental controls)
- Drill and fix bolts and base plate
- Grouting
- Grout curing
- Mounting assembly (upper brace, lower brace, horizontal beam, and gantry post)
- Site decommissioning.

For gantry 19 (where connection to an existing abutment is proposed), the following is an indicative sequence of works:

- Site set up (including establishment of traffic and environmental controls)
- Drill and fix bolts and base plate
- Grouting
- Grout curing
- Mounting assembly (horizontal beams and gantry post)
- Site decommissioning.

For gantries 7, 8 and 10 (where connection to an existing headstock is proposed), the following is an indicative sequence of works:

- Site set up (including establishment of traffic and environmental controls)
- Drill and fix bolts and base plate
- Grouting
- Grout curing
- Mounting assembly (gantry post)
- Site decommissioning.

Installation of new gantries

A mobile crane and elevated work platform would be used to lift new gantry posts and gantries into position. For gantry posts the following is an indicative work sequence.

- Close two of three lanes, while keeping one lane open to traffic at a reduced vehicle speed (if the gantry is located on a one or two-lane viaduct, the gantry post erection would require closure of the viaduct)
- Site set up including environmental controls
- Lift first gantry post into position. The lifting arrangement for each gantry post would likely be with a lifting point connection at the top of the gantry post (refer Figure 3-21 below), with chains from the lifting point, through the bolt holes to the bottom of the gantry post, to aid in rotational control.
- Swap traffic to the other side of the road
- Lift second (as required) gantry post into position.

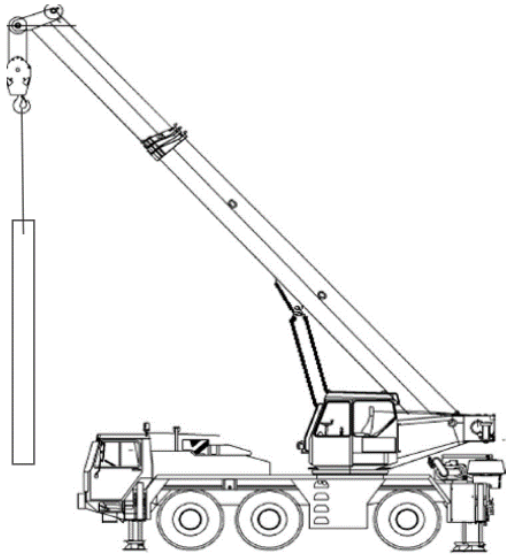


Figure 3-21: Indicative gantry post lifting arrangement

Gantries would also be lifted into position using mobile cranes. Adjacent viaduct lanes and roads below the viaduct would need to be closed as required during the installation due to the safety risk of lifting live loads. The lifting arrangement for each gantry lift will likely be with four points of contact with a spreader beam potentially required for the larger gantries (refer to Figure 3-22).

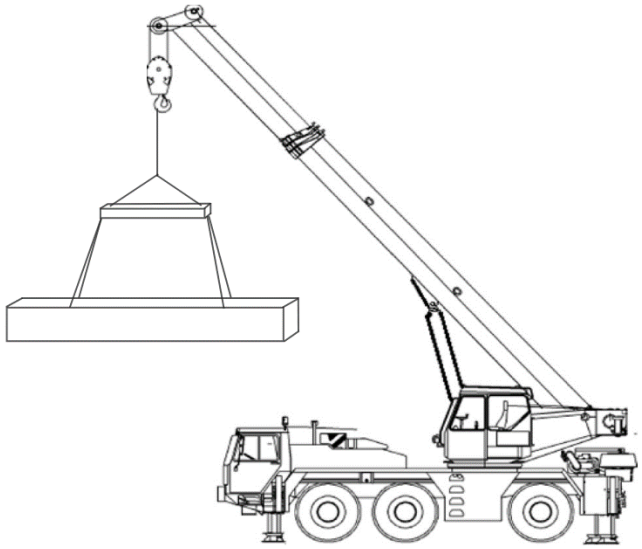


Figure 3-22: Indicative gantry lifting arrangement

Proposed changes to signage on Sydney Harbour Bridge gantries (including installation of new brackets where needed) would require the use of mobile cranes and elevated work platforms and would occur during nightshifts with lane closures in place.

ITS cabling

There is an estimated 2.5 kilometres of new viaduct level ITS cabling and 1.4 kilometres of new ground level ITS cabling to be installed as part of the proposal (refer Figure 3-1 to Figure 3-15). New ITS cabling would be needed across the Sydney Harbour Bridge, however, new cabling would be installed into existing cable housing infrastructure along the bridge such as cable pits, junction boxes or mounted cable ducts. No new structures would be installed. No trenching would be required.

A specialised ITS crew would install all the ITS conduits and pull cables. For the viaduct level ITS, as much of the installation as possible would occur from below the viaduct using elevated work platforms to minimise impacts on traffic.

The following is an indicative sequence of works for ITS cabling on viaducts:

- Site set up (including establishment of traffic and environmental controls)
- Install conduit
- Test conduit
- Pull cables
- Site decommissioning.

The following is an indicative sequence of works for ITS cabling at ground level:

- Site set up (including establishment of traffic and environmental controls)
- Excavation, placement of ducts and backfilling
- Pull cables
- Reinstate pavements to local council requirements
- Site decommissioning.

Removal of existing gantries

There are four existing gantries to be removed at the proposed locations of gantries 08, 10, 11 and 12 (refer to Figure 3-3 and Figure 3-4). A lifting crew would remove these existing gantries during night shifts to minimise the impact on the traffic network. This would involve:

- Site setup including environmental controls and traffic control closing sufficient lanes and roadways
- Isolation and disconnection of existing coms and power
- Truss beam removal
- Post removal
- Ground level bolt removal, making good as required
- Site decommissioning.

Pavement works

There is about 6445 square metres of pavement resurfacing for road pavement areas and about 5830 square metres of asphalt wearing course replacement over bridge deck areas required between Darling Harbour and King Street.

These works would be carried out concurrently with other works in the area to make use of the same viaduct lane or road closures to minimise the impact on traffic.

Static signage

There are existing static signs (about 20 including static speed limit signs) to be removed and new static signage (about 11) to be installed as part of the proposal. Of the new signs to be installed most are small speed limit signs (that apply when variable signs are blacked out) that would be affixed to the Western Distributor viaducts. New static directional signs (three in total) are to be installed at the Fig Street / Harris Street intersection, near Gantry 12 (affixed to the viaduct) and on Gantry 13. A small post and foundation would be required for a 'No Pedestrian Access' sign adjacent to the northern leg of the York Street / Grosvenor intersection.

Installation of static signs would occur using truck mounted cranes and elevated work platforms where needed. These works would be carried out concurrently with other works in the area to make use of the same viaduct lane or road closures to minimise the cumulative impact on traffic.

Testing and commissioning

Testing of new smart motorway infrastructure would occur both off-site and on-site. Closure of traffic lanes is not expected to be needed for the testing and commissioning works.

3.3.2 Construction workforce

Construction of the proposal is expected to require up to 50 workers during peak construction times. Workers would be distributed between the worksite and the site compound depending on the activities occurring and the time of day,

3.3.3 Construction hours and duration

Subject to approval, site investigations are anticipated to commence in late 2021, with construction starting mid-2022 and taking about 18 months to complete, weather permitting.

Construction work would be carried out during standard hours, where possible:

- Monday to Friday: 7am to 6pm

- Saturday: 8am to 1pm
- Sunday: No work
- Public holidays: No work

However, to minimise disruption to daily traffic, to minimise disruption of property access to surrounding land owners and businesses, and to ensure the safety of workers, it would be necessary to carry out work outside of standard working hours. Nosier activities such as jackhammering and concrete cutting would be completed by midnight. These hours would be in accordance with the Road Occupancy Licence (ROL) issued by the Transport Management Centre and up to five consecutive nights a week as follows:

- Evening / night work– Sunday to Thursday
- No work on public holidays.

Approval from Transport for NSW would be required for out of hours works and the affected community would be engaged regarding the proposed construction hours at least five working days prior to works commencing in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime, August 2016) and EPA Interim Construction Noise Guideline (ICNG) (DECC, 2009). The community would be provided with works details and contact information if there are any issues.

A noise and vibration assessment has been carried out for the proposal. Refer to Section 6.4 and Appendix G for details.

3.3.4 Plant and equipment

Plant and equipment to be used for construction would be confirmed during the construction planning process, but an indicative list of equipment expected to be used on site during construction of the proposal includes:

- Backhoes or small excavators
- Elevated work platforms
- Concrete/pavement saws
- Jackhammers
- Mobile cranes
- Portable lights
- Asphalt milling machines and pavers
- Line marking equipment
- Generators and air compressors
- Trucks
- Vacuum truck
- Utes and light vehicles.

3.3.5 Earthworks

Most works are confined to elevated structures and would not require excavation. Excavation would result in only small amounts of spoil and would be limited to the following:

- Trenching for power and communications connections for ITS infrastructure
- ISLUS foundations (where not affixed to existing structures).

3.3.6 Source and quantity of materials

The proposal would require moderate quantities of materials, primarily manufactured steel components for supporting structures gantries). The quantities of material required would not result in a regional or local supply shortage, and none are likely to be in short supply in the foreseeable future. Materials would be sourced from local commercial suppliers where available.

Non-renewable resources such as petroleum fuels would not be used in large quantities.

3.3.7 Traffic management and access

Access to the proposal site would generally occur directly from within the proposal corridor.

Some temporary road and lane closures and minor temporary pedestrian diversions may be required. These would occur in accordance with a Traffic Management Plan (TMP) and, where necessary, a Road Occupancy Licence (ROL). Lane and road closures (including temporary removal of on street parking) on roads below viaducts would also be required. The potentially impacted roads include:

- Pyrmont Bridge Road, Pyrmont
- Allen Street, Pyrmont
- Harris Street, Pyrmont
- Druitt Street, Sydney
- Harbour Street, Sydney
- Cross-City Tunnel, Sydney
- Market Street, Sydney
- King Street, Sydney
- Wheat Road, Sydney
- Clarence Street, Sydney
- York Street, Sydney
- Kent Street, Sydney.

Standard traffic management measures would be used to minimise the short-term traffic impacts during construction. Measures are described in Section 6.1 and would be identified in TMP for the proposal. Traffic control measures would be developed in accordance with the Traffic Control at Works Sites Manual (Roads and Traffic Authority, 2010) and Transport for NSW Specification G10 – Control of Traffic.

During all stages of construction, access to businesses and other private property would be maintained. Pedestrian and cyclist routes would be managed daily to suit construction activities.

3.4 Ancillary facilities

Construction compound locations for the proposal have not yet been identified. Compound locations would be identified and assessed in accordance with the *Environment and Planning Assessment Act 1979* prior to construction commencement.

3.5 Public utility adjustment

Existing public utilities or services are generally located on the interchanges and ramps along the motorway corridor. New gantries, ITS cabinet and ITS conduits are not expected to impact existing utilities as it is likely to be feasible to adjust the new infrastructure and avoid clashes.

ITS equipment would require power and communications services to be provided to each device. Proposed new conduits (on viaducts and at ground level are shown on Figure 3-1 to Figure 3-15).

Additional surveys would be carried out during detailed design to assist development of the proposal elements with avoid clashes with existing utilities and services. Consultation with public utility providers for the proposal is ongoing.

3.6 Property acquisition

Property acquisition is not required for the proposal, although easements may be needed for cabling at some locations.

4 Statutory planning framework

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and road infrastructure facilities and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not require development consent or approval under State Environmental Planning Policy (Coastal Management) 2018 or State Environmental Planning Policy (State Significant Precincts) 2005.

The proposal traverses three sites identified as State significant development sites under the State Environmental Planning Policy (State and Regional Development) 2011 – The Rocks, Bays Precinct and Darling Harbour. However, as the proposal is permissible without consent under the ISEPP it is not State significant development (refer to clause 8 of the State and Regional Development SEPP).

Part 2 of ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in Chapter 5 of this REF.

Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

The proposal is located within the Sydney Harbour Catchment and is subject to the Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 (Sydney Harbour SREP), which is a deemed SEPP.

Parts of the proposal corridor are zoned W1 – Maritime Waters. The Sydney Harbour Bridge, including approaches and viaducts (road and rail), is listed as a heritage item by the Sydney Harbour REP (Item 67). However, development consent is not required for the proposal due to the operation of ISEPP provisions as described above. In this regard, it is noted that the ISEPP prevails to the extent of any inconsistency with Sydney Harbour SREP.

Part 3 Division 2 (and Part 5 in relation to heritage) of the Harbour SREP sets out matters that need to be considered by determining authorities (under Division 5.1 of the EP&A Act). These matters are considered in Table 4-1.

Table 4-1: Sydney Harbour REP Part 3 Division 2 matters

Clause	Matter	Comment
21	Contains a number of matters in relation to biodiversity, ecology and environmental protection, with a focus on wetlands and aquatic vegetation.	The proposal is expected to have a negligible effect on biodiversity including aquatic vegetation. Potential impacts and mitigation measures are detailed further in Section 6.5.

Clause	Matter	Comment
22	Public access to foreshores and waterways	No impact.
23	Maintenance of a working harbour	No impact.
24	Interrelationship of waterway and foreshore uses	No impact.
25	Scenic quality	The proposal would result in some changes to the visual environment. It is not considered that this would affect scenic quality. Refer to Section 6.2.
26	Maintenance, protection and enhancement of views	Potential impacts on views have been assessed. Refer to Section 6.2.
27	Boat storage	No impact.
Part 5	Heritage	The proposal would result in minor impacts on the Sydney Harbour Bridge. Refer to Section 6.3.

Darling Harbour Development Plan No.1

Darling Harbour Development Plan No.1 applies to land within the Darling Harbour Development Area, which is traversed by those parts of the proposal on the Western Distributor. Under Schedule 1, Part 7, Clause 23 of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017, Darling Harbour Development Plan No.1 has the status of a regional environmental plan (and is therefore now a deemed SEPP). The plan requires a permit for various types of development including 'public utility undertakings'. The ISEPP removes this requirement.

4.1.2 Local Environmental Plans

An overview of the land use adjacent to the proposal corridor is shown in Figure 4-1.

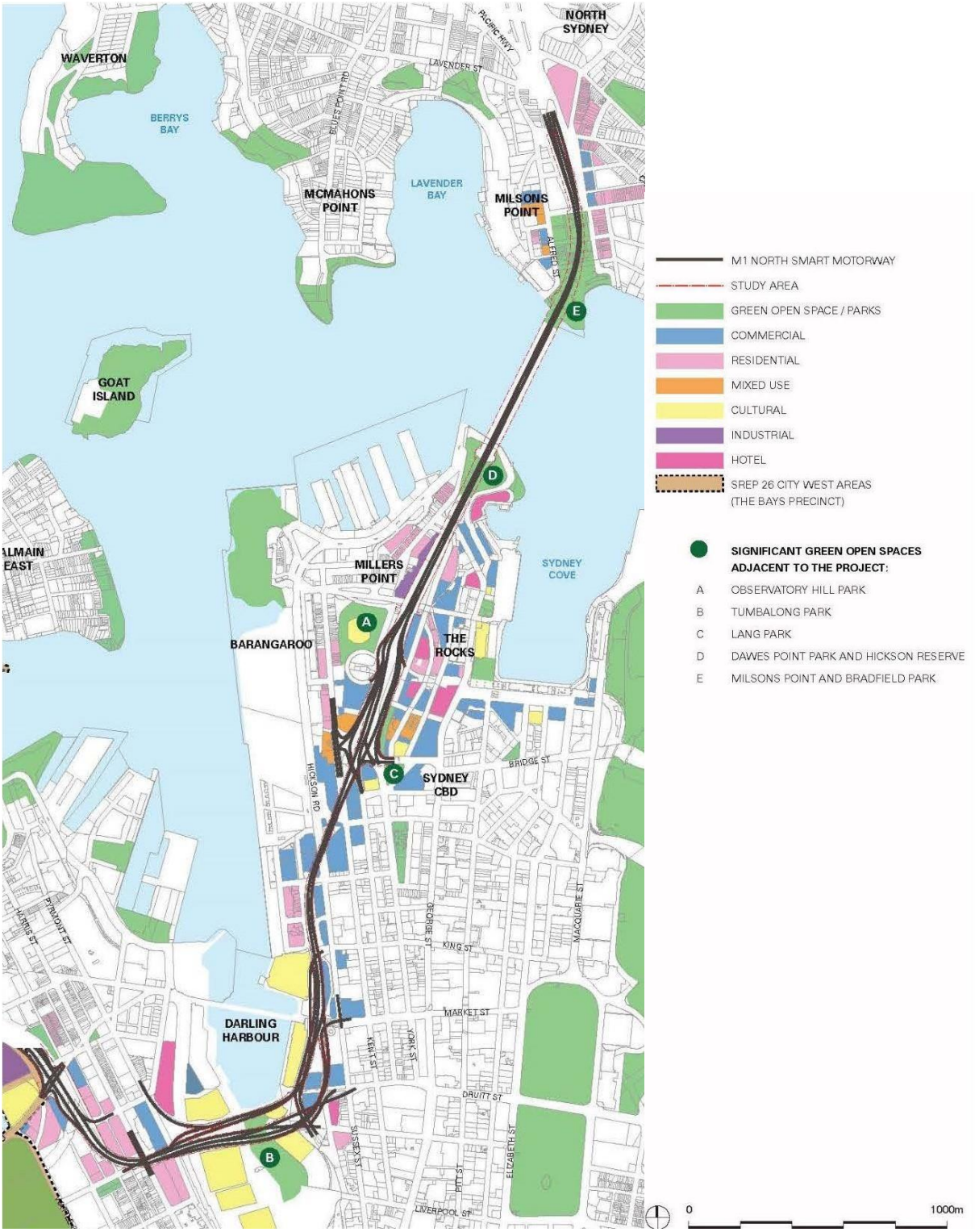


Figure 4-1: Land use adjacent to proposal

North Sydney Local Environmental Plan 2013

The North Sydney Local Environmental Plan 2013 (North Sydney LEP) zones the northern extent of the proposal corridor as RE1 Public Recreation and SP2 Infrastructure.

Table 4-2: Consistency with zone objectives – Sydney LEP

Zone	Objective	Comment
RE1 Public Recreation	• To enable land to be used for public open space or recreational purposes • To provide a range of recreational settings and activities and compatible land uses • To protect and enhance the natural environment for recreational purposes.	The proposal would not affect land currently or with the potential to be used for public open space or recreational purposes.
SP2 Infrastructure	• To provide for infrastructure and related uses • To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The proposal relates to the provision of infrastructure and is therefore consistent with the first SP2 zone objective.

Development of the purposes of roads and road infrastructure is permitted with development consent in the above zones.

Schedule 5 of the North Sydney LEP identifies five heritage items at the northern extent of the proposal corridor (refer Section 6.3).

Clause 5.10 of the North Sydney LEP requires development consent for demolishing, moving, altering, disturbing a heritage item or subdividing and/or erecting a building on land on which a heritage item is located. None of these activities are proposed in relation to the North Sydney LEP listed items. It is also noted that Clause 94 of the ISEPP operates to remove otherwise applicable consent requirements (refer to Section 4.1.1).

Sydney Cove Redevelopment Authority Scheme

Part of the southern Sydney Harbour Bridge approach is within the area to which the Sydney Cove Redevelopment Authority Scheme applies. Under the scheme and under Schedule 1, Part 8, Clause 29 of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017, development of any kind requires development consent. Clause 94 of the ISEPP operates to remove that consent requirement (refer to Section 4.1.1).

Sydney Local Environmental Plan 2012

The proposal would occur within the following land use zones under the Sydney Local Environmental Plan 2012 (Sydney LEP).

- B3 Commercial Core
- B8 Metropolitan Centre
- RE1 Public Recreation
- SP2 Infrastructure.

Table 4-3 identifies the objectives for each of the affected zones and considers the consistency of the proposal with those objectives.

Table 4-3: Consistency with zone objectives – Sydney LEP

Zone	Objective	Comment
R2 Low Density Residential	• To provide for the housing needs of the community within a low density residential environment • To enable other land uses that provide facilities or services to meet the day to day needs of residents.	The proposal would not affect provision for housing needs. It would provide important active transport infrastructure available for use by residents.
B4 Mixed Use	• To provide a mixture of compatible land uses • To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling • To ensure uses support the viability of centres.	The proposal would not affect the mix of land uses or the viability of centres. It is directly consistent with the objective of maximising use of public transport and encouraging walking and cycling.
RE1 Public Recreation	• To enable land to be used for public open space or recreational purposes • To provide a range of recreational settings and activities and compatible land uses • To protect and enhance the natural environment for recreational purposes.	The proposal would not affect land currently or with the potential to be used for public open space or recreational purposes.
SP2 Infrastructure	• To provide for infrastructure and related uses. • To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The proposal relates to the provision of infrastructure and is therefore consistent with the first SP2 zone objective.

Development of the purposes of roads and road infrastructure is permitted with development consent in the above zones.

Schedule 5 of the Sydney LEP identifies twenty heritage items within or near the proposal corridor (refer Section 6.3).

Development consent is also required under the Sydney LEP for works involving alterations to the exterior of heritage items or buildings, works, relics or trees within a heritage conservation area. As noted in Section 4.1.1, the ISEPP removes these consent requirements.

4.2 Other relevant NSW legislation

4.2.1 Protection of the Environment Operations Act 1997

Part 3.2 of the *Protection of the Environment Operations Act 1997* requires an environmental protection licence for scheduled development work and the carrying out of scheduled activities (as set out in Schedule 1 of the POEO Act), which includes road construction. The proposal does not trigger these requirements.

Section 148 of the *Protection of the Environment Operations Act 1997* requires immediate notification of pollution incidents causing or threatening material harm to the environment to each relevant authority. An Incident Management Plan would be included in the environmental management documentation for the proposal, to be prepared during the detailed design phase. Section 6.5 of this REF details the proposal's contamination and waste management safeguards.

4.2.2 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides protection for items of state heritage significance that are listed on the State Heritage Register. Under Section 57(1) of the Heritage Act, the approval of the Heritage Council of NSW is generally required for development within a site included on the State Heritage Register, including works to the grounds or structures. Section 57(2) allows for certain works to be exempt from approval and this includes minor activities with little or no impact. The application of this exemption needs to be endorsed by Heritage NSW.

An excavation permit is required to disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed. A permit is also required to disturb or excavate any land on which the person has discovered or exposed a relic. Relics are not expected to be affected by the proposal and an unexpected find procedure would be documented in the Construction Environmental Management Plan to be implemented during construction.

The potential heritage impacts and associated safeguards of the proposal are detailed in Section 6.3.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix A and Chapter 6 of the REF.

A referral is not required for proposed road activities that may affect nationally listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

Potential impacts to these biodiversity matters are also considered as part of Chapter 6 of the REF and Appendix A.

Findings – matters of national environmental significance

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Agriculture, Water and the Environment under the EPBC Act.

4.3.2 Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affective native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act a future act includes proposed public infrastructure on land or waters that affects native title rights or interests.

A search of the Native Title Tribunal Native Title Vision website was undertaken, with no Native Title holders/claimants identified.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and road infrastructure facilities and is being carried out by or on behalf of a public authority. Under clause 94 of ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act.

Transport for NSW is the determining authority for the proposal. This REF fulfils Transport for NSW's obligation under section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

A referral to Australian Government Department of Agriculture, Water and the Environment under the EPBC Act is not required.

5 Consultation

5.1 Consultation strategy

Broader community engagement was not considered necessary during the planning phases of the proposal as most works are confined to existing motorway structures. Environmental impacts of the proposal and potential community or stakeholder interest are assessed to be minor and limited respectively.

Community engagement would be conducted prior to construction commencement to notify local residents and stakeholders of the proposal and any construction-related impacts.

5.2 ISEPP consultation

The proposal area occurs within the North Sydney Council and the City of Sydney local government areas, however, the proposal does not trigger any of the criteria for consultation as outlined in Part 2 Division 1 of the ISEPP. As such, ISEPP consultation with councils and public authorities other than councils have not been undertaken.

5.3 Government agency and stakeholder involvement

Engagement to date has included consultation with internal Transport for NSW stakeholders (such as the Transport Management Centre) to progress and refine the development of the proposal.

Consultation has also been undertaken with interfacing project stakeholders including the Western Harbour Tunnel and Beaches Link, WestConnex and the Sydney Harbour Bridge Southern Cycleway project teams.

Early engagement has occurred with relevant councils, including the City of Sydney and with relevant government departments, including Property NSW and the Office of Environment and Heritage.

Internal Transport for NSW stakeholders raised issues which are documented and addressed in Table 5-1. External stakeholders and government agencies raised no issues during initial consultation.

Table 5-1: Key internal stakeholder issues and responses

Key identified stakeholder issue	Section of the REF where issue is addressed
Construction noise may be disruptive to adjacent residents and business	The potential impacts and mitigation measures of construction noise are detailed in Section 6.4.
Some temporary lane closures and minor pedestrian diversions may be required	Traffic, transport and access disruptions are detailed in Section 6.1
Concern about the potential extent of trimming or removal of shrubs or trees for the proposal	One street tree would require removal due to the proposed works. The impact and mitigation measures for this tree removal are discussed in Section 6.5.
Concern about potential full or partial property acquisition	Property acquisition is not required for the proposal, although easements may be needed for cabling at some locations. Land outside the proposal corridor may also need to be temporarily leased for construction purposes.

Key identified stakeholder issue	Section of the REF where issue is addressed
Proximity of any construction compound location, and any additional compounds, to residential dwellings.	Construction compound locations have not yet been proposed and assessed. Proximity of any proposed compound locations to residential dwellings will be assessed.

5.4 Ongoing or future consultation

Prior to construction, targeted consultation would be undertaken with stakeholders that are directly impacted by the project, for example, residents of buildings that will have direct views of new gantries.

During construction, communication with the community, stakeholders and media around construction, its impact and timetable would be carried out. This would include notifications of night works, changes to traffic conditions and coordination with local councils, utility authorities as well as interfacing projects.

Ongoing communications and notifications prior to and during construction may include:

- Community/construction updates
- Media announcements
- NSW LiveTraffic updates and social media updates
- Stakeholder meetings as required
- Web page updates
- Work notification letters (as required).

As the proposal transitions to operation, communication would focus on changes in the road user experience with the introduction of smart motorway operations.

6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the guidelines Is an EIS required? (Department of Planning, 1995) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the Roads and Related Facilities EIS Guideline (Department of Urban Affairs and Planning, 1996). The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

Specialist assessments were engaged during concept design development when Gantries 1 to 5 were still considered a part of the scope. As such, the full reports where appended to this REF still refer to those gantries, however, this REF only assesses the existing environment and potential impacts of Gantries 6 to 19, 24 and 25 (refer Section 3.1 for proposal description).

6.1 Transport and traffic

A Traffic and Transport Assessment for the proposal was carried out by GTA Consultants. The main findings of that assessment are summarised below while the full report is included in Appendix D.

The proposed smart motorway was modelled with the inclusion of Gantries 1 to 5 which are no longer included in this REF scope but anticipated traffic benefits are expected to be substantially similar.

6.1.1 Methodology

The Sydney Strategic Motorway Planning Model (SMPM) was used for estimates of future changes in traffic patterns and demands in the proposal area. The model allowed consideration of existing conditions (2016) and future conditions, with and without the proposal. Table 6-1 shows the modelling scenarios considered. Scenarios considered the impacts of infrastructure in development or construction on future traffic demand.

Table 6-1: Operational traffic modelling scenarios

Scenario	Year	Network
Existing	2016	• Existing network
Future base case (without proposed smart motorway)	2021	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A
	2026	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A

Scenario	Year	Network
	2031	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A
	2031	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A • Western Harbour Tunnel and Beaches Link • Two way Eastern Distributor toll
	2036	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Sections A, B and C • Western Harbour Tunnel and Beaches Link • Two way Eastern Distributor toll
Future project case (with proposed smart motorway)	2021	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A
	2026	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A
	2031	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A
	2031	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Section A • Western Harbour Tunnel and Beaches Link • Two way Eastern Distributor toll
	2036	• WestConnex Stages 1, 2 and 3 • Sydney Gateway • M6 Sections A, B and C • Western Harbour Tunnel and Beaches Link • Two way Eastern Distributor toll

The model outputs, including volumes, speed and capacity were used to estimate the base case performance within the proposal corridor.

The proposal case improvement was informed by a literature review and benchmarking. SMPM data for both cars and heavy vehicles was used to establish a baseline with improvements based on evidence of smart motorway benefits on other facilities to quantify changes under the project. With proposed smart motorways, it was assumed that there would be no route or mode shift changes. Therefore, travel speeds and travel times have been reduced in line with the proposed improvements.

The traffic and transport assessment also considers construction-related traffic impacts on general traffic, buses, pedestrians and cyclists.

6.1.2 Existing environment

Road safety

Transport for NSW crash data for the six-year period between 2013 and 2018 (inclusive) along the entirety of the proposal identified about 247 crashes, 65 per cent of which resulted in injury.

The main crash types were same direction crashes (accounting for 68 per cent of all crashes), followed by off path crashes (where a car leaves the travel lane due to fatigue, distraction or other causes) (accounting for 18 per cent 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. The data shows that 64 per cent of same direction crashes resulted in injury, and likewise for 71 per cent of off path crashes.

The safety characteristics for a 6U road classification (urban motorway – high-speed, grade separated, multi-lane divided carriageways with strictly limited direct access) are averaged at 3.9 casualty crashes per kilometre per year. The length of the M1 corridor between Allen Street in Pyrmont and the Pacific Highway in North Sydney is about seven kilometres and experienced a rate of about 5.7 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, there was a concentration of crashes around Southern Toll Plaza Sydney Harbour Bridge, 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. A high density of crash clusters also occurred along the Sydney Harbour Bridge. Figure 6-1 shows the distribution and severity of crashes within the proposal corridor for the five year period 1 October 2014 to 30 September 2019.

Figure 6-1: Crashes within the proposal corridor – 1/10/2014 to 30/9/2019

Traffic

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

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

Existing traffic volumes at key points along the corridor are provided in Table 6-2.

Table 6-2: Vehicle flows at key locations (2016, vehicles per hour)

Location	Direction	AM peak	Interpeak	PM peak	Off Peak
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

Network statistics for the proposal corridor from the SMPM (refer to show that the AM peak has the highest traffic demand, with similarly high levels of demand in the PM peak.

Table 6-3: 2016 SMPM network statistics results, average peak hour

Peak period	Time	Demand (veh/hr)	Vehicle hours travelled	Vehicle kilometres travelled
AM	7am-9am	135,600	48,400	1,500
Inter peak	9am-3pm	123,900	43,300	900
PM	3pm-6pm	133,800	48,000	1,200
Off peak	6pm-7am	106,000	37,000	700

Traffic analysis indicates the following existing performance issues of the proposal corridor:

- Sydney Harbour Bridge northbound approach from the south – causing significant queueing that extends to Pyrmont and beyond during the AM peak period
- Sydney Harbour Bridge southbound – traffic reaches road capacity during AM and PM peak periods
- Darling Harbour eastbound weave – due to high flows from the Fig Street / Pyrmont Street on ramp, flow ramp disruptions occur, exacerbated by the queueing from the Sydney Harbour Bridge southern approach (below)
- Darling Harbour southbound diverge – operates at capacity in the PM peak only, resulting in generally localised queueing and congestion.

These existing issues in the AM and PM peak periods are depicted in respectively.

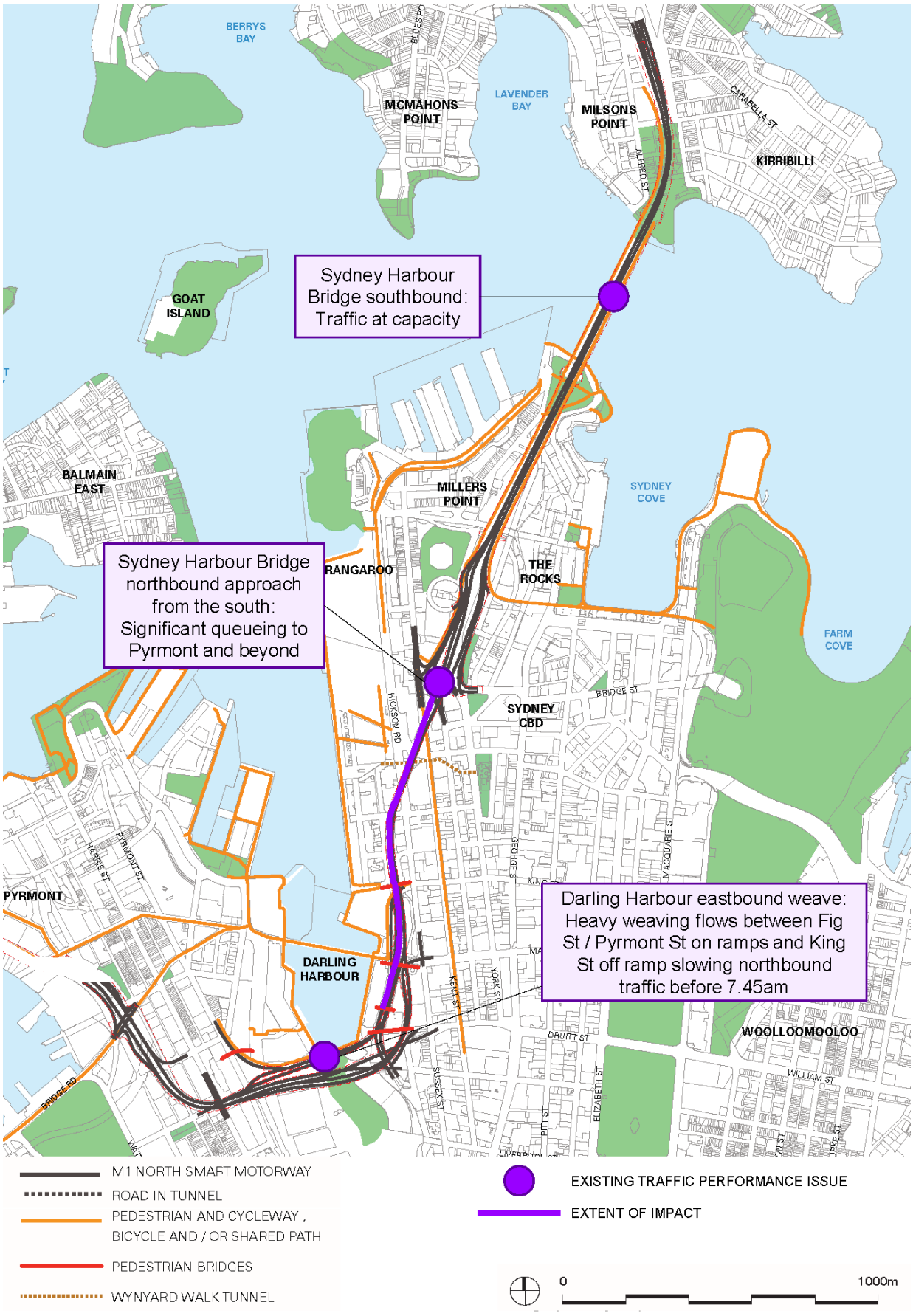


Figure 6-2: Existing traffic performance issues during the AM peak period

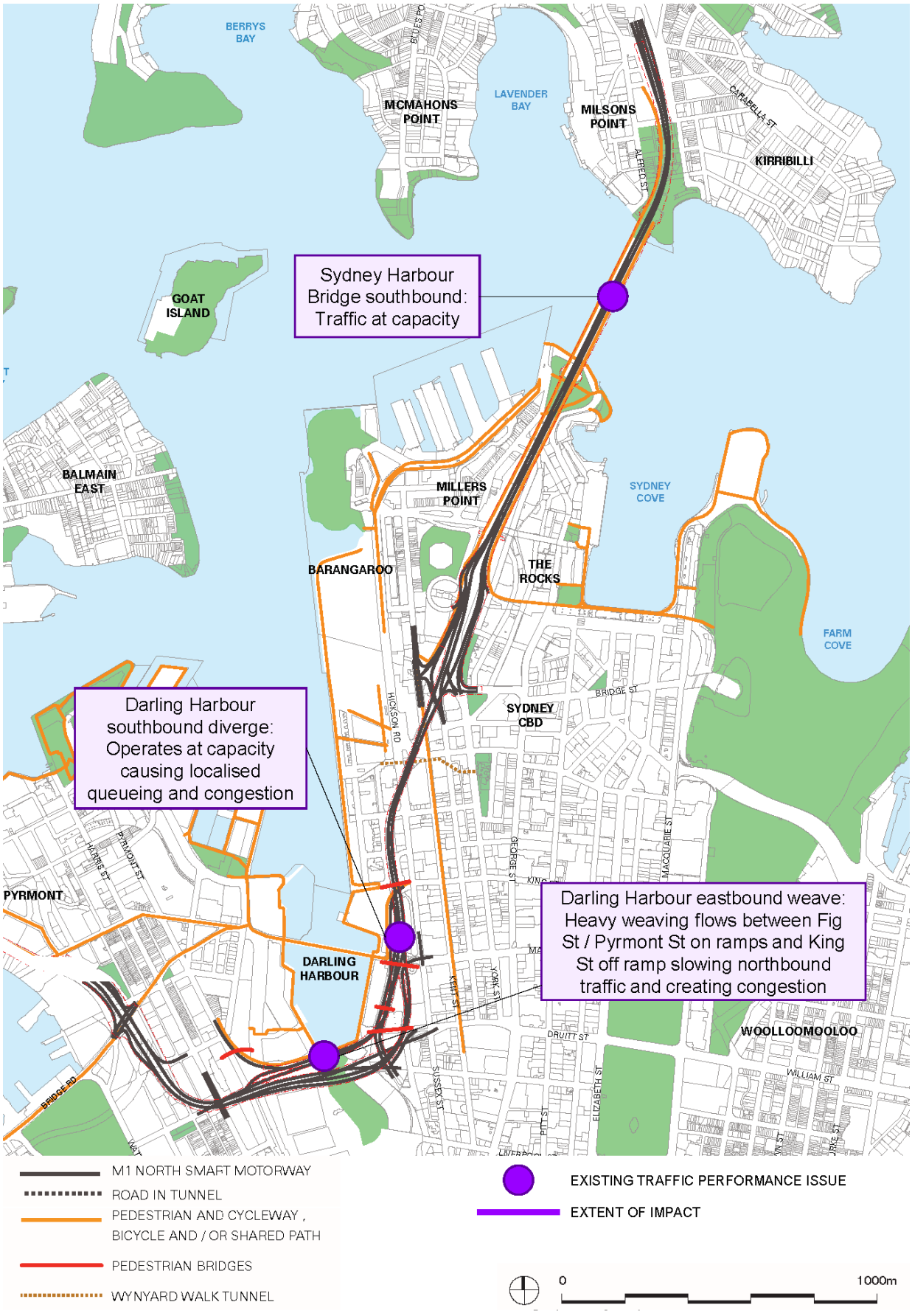


Figure 6-3: Existing traffic performance issues during the PM peak period

Freight

The proposal 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.

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 of Appendix D (Traffic and Transport Report).

Structures along the Western Distributor and Sydney Harbour Bridge restrict these corridors from use by General Mass Limit (GML), Concessional Mass Limit (CML) and Higher Mass Limit (HML) vehicles. Heavy vehicles are mostly limited to 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 height restrictions apply. The only interfacing roads that enable movement of these vehicle types are Pyrmont Bridge Road and Harris Street in the Pyrmont area.

Existing heavy vehicle volumes at key points along the corridor are provided in Table 6-4.

Table 6-4: Vehicle flows at key locations (2016, vehicles per hour)

Location	Direction	AM peak	Interpeak	PM peak	Off Peak
Sydney Harbour Bridge	Northbound	190	320	270	190
	Southbound	190	190	150	110
Western Distribution between Grosvenor Street and King Street	Northbound	150	250	190	140
	Southbound	150	170	130	90

Public transport

The corridor is used every day by multiple services of the public transport network to access the Sydney CBD with buses travelling from the Northern Beaches, North Shore, North Western Sydney, Inner West and Central Western Sydney. The Northern Beaches B-Line – a Bus Rapid Transit System from Mona Vale to the Sydney CBD is now operational.

Walking

As most of the proposal corridor is a grade separated motorway, the corridor has limited interaction with the pedestrian network, except at critical links such as the Sydney Harbour Bridge where all modes converge (refer Figure 6-2). 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.

Cycling

There is a convergence of key cycling facilities on the corridor at the Sydney Harbour Bridge with off-road facilities for cyclists (refer Figure 6-2). 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 routes from the north and west (via 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.

6.1.3 Potential impacts

Construction

There is the potential for delays during construction associated with lane closures and temporary diversions along the Western Distributor and M1 corridor. These would be limited to the construction period and would affect different areas as the proposal is constructed. Roads potentially impacted by viaduct road and lane closures during construction are listed in Section 3.3.7. Closures may involve temporary loss of street parking. Works requiring road/lane closures would be conducted subject to approvals from the relevant traffic authorities and would generally occur at night to minimise disruption to traffic and parking. Road closures affecting local roads at night may impact vehicle access to residences and businesses, however, access would be maintained as much as possible. Advance notice would be provided to residents and business owners prior to any access disruptions.

The proposal is expected to generate up to 10 heavy construction vehicle and 50 light construction vehicle movements per day between the compound site and work sites within the proposal corridor. This level of construction traffic is not expected to adversely affect the operation of the road network as there is fairly direct access to the proposal corridor (and therefore minimal impact on local roads) and construction vehicle volumes would be low compared to existing volumes on both the motorway and local roads. Most vehicle movements would not occur during peak periods.

Access for pedestrian and cyclists would be maintained during construction, with the potential for minor diversions over short periods. This would mainly occur on those parts of the corridor where utility works / ITS connections require temporary occupation of footpaths. Advance notice of footpath impacts would be communicated to the public and the City of Sydney and suitable alternative routes would be clearly signposted.

Operation

Road safety

Smart motorways have been demonstrated to reduce both the number and severity of crashes through the mechanisms such as the following:

- Improved management of traffic speeds – The improved management of traffic speeds through the corridor would 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
- Better incident detection and management – smart motorways would facilitate automation of incident management to facilitate earlier detection and emergency response as well as to manage vehicle speeds and improve access for safety crew and emergency vehicles.
- Improved wayfinding and overall network control – The provision of improved wayfinding, especially at key decision-making points, would 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 Australia and internationally (Wang, Gorlick, Taylor, & Elaurant, 2017). The research identified that smart motorway technologies including incident detection, variable speed limit signs and combined variable speed limit signs and land use management signs may provide road crash reductions ranging from 17.1 per cent to 26.4 per cent.

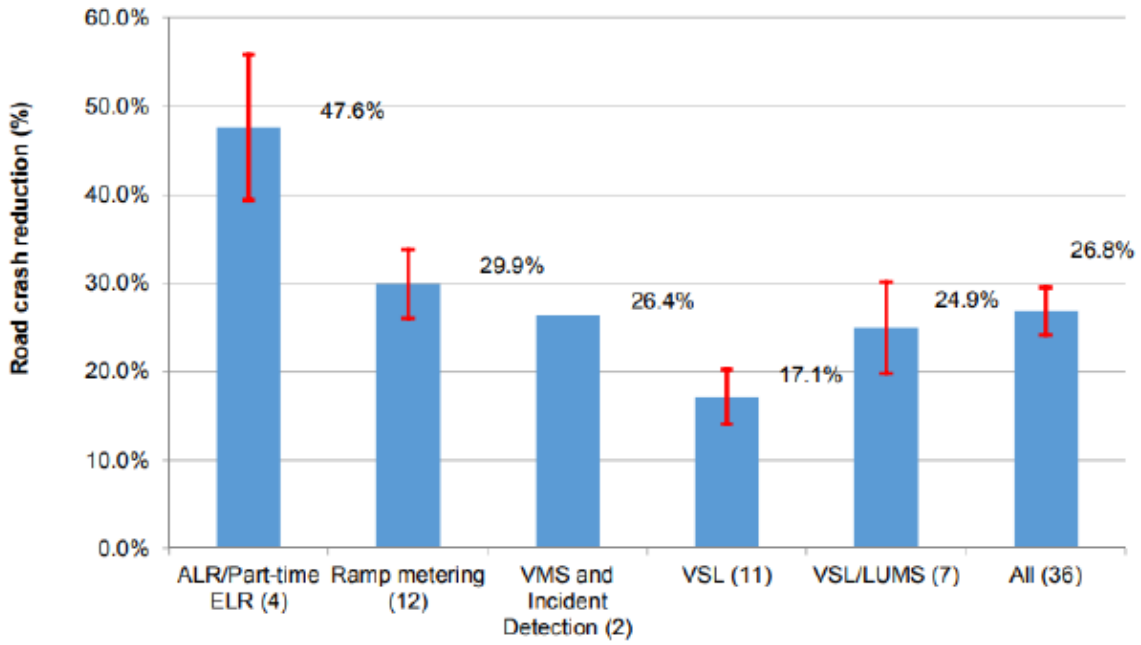


Figure 6-4: Crash benefits of 36 smart motorway case studies in Australia, USA, UK, Germany, Netherlands

Source: (Wang, Gorlick, Taylor, & Elaurant, 2017)

Note: All Lane Running (ALR), Emergency Lane Running (ELR) and ramp metering are not part of the proposal.

The anticipated road crash reductions to be provided by the smart motorway technology at specific locations along the proposal corridor are described in 5.

Table 6-5: Proposal impact on existing crash clusters

Existing crash cluster locations	Proposal impact
Around Southern Toll Plaza Sydney Harbour Bridge	The proposed smart technologies on Gantries 18 and 19 would minimise crash risks for northbound and southbound traffic respectively. Gantry 18 proposes the following features which would minimise crash risks at this location: • ISLUS for wayfinding and traffic speed management • A vehicle detection system for improved network control • An automatic incident detection camera for faster incident response and improved network management in response to an incident including control of lane usage and traffic speed. Gantry 19 proposes the following features which would minimise crash risks at this location: • A vehicle detection system for improved network control • An automatic incident detection camera for faster incident response and improved network management in response to an incident including control of lane usage and traffic speed. Additional vehicle detection infrastructure and automatic incident cameras are proposed on approaches to these gantries to support the overall network control in this area.

Existing crash cluster locations	Proposal impact
Harris Street / Fig Street entry / exit ramps	Proposed Changes to address weaving on the Western Distributor (refer Section 3.2.3) near the Harris Street / Fig Street entry / exit ramps would improve wayfinding, thereby minimising the risk of crashes due to complex merging manoeuvres and would improve incident response due to the vehicle detection systems and automatic incident detection cameras proposed on approach to the Harris Street / Fig Street entry / exit ramps. Advance signage is proposed as far south as Gantry 8 for northbound traffic and as far north as Gantry 19 for southbound traffic.
Pyrmont Bridge Road entry / exit ramps	The following smart technologies are proposed near the Pyrmont Bridge Road entry / exit ramps to reduce crash risk at this interchange: • ISLUS, incident detection cameras and a vehicle detection system on Gantry 6 • Vehicle detection systems on northbound and southbound exit ramps • An automatic incident detection camera on the northbound entry ramp.
On the Sydney Harbour Bridge	The following smart technologies are proposed along the Sydney Harbour Bridge to address the existing concentration of crashes along its length: • Dynamic directional signs, ISLUS, VSLS, incident detection cameras and a vehicle detection system on Gantry 24 • Dynamic directional sins, incident detection cameras and a vehicle detection system on Gantry 25 • Replacement of existing VSLS with new VSLS on existing Sydney Harbour Bridge gantries • Installation of automatic incident detection cameras at even intervals along the bridge for faster incident response and improved network management in response to an incident including control of lane usage and traffic speed. • Installation of further vehicle detection system infrastructure along the bridge for improved network control.

In addition to the above, safety benefits are expected from the minimisation of weaving movements on the Western Distributor (refer Section 3.2.3). The clear definition of two lanes on the Western Distributor as the primary through traffic route (eastbound between Harris Street/Fig Street/Pyrmont Street and King Street) would isolate these lanes from local traffic and reduce the risk of lane change related crashes.

Traffic

Traffic analysis indicates that with the implementation of the proposed smart motorway, the vehicle hours travelled (VHT) along the proposal corridor in both current and future years would be improved (i.e. reduced) by about 13 per cent. There would also be substantial improvements (i.e. increases) to weekday average speeds. The results are provided in

Table 6-6 and Table 6-7.

Table 6-6: Vehicle hours travelled improvements to existing condition along the proposal corridor

Scenario	Year	AM peak	PM peak	Interpeak	AM & PM	All day
Future project case (with proposed smart motorway)	2021	13.88%	14.02%	13.75%	13.94%	13.91%
	2026	13.97%	14.04%	13.79%	14.00%	13.96%
	2031	14.10%	14.10%	14.05%	14.10%	14.09%
	2031	12.16%	13.33%	11.07%	12.70%	12.50%
	2036	12.56%	13.44%	11.65%	12.96%	12.80%

Table 6-7: Vehicle speed improvements to existing condition along the proposal corridor (weekday average)

Scenario	Year	AM peak	PM peak	Interpeak	AM & PM	All day
Future project case (with proposed smart motorway)	2021	15.15%	16.23%	15.92%	15.69%	15.90%
	2026	15.19%	16.21%	15.95%	15.71%	15.91%
	2031	15.18%	16.23%	16.35%	15.72%	16.04%
	2031	12.63%	15.31%	12.55%	13.96%	13.92%
	2036	12.78%	15.40%	13.37%	14.09%	14.21%

In addition to easing congestion, the smart motorway benefits of improved incident management and improved wayfinding are expected to improve the travel time reliability of trips travelled along the proposal corridor. The effects of incidents on travel time and congestion would be reduced by earlier and more effective response to incidents. The improved wayfinding would improve the flow of overall traffic, subsequently reducing variation in travel times along the same route.

Public transport

Travel time reliability is a key criteria for commuters' choice of transport mode. A road network that can support more reliable trips through better traffic and hazard management would improve the travel time reliability of bus services operating within the proposal corridor and improve the bus transport experience, potentially attracting further customers.

The proposed traffic speed improvements would also facilitate development of the rapid bus routes identified in Sydney Bus Futures (refer 2.1.2).

Walking

The corridor does not have a high walking function currently or in the future. There are not expected to be impacts on pedestrians during operation.

Cycling

The proposal does not directly propose cycling infrastructure improvements because use of the corridor as part of the cycling network is not expected to increase significantly. There are not expected to be impacts on cyclists during operation.

Parking

No permanent changes to on-street parking provision are proposed.

6.1.4 Safeguards and management measures

Table 6-8: Traffic and transport environmental management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Traffic Control at Work Sites Manual (Roads and Maritime, 2018) and QA Specification G10 Control of Traffic (Roads and Maritime, 2008). The TMP will include: • confirmation of construction traffic routes • measures to maintain access to local roads and properties • site-specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access • requirements and methods to consult and inform the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic monitoring, review and amendment mechanisms	Contractor	Pre-construction	Section 4.8 of QA G36 Environment Protection
Emergency services vehicles and buses	Traffic management measures will be implemented to ensure emergency services vehicles and buses can negotiate work areas during construction. Where access is not possible, emergency services would be notified at least five business days prior to closures.	Contractor	Construction	Additional measure
Property and parking access	Property owners would be notified at least five business days prior to any temporary disruption to their property access or street parking due to construction.	Contractor	Construction	Additional measure

Impact	Environmental safeguards	Responsibility	Timing	Reference
Pedestrian and cyclist access	Footpath and or cycleway impacts would be communicated to the public, City of Sydney Council and North Sydney Council at least five business days in advance and suitable alternative routes would be clearly signposted.	Contractor	Construction	Additional measure

6.2 Landscape character and visual

The methodology used for the visual impact assessment is consistent with the Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment (Roads and Maritime Services, 2018). The assessment focused on the temporary visual amenity impacts during construction, and the long-term visual impacts on landscape character zones and selected viewpoints due to changes introduced under the proposal.

The operational assessment includes an assessment of both landscape character and visual impacts. The full Landscape Character and Visual Impact Assessment is in Appendix E.

Landscape character assessment

A landscape character zone is an area of distinct and consistent character, and the impact of a proposal within one landscape character zone may differ from the impact in another zone. The landscape character assessment involved photographing, mapping, understanding and describing the different landscape character zones in the corridor, and then determining and describing the capacity of these different zones to visually absorb the proposal. The ability to absorb a proposal is dependent on landform, vegetation cover and existing structures. The more pristine the landscape, the greater the consequence of introducing new features and therefore the higher the sensitivity rating of that landscape character zone.

Visual impact assessment

This involved assessing the likely visual impact of the proposal from key viewpoints. The assessment was limited to proposed gantries and smaller VMS structures, as these were determined to be the most visually noticeable design elements of the proposal. The following tasks were completed as part of the visual impact assessment:

- Desktop analysis to understand the visual catchment of the proposal and identify potential receptors of visual impacts. This was carried out using topographic analysis and Google Maps
- On-site field inspection to confirm the visual catchment and confirm key viewpoints and the sensitivity of potential visual receivers

Assessment matrix

Two primary factors are used to determine landscape character and visual impacts:

- Sensitivity – meaning how sensitive the character of the setting or viewpoint is to the proposed change
- Magnitude of the proposal – referring to the scope of the proposal in that area.

The impact is determined using the matrix show in Figure 6-5, where rankings for sensitivity and magnitude are combined to generate the impact.

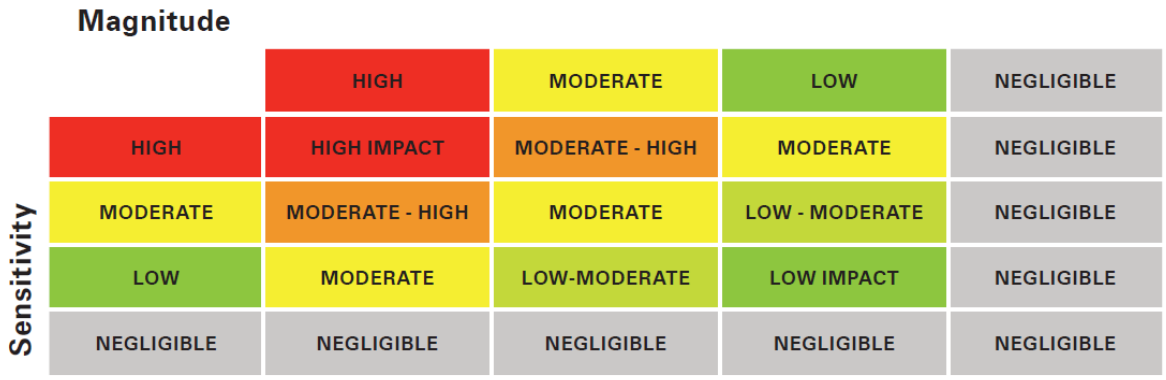


Figure 6-5: Landscape character and visual impact assessment matrix

6.2.1 Existing environment

The proposal is in an area typical of a highly urbanised global city, with a mix of commercial, residential and mixed-used buildings including tall towers and large cultural buildings.

The existing road is a combination of bridge and viaduct structures, with very little of the road corridor at grade. Urban public spaces occur along the length of the proposal corridor, with notable green spaces in the following areas:

- Observatory Hill Park
- Tumbalong Park (Darling Harbour)
- Lang Park (York Street, Sydney)
- Dawes Point Park and Hickson Reserve
- Milsons Point and Bradfield Park.

There are a number of important views from the proposal corridor, including views of Darling Harbour and views towards the Sydney Harbour Bridge.

There are also several iconic landmarks in the area which have been considered in the assessment including:

- Anzac Bridge
- Sydney Fish Markets
- Harbour Mill building
- International Convention Centre
- National Maritime Museum
- Pyrmont Bridge
- Darling Harbour
- Sydney Aquarium and Sydney Wildlife World
- Observatory Hill
- The Rocks
- Sydney Harbour Bridge and Sydney Harbour
- North Sydney Swimming Pool
- Luna Park
- Sydney Opera House

- Royal Botanic Garden.

Landscape character zones

To characterise the differences in the landscape across the proposal corridor, landscape character zones were identified and defined.

Table 6-9 describes each zone, its characteristics and its sensitivity to change. Figure 6-6 shows the location of each of the landscape character zones.

Table 6-9: Landscape character zones

Zone	Name	Description	Sensitivity
LCZ3	Blackwattle Bay, Pyrmont and Ultimo	Extending from the eastern end of the Anzac Bridge continuing along the elevated viaduct and then moving into the inner CBD.	Moderate The motorway is an elevated viaduct winding through waterfront industrial, commercial, residential and heritage landscapes, with typical road infrastructure such as overhead signage, street lighting and noise walls.
LCZ4	Darling Harbour	Connects the Pyrmont peninsula with the CBD via a series of adjacent elevated viaducts that pass through Darling Harbour.	High An area of high visual sensitivity with significant public spaces and views to the harbour with a new key city landmark of the International Convention Centre (ICC). It includes typical road infrastructure such as overhead signage and street lighting.
LCZ5	Cockle Bay Wharf and the CBD Canyon	Continues as an elevated viaduct, moving around Cockle Bay to the north and then passing along the western edge of the CBD. This zone has views to Darling Harbour to the west and tall high-rise commercial buildings to the east.	Moderate City hotel precinct with viaduct carriageways located predominantly at lower level to buildings.
LCZ6	The CBD (western edge)	Extends from King Street in the south to the Cahill Expressway in the north. Characterised by the cityscape to the east and Barangaroo to the west.	Moderate Moderate visual sensitivity as it is surrounded by commercial buildings only and has few existing gantry or signage structures.
LCZ7	Millers Point and The Rocks	Much of this zone is protected by heritage conservation areas such as The Rocks and Millers Point with multiple listed heritage items in the vicinity. Includes the approach to the Sydney Harbour Bridge.	High High visual sensitivity as it is the approach to the Sydney Harbour Bridge and adjacent the Rocks and Millers Point Conservation Areas.
LCZ8	The Sydney Harbour Bridge	Includes the 2.4-kilometre extent of the Sydney Harbour Bridge, which is a state listed heritage items and with views of Sydney Harbour from both the east and the west.	High High visual sensitivity as it is the iconic Sydney Harbour Bridge with State Heritage Listing in a World Heritage Zone with views to and from the bridge structure.

Zone	Name	Description	Sensitivity
LCZ9	Milsons Point and Kirribilli	Includes the northern approach to the Sydney Harbour Bridge, separating Milsons Point to the west and Kirribilli to the east.	High High visual sensitivity as the zone includes the northern approach to the iconic Sydney Harbour Bridge, adjacent visually sensitive parks and open space around the bridge curtilage and the highly urban areas of North Sydney CBD.

Figure 6-6: Landscape character zones

Visual envelope and viewpoints

The visual envelope is defined as the visual catchment for the proposal and focuses on the proposed gantries. It describes the area surrounding the proposal from which direct views are possible. The visual envelope (refer to Figure 6-7) also considers existing landforms, vegetation, land uses and structures. A total of 25 viewpoints were selected for the purposes of visual impact assessment. These are shown in Figure 6-7 and described in Table 6-10.

Table 6-10: Viewpoints

Viewpoint	Location	Description	Sensitivity
VP6	View north along Western Distributor towards Gantry 6.	For road users and residences adjacent to the Western Distributor on Bulwara Road, this viewpoint comprises the Western Distributor road corridor leading to the Pyrmont skyline and views of the Anzac Bridge as well as the skyline beyond.	High
VP7	View west along Western Distributor towards Gantry 7.	For transient pedestrians and road users on Pyrmont Street, this viewpoint comprises the elevated Western Distributor with an existing gantry over the eastbound lanes as well as multi-level commercial and residential buildings.	Moderate
VP8	View east along Western Distributor towards Gantry 8.	For residents of 243 Pyrmont Street and transient road users of the Western Distributor, this viewpoint comprises the road corridor and Sydney CBD high rise buildings in the background. Existing gantry structures extend over traffic in both directions.	Low
VP9	View west along the Western Distributor to Gantry 9.	For transient road users, this viewpoint comprises a key Sydney landmark, the ICC.	High
VP10	View east along the Western Distributor at Darling Harbour, towards Gantry 10.	For transient road users, this viewpoint comprises the road corridor and Sydney CBD high rise buildings in the background with views to Cockle Bay to the left.	Moderate
VP11	View south-west along Western Distributor, Westbound towards Gantry 11, South of Hyatt Regency Hotel Darling Harbour Tunnel.	For transient road users, this viewpoint comprises the elevated Western Distributor road corridor and viaducts.	Moderate
VP12	View east along Western Distributor towards Gantry 12, adjacent to Cockle Bay.	For transient road users, this viewpoint comprises the road corridor and Sydney CBD high rise buildings in the background with substantial views of Cockle Bay to the left.	Moderate
VP13	View south along Western Distributor, Westbound towards Gantry 13, adjacent to Market Street.	For patrons of the hotel precinct and transient road users, this viewpoint comprises views of the road corridor and Western Distributor viad ucts from below.	Moderate

Viewpoint	Location	Description	Sensitivity
VP14	View north-east along the Western Distributor towards Gantry 14, near to Market Street.	For transient road users, this viewpoint comprises views of the elevated Western Distributor viaducts and the Hyatt Regency Hotel.	Moderate
VP15	View north-east along the Western Distributor towards the King Street overpass, north/eastbound, north of Hyatt	For transient road users and patrons of the Hyatt Regency Hotel overlooking the motorway, this viewpoint comprises views of the road corridor and viaducts from below.	Low
VP16	View south along the Western Distributor towards the northern face of the King Street footbridge.	For commercial buildings adjacent the road corridor and transient road users, this viewpoint comprises the road corridor with Sydney CBD high-rise buildings in the background interrupted by a viaduct with sparse vegetation on either side of the road corridor.	Moderate
VP17A	View north-east along the Western Distributor towards Gantry 17, above Sussex Street.	For road users on the road corridor and occupants of the adjacent commercial building overlooking the motorway, this viewpoint comprises the elevated road corridor bounded by high-rise commercial buildings on either side.	Moderate
VP17B	View north from Sussex Street towards the Western Distributor and the Gantry 17 location.	For transient road users and pedestrians on Sussex Street, this viewpoint comprises the road corridor viaducts from below bounded by high-rise commercial buildings on either side.	Moderate
VP18	View north along the Western Distributor towards Gantry 18, adjacent to Kent Street.	For transient road users and occupants of the adjacent commercial building overlooking the motorway, this viewpoint comprises views along the elevated road corridor bounded by high-rise commercial buildings with distant views of the Sydney Harbour Bridge.	High
VP19	View south along the Western Distributor, towards Gantry 19 near Kent Street.	For transient users exiting the Sydney Harbour Bridge entering the Sydney CBD, this viewpoint comprises the wide road corridor bounded by high-rise Sydney CBD buildings. Static signage structures extending across six lanes of the road corridor was removed in 2017.	Moderate
VP24	View north along the Sydney Harbour Bridge southern approach.	For transient road users entering the Sydney Harbour Bridge from the south, this viewpoint comprises close views of the global landmark, Sydney Harbour Bridge and abutments, interrupted only by existing portal gantry.	High

Viewpoint	Location	Description	Sensitivity
VP25	View south along the Sydney Harbour Bridge northern approach.	For transient road users approaching the Sydney Harbour Bridge from the north, this viewpoint comprises the road corridor with views of the high-rise Sydney CBD buildings in the distance and an existing portal gantry structure. No views of the bridge as yet at this location.	Moderate

Figure 6-7: Visual envelope (Note: this figure depicts an outdated proposal area. Refer to Figure 1-2 for an accurate proposal depiction)

6.2.2 Potential impacts

Construction

During construction, temporary visual impacts may include visible construction activities such as demolition and excavation works, removal of vegetation, installation works involving cranes and hoists, construction compounds and finishing works (e.g. concrete sawing, joint installation, line marking, kerb and gutter construction, and installation of safety barriers, street lighting, landscaping and sign posting).

Residents of residences and hotels are receivers of viewpoints 6, 8 and 14. The Hyatt Regency Hotel is located directly over the proposal location of Gantry 14 and residents near Gantries 6 and 8 are located within 30 metres of works.

Due to the traffic closures required to construct the proposal, works would be undertaken as night shifts with each work area decommissioned and return to traffic by day. As such, visual impacts during construction are anticipated to be similar to operational impacts at all viewpoints during the day. Road users, the primary visual receivers of construction works at night would likely be diverted around work areas due to associated lane and road closures and thus experience minimal impact. Residential receivers as identified above may experience impacts due to light spill during night works.

Construction impacts are not anticipated to be significant due to the minor nature of the works in each location and provided that the safeguards in this REF are appropriately implemented.

Operation

The proposal has incorporated urban design objectives (refer Section 2.3.3) in the design of the smart motorway infrastructure to minimise the impacts to landscape character and visual amenity.

Landscape character assessment

The impact of the proposal on the landscape character zones varies from Negligible to Moderate-High. The assessment outcomes are provided in Table 6-14.

Table 6-11: Landscape character assessment outcomes

Zone	Changes	Sensitivity	Magnitude	Impact
LCZ3	New gantries are proposed in this zone to replace existing signage. There is likely to be a moderate degree of change as the signage is larger than existing and potentially may be more visible due to the illuminated component.	Moderate	Moderate	Moderate
LCZ4	New and replacement gantries and signage are larger than the existing signs and potentially more visible due to the illuminated components. Moderate degree of change.	High	Moderate	Moderate - High
LCZ5	New gantry structures and signage would either replace existing signage or be attached to existing buildings or overhead bridges. Low degree of change.	Moderate	Low	Low - Moderate

Zone	Changes	Sensitivity	Magnitude	Impact
LCZ6	New signage structures in this zone would result in a moderate degree of change as there are no existing gantry structures and the signage would be a new element in the setting.	Moderate	Moderate	Moderate
LCZ7	There would be a small degree of change as the proposed signage would be attached to the existing portal gantry which has new LED signage that has been recently installed.	High	Low	Moderate
LCZ8	Moderate degree of change associated with additional LED signage.	High	Moderate	Moderate-high
LCZ9	The proposed signage would be attached to the existing portal gantry which includes recently installed illuminated LED signage. Minimal visual change.	High	Low	Moderate

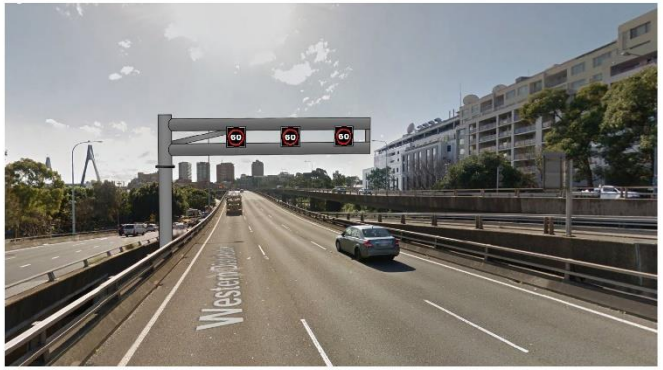
Visual impact assessment

The areas in which the gantries and signage are proposed to be located is a city environment. Its urban presentation is highly developed and modified and at the same time can also be a highly scenic environment with many heritage items and significant view corridors. Being a city environment, existing signs, light poles and other road furniture already provide a degree of urban visual clutter.

In general, where new gantries replace existing signage gantries, visual impacts are lower. Where there are no existing gantries or signage the visual impact is higher. The visual impacts are highest in the areas where the adjoining land use is more visually sensitive such as areas with residential buildings or areas with heritage significance. Table 6-12 summarises the assessed visual impact at each viewpoint for proposed gantries.

Safeguards have been proposed to ensure protection of street trees during foundation works and placement of underground conduits.

Table 6-12: Visual impact assessment outcomes

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
6	6	View north along Western Distributor towards Gantry 6.	Cantilever gantry with ISLUS– located westbound near Pyrmont off ramp – post would extend down to ground level between westbound viaduct and Pyrmont off ramp. The proposal would introduce a gantry and illuminated signage where there is currently no gantry or signage.	High	Moderate	Moderate-High	 Existing View of Gantry Location 6  Proposed view of Gantry Location 6

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
7	7	View west along Western Distributor towards Gantry 7.	Portal located on bridge beam/ headstock – located westbound over Pyrmont Street with dynamic signage and ISLUS. Public walkway/ stairs directly underneath, portal would be visible from Pyrmont Street and new residential apartments at No. 273. Immediately adjacent is a less sensitive commercial building use. Residential sensitivity at Goldsborough Mort building. Moderate visual impact with new large signage and gantry structure which is more visible.	High	Moderate	Moderate-High	 Existing View of Gantry Location 7  Proposed view of Gantry Location 7

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
8	8	View east along Western Distributor towards Gantry 8.	Portal gantry with ISLUS and dynamic signage attached to the bridge deck at the parapet, located over eastbound carriageway – replaces existing portal gantry signage. Low visual impact as replaces existing signage but potentially more visible due to illuminated LED component.	Low	Low	Low	 Existing View of Gantry Location 8  Proposed view of Gantry Location 8

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
9	9	View west along the Western Distributor to Gantry 9.	Located in an area of high visual sensitivity with views to new key landmark of ICC. Gantry will obscure this view momentarily. Fixings will be visible from open space below viaduct carriageway.	High	Moderate	Moderate-High	 Existing View of Gantry Location 9  Proposed view of Gantry Location 9

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
10	10	View east along the Western Distributor at Darling Harbour, towards Gantry 10.	New portal gantry with ISLUS and dynamic signage, attached to existing viaduct headstock. Located in an area of moderate visual sensitivity with view to Cockle Bay and CBD. Fixings would be visible from open space below viaduct carriageway and shared path.	Moderate	Moderate	Moderate	 Existing View of Gantry Location 10  Proposed view of Gantry Location 10

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
11	11	View south-west along Western Distributor, Westbound towards Gantry 11, South of Hyatt Regency Hotel Darling Harbour Tunnel.	New portal with dynamic signage and ISLUS replaces existing portal and static signage. Hotel precinct with moderate sensitivity. Replaces existing structure but with illuminated signage. Negligible visual impact as no direct building adjacencies and minor degree of change.	Moderate	Negligible	Negligible	 Existing View of Gantry Location 11  Proposed view of Gantry Location 11

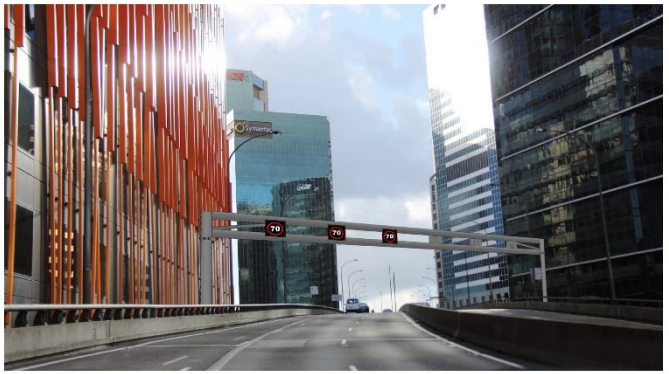
ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
12	12	View east along Western Distributor towards Gantry 12, adjacent to Cockle Bay.	Replaces existing portal gantry signage – portal structure with ISLUS and dynamic signage attached to bridge deck parapet. Low-Moderate visual sensitivity from carriageway as replaces existing signage but potentially more visible due to illuminated LED component. Fixings will be visible from open space below viaduct carriageway.	Moderate	Low	Low-Moderate	 Existing View of Gantry Location 12  Proposed view of Gantry Location 12

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
13	13	View south along Western Distributor, Westbound towards Gantry 13, adjacent to Market Street.	Cantilever structure with ISLUS and static signage. One lane converted to two lanes. Some shrub vegetation which does not provide connectivity to other streetscape landscaping would require removal at the location of the gantry post. Hotel precinct with moderate sensitivity. Negligible visual impact as no direct building adjacencies and carriageway located at lower level to buildings.	Moderate	Negligible	Low-Moderate	 Existing View of Gantry Location 13  Proposed view of Gantry Location 13

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
14	14	View north-east along the Western Distributor towards Gantry 14, near to Market Street.	New freestanding cantilever structure with ISLUS. Post comes to ground level between carriageways. Hotel precinct with moderate sensitivity. Hyatt Regency Hotel building spans over the motorway. Illuminated LED components and signage gantry will not be visible as the illuminated element faces away from hotel.	Moderate	Low	Low-Moderate	 Existing View of Gantry Location 14  Proposed view of Gantry Location 14

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
15	15	View north-east along the Western Distributor towards the King Street overpass, north/eastbound, north of Hyatt	Regency building – new LED signage connected to bridge. Hyatt Regency adjacent. Located 5.5m below windows looking out over motorway with limited visibility. Low visual impact as carriageway at lower level to buildings and minimal degree of change.	Low	Low	Low	 Existing View of Gantry Location 15  Proposed view of Gantry Location 15

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
16	16	View south along the Western Distributor towards the northern face of the King Street footbridge.	New dynamic signage with ISLUS below. mounted to face of existing pedestrian bridge. Located within a “Protected Public Street Views to Water” identified by the City of Sydney, although is parallel with the view and results in no additional obstruction. Minimal degree of change to view.	Moderate	Low	Low-Moderate	 Existing View of Gantry Location 16  Proposed view of Gantry Location 16

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
17a	17	View north-east along the Western Distributor towards Gantry 17, above Sussex Street.	Portal structure with ISLUS spanning both directions. Far enough away from Sydney Harbour Bridge to not impact that vista or block water views. New element in the streetscape setting, but surrounded by less visually sensitive commercial buildings.	Moderate	Moderate	Moderate	 Existing View of Gantry Location 17  Proposed view of Gantry Location 17

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
17b	17	View north from Sussex Street towards the Western Distributor and the Gantry 17 location.	Portal structure with ISLUS spanning both directions. Gantry connection to parapet would be visible from this view on Sussex Street. New element in the streetscape setting, but surrounded by commercial buildings only.	Moderate	Moderate	Moderate	 Existing View of Gantry Location 17 from Sussex Street  Proposed view of Gantry Location 17 from Sussex Street

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
18	18	View north along the Western Distributor towards Gantry 18, adjacent to Kent Street.	New portal structure with ISLUS signage. Surrounded by commercial buildings but with a distant vista to Sydney Harbour Bridge. Connection to the parapet of the bridge would be visible from the pedestrian underpass below and Kent Street and in the distance from Grosvenor Street.	High	Moderate	Moderate-High	 Existing View of Gantry Location 18  Proposed view of Gantry Location 18

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
19	19	View south along the Western Distributor, towards Gantry 19 near Kent Street.	New portal structure with dynamic signage. Surrounded by commercial buildings only. Replaces existing signage that has been removed as part of recent road works.	Moderate	Moderate	Moderate	 Existing View of Gantry Location 19  Proposed view of Gantry Location 19

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
24	24	View north along the Sydney Harbour Bridge southern approach.	Dynamic signage attached to existing portal gantry. High sensitivity view of the Sydney Harbour Bridge vista. New signage partially obscures view of south-west bridge pylon.	High	Moderate	Moderate-High	 Existing View of Gantry Location 24  Proposed view of Gantry Location 24

ID	Gantry	Location	Proposed impact	Sensitivity	Magnitude	Impact	Images
25	25	View south along the Sydney Harbour Bridge northern approach.	Dynamic signage attached to existing portal gantry. Moderate degree of change in area of moderate sensitivity.	Moderate	Moderate	Moderate	 Existing View of Gantry Location 25  Proposed view of Gantry Location 25

Some excavation for new ITS conduits is proposed near street trees at the following locations:

- Bulwara Road, Pyrmont
- Shelley Street, Sydney
- Between the southbound Western Distributor lanes and the Kent Street on ramp.

Any loss of street trees would have an impact on the streetscape and visual amenity at these locations and therefore safeguards have been proposed to address potential impacts on street trees.

6.2.3 Safeguards and management measures

Table 6-13: Landscape character and visual environmental management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Visual impacts during construction	Suitable barriers will be provided to screen the visibility of construction activities from adjacent areas where appropriate.	Contractor	Construction	Additional measure
Visual impacts during construction	Construction site compound areas will be returned to at least their preconstruction state following completion of the project.	Contractor	Construction	Additional measure
Visual impacts during construction	Following the completion of construction works, plant/equipment will be removed, and disturbed areas will be revegetated, turfed or otherwise restored as appropriate.	Contractor	Construction	Additional measure
Impact from lighting	Temporary site lighting will be installed and operated in accordance with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting, and an approved Traffic Management Plan.	Contractor	Construction	Additional measure
Impacts on street trees	Establishment of Tree Protection Zones and tree protection measures consistent with AS4970-2009 Protection of Trees on Development Sites will be implemented for all trees within or immediately adjacent to the construction footprint.	Contractor	Construction	Additional measure
Visual impacts	Where illuminated signage is located adjacent to more sensitive residential uses at Bulwara Road, investigate screening to minimise potential light spill.	Transport for NSW	Detailed design	Additional measure

Impact	Environmental safeguards	Responsibility	Timing	Reference
Visual impacts	The following will occur during the detailed design of proposed new gantries: • Minimise the number signs required in order to minimise visual clutter and the overall bulk and massing of the gantries • Provide minimal depth and width for structural post and beams for the gantry structure • Conceal fixings to streamline appearance • Utilise a visually recessive colour on posts and fixings so that the visual impact on the skyline is minimised, such as Sydney Harbour Bridge Grey.	Transport for NSW	Detailed design	Additional measure
Visual impacts	Offset any street trees removed for the proposal in consultation with local Council.	Transport for NSW	Detailed design	Additional measure

6.3 Non-Aboriginal heritage

A Statement of Heritage Impact for the proposal was carried out by GML. The main findings of that assessment are summarised below while the full report is included in Appendix F.

6.3.1 Methodology

The Heritage Impact Statement has been prepared in general accordance with the following key guidelines and policies relevant to heritage management in NSW:

- NSW Heritage Manual (NSW Heritage Office and Department of Urban Affairs and Planning, 1994)
- Statements of Heritage Impact (Heritage Council of NSW, 2002)
- The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013 (the Burra Charter).

To assess the potential impacts of the proposal a standard ranking system for measuring the level of potential impacts on heritage values was used as described in Table 6-14.

Table 6-14: Impact gradings

Impact grading	Built heritage or historical urban landscape attributes
Major adverse	Actions that would have a severe, long-term and possibly irreversible impact on a heritage item. Actions in this category would include partial or complete demolition of a heritage item or addition of new structures in its vicinity that destroy the visual setting of the item. These actions cannot be fully mitigated.

Impact grading	Built heritage or historical urban landscape attributes
Moderate adverse	Actions that would have an adverse impact on a heritage item. Actions in this category would include removal of an important part of a heritage item's setting or temporary removal of significant elements or fabric. The impact of these actions could be reduced through appropriate mitigation measures.
Minor adverse	Actions that would have a minor adverse impact on a heritage item. This may be the result of the action affecting only a small part of the place or a distant/small part of the setting of a heritage place. The action may also be temporary and/or reversible.
Neutral	Actions that would have no heritage impact.
Minor positive	Actions that would bring a minor benefit to a heritage item, such as an improvement in the item's visual setting.
Moderate positive	Actions that would bring a moderate benefit to a heritage item, such as removal of intrusive elements or fabric or a substantial improvement to the item's visual setting.
Major Positive	Actions that would bring a major benefit to a heritage item, such as reconstruction of significant fabric, removal of substantial intrusive elements/fabric or reinstatement of an item's visual setting or curtilage.

The type of impact was also identified as part of impact assessment for each affected heritage item as described in Table 6-15.

Table 6-15: Description of impact types

Impact grading	Built heritage or historical urban landscape attributes
Physical	The proposed works impact on the fabric of the heritage item (e.g. partial or full demolition, additions, alterations).
Direct Visual	The proposed works are located such that they may directly impede significant/primary views of or to the heritage item.
Indirect Visual	The proposed works are located such that they may impede secondary views of or to the heritage item.
Setting	The proposed works are located such that they may have an impact on the general setting and visual curtilage of the heritage item.

A preliminary baseline assessment of historical archaeological potential was also carried out for areas of expected ground disturbance. This assessment involved review of existing archaeological management plans (Higginbotham, Kass, & Walker, 1991) and zoning plans (Lavelle & Mider, 1992) to inform likely constraints.

6.3.2 Existing environment

Context

The proposal corridor extends into the Sydney CBD, adjacent to historic streets (such as Sussex Street), and through historic areas (such as Milsons Point, The Rocks, Haymarket, Ultimo and Pyrmont).

The Sydney Harbour Bridge approaches and Western Distributor are largely constructed with elevated roadways that run above the streets and buildings below. The construction of these roadways involved the destruction of historic streetscapes and divided some of the historic

areas that they traverse, impacting on the cohesion of the historic layout of parts of central and northern Sydney.

The nationally significant Sydney Harbour Bridge and Circular Quay are also located within the World Heritage-listed Sydney Opera House buffer zone. The Sydney Opera House buffer zone centres on the nearby waters of Sydney Harbour. It includes places around Sydney Harbour within a radius of 2.5 kilometres that have been identified as offering critical views to and from the Sydney Opera House which contribute to its World Heritage significance. The buffer zone includes the Sydney Harbour Bridge in its entirety and most of its approach spans.

There are several conservation areas along the corridor. They include:

- The Rocks Conservation Area
- Millers Point Conservation Area
- Pyrmont Heritage Conservation Area
- Ultimo Heritage Conservation Area.

Other smaller individual heritage listed buildings occur along the entire length of the corridor and have been identified in Table 6-16.

Listed heritage items

Table 6-16 lists heritage items (with statutory recognition) within and adjacent to the proposal corridor while the location of these items are shown in Figure 6-8 to Figure 6-12.

Table 6-16: Statutory listed heritage items within and near the proposal corridor

ID	Name	Address	Endorsed significance	Listings
I0187	Greenway Flats	Corner Broughton and McDougall Streets, Kirribilli	Local	North Sydney LEP 2013
I0185	St John the Baptist Anglican Church	7–9 Broughton Street, Kirribilli	Local	North Sydney LEP 2013
01194 4801026 I0539	Milson Point Railway Station Group	North Shore railway, Milsons Point	State	State Heritage Register
00781	Sydney Harbour Bridge, approaches and viaducts (road and rail)	Bradfield Highway and North Shore Railway Milsons Point/Dawes Point	State	State Heritage Register
4301067	Sydney Harbour Bridge, approaches and viaducts	Sydney Harbour Bridge	State	Roads and Maritime S.170
4801022	Milsons Point (Fitzroy Street) Underbridge	Concrete Arch over Fitzroy Street, Milsons Point	State	RailCorp S.170
4801023	Milsons Point (Lavender Street) Underbridge	Concrete Arch over Lavender Street, Milsons Point	State	RailCorp S.170
4801059	Sydney Harbour Bridge Approaches Group including	Sydney Harbour Bridge Approaches Group including	State	RailCorp S.170

ID	Name	Address	Endorsed significance	Listings
	pylons, pedestrian stairs and access roads	pylons, pedestrian stairs and access roads		
I539	Sydney Harbour Bridge Approaches Group including pylons, pedestrian stairs and access roads	Sydney Harbour Bridge Approaches Group including pylons, pedestrian stairs and access roads	Local	Sydney LEP 2012
I0541	Sydney Harbour Bridge North Pylons	Sydney Harbour Bridge	Local	North Sydney LEP 2013
I0530	Sydney Harbour Bridge approach viaducts, arches and bays under Warringah Freeway	Sydney Harbour Bridge and approach viaducts including 2–4 Ennis Road and 2–74 Middlemiss Street	Local	North Sydney LEP 2013
I0538	Bradfield Park (including northern section)	Alfred Street South, Milsons Point	Local	North Sydney LEP 2013
01543	Dawes Point Battery Remains	Hickson Road, The Rocks	State	NSW SHR
	Dawes Point Heritage Precinct	George Street/Lower Fort Street, Hickson Road and Harbour Promenade, The Rocks	State	PNSW S170
01682	Millers Point and Dawes Point Village Precinct	Upper Fort Street, Millers Point	State	NSW SHR
00884	Millers Point Heritage Conservation Area	Millers Point	State	NSW SHR
C35	Millers Point/Dawes Point Heritage Conservation Area	Millers Point	State	Sydney LEP 2012
	The Rocks Heritage Conservation Area	The Rocks	State	PNSW S170
01555	Mining Museum (Former)	36-64 George Street, The Rocks	State	NSW SHR PNSW S170
01022 4800006	The Argyle Street Railway Substation (and Switchhouse)	Trinity Avenue, Millers Point	State	Transport for NSW S170
4801821	The Rocks (Argyle Street) Railway Underbridge	Concrete Arch over Argyle Street	State	NSW SHR PNSW S170

ID	Name	Address	Endorsed significance	Listings
01523	Argyle Cut	Argyle Street, The Rocks	State	NSW SHR PNSW S170
01522	Argyle Bridge	Cumberland Street, The Rocks	State	NSW SHR PNSW S170
01449 I934	Sydney Observatory	Upper Fort Street, Millers Point	State	NSW SHR Sydney LEP 2012
I935	Observatory Park including Boer War Memorial, Bandstand, fences and landscaping	Upper Fort Street, Millers Point	Local	Sydney LEP 2012
I936	Bureau of Meteorology including interior	9 Upper Fort Street, Millers Point	Local	Sydney LEP 2012
I937	Messengers Cottage for Sydney Observatory including interior	9A Upper Fort Street, Millers Point	Local	Sydney LEP 2012
I938	Fort Street Primary School	1005 Bradfield Highway, Millers Point	Local	Sydney LEP 2012
I1876	National Trust Centre including buildings and their interiors, retaining walls and grounds	1001 Bradfield Highway, Millers Point	Local	Sydney LEP 2012
I923	House “Richmond Villa”	116-122 Kent Street, Millers Point	Local	Sydney LEP 2012
I925	Terrace Group “Glover Cottages”	124–134 Kent Street, Millers Point	Local	Sydney LEP 2012
01606	Terrace	130 Cumberland Street, The Rocks	State	NSW SHR
01592	Terraces	132-134 Cumberland Street, The Rocks	State	NSW SHR
01592	Shops and Residences	136-138 Cumberland Street, The Rocks	State	NSW SHR PNSW S170
1599	Tenements	117-117A Gloucester Street, The Rocks	State	NSW SHR
	Longs Lane Precinct	Gloucester Street and Cumberland Street, The Rocks	State	PNSW S170
01598	Tenements	117-117A Gloucester Street, The Rocks	State	NSW SHR PNSW S170

ID	Name	Address	Endorsed significance	Listings
I1848	Lang Park including plaques, fountain and archaeology	Lang Street, Sydney	Local	Sydney LEP 2012
01558	Lilyvale	176 Cumberland Street, The Rocks	State	NSW SHR PNSW S170
01593	Shop and Residences	178-180 Cumberland Street, The Rocks	State	NSW SHR
01581	Shop and Residence	182 Cumberland Street, The Rocks	State	NSW SHR PNSW S170
01607	Terraces	182.5-188 Cumberland Street, The Rocks	State	NSW SHR
01557	Lawson House	212-218 Cumberland Street, The Rocks	State	NSW SHR PNSW S170
01564 B090 AR121	NSW Housing Board Building (former)	16-18 Grosvenor Street, The Rocks	State	NSW SHR PNSW S170
I1972	St Philip's Church of England including interior and grounds	3 York Street, Sydney	Local	Sydney LEP 2012
0513 I1952	Big House Hotel (Former "New Hunter River Hotel" including interiors)	20 Sussex Street, Sydney	State	NSW SHR Sydney LEP 2012
I1954	Former MWS&B pumping station	21-25 Sussex Street, Sydney	Local	Sydney LEP 2012
I1955	"Bristol Arms" Hotel including interior	81 Sussex Street, Sydney	Local	Sydney LEP 2012
I1956	Former "Hawken & Vance Produce Exchange" facades and exterior form	95-105 Sussex Street, Sydney	Local	Sydney LEP 2012
I1957	Former "Cuthbert's Patent Slip" warehouse including interiors	107-113 Sussex Street, Sydney	Local	Sydney LEP 2012
00411 I1958	Royal George Hotel	115–117 Sussex Street, Sydney	State	NSW SHR Sydney LEP 2012
00413	Royal George Hotel	115-117 Sussex Street, Sydney	State	NSW SHR Sydney LEP 2012
00413	Warehouses (former)	139-153 Sussex Street, Sydney	State	NSW SHR PNSW S170

ID	Name	Address	Endorsed significance	Listings
00416	Dundee Arms	171 Sussex Street, Sydney	State	NSW SHR PNSW S170
01619	Corn Exchange	173-185 Sussex Street, Sydney	State	NSW SHR PNSW S170
01618	Pyrmont Bridge	Sydney	State	NSW SHR
C69	Ultimo Heritage Conservation Area	Ultimo	Local	Sydney LEP 2012
I1205	Former industrial building elements and industrial components “Edwin Davey & Sons Flour Mill”	2A Allen Street, Pyrmont	Local	Sydney LEP 2012
1	Glebe Island Wheat Silos	Victoria Road, Glebe Island	State	SREP20
01600	Terrace	130 Cumberland Street, The Rocks	State	NSW SHR
01606	Terraces	132-134 Cumberland Street, The Rocks	State	NSW SHR
01592	Terraces	136-138 Cumberland Street, The Rocks	State	NSW SHR PNSW S170
01599	Tenements	140-142 Cumberland Street, The Rocks	State	NSW SHR
	Longs Lane Precinct	Gloucester Street and Cumberland Street, The Rocks	State	PNSW S170
01598	Tenements	117–117A Gloucester Street, The Rocks	State	NSW SHR PNSW S170

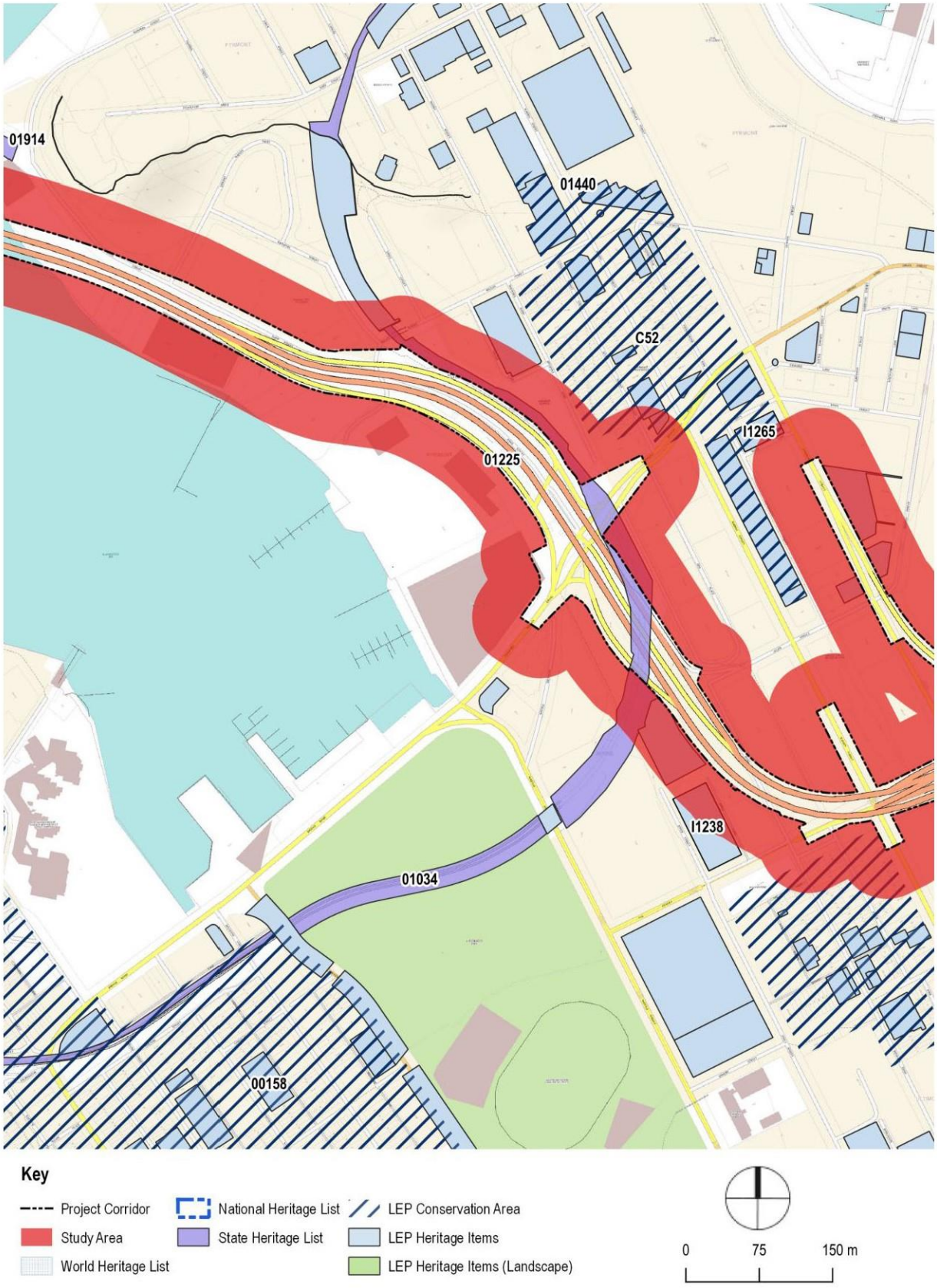


Figure 6-8: Heritage items – map 2 (Note: this figure depicts an outdated proposal area. Refer to Figure 1-2 for an accurate proposal depiction)

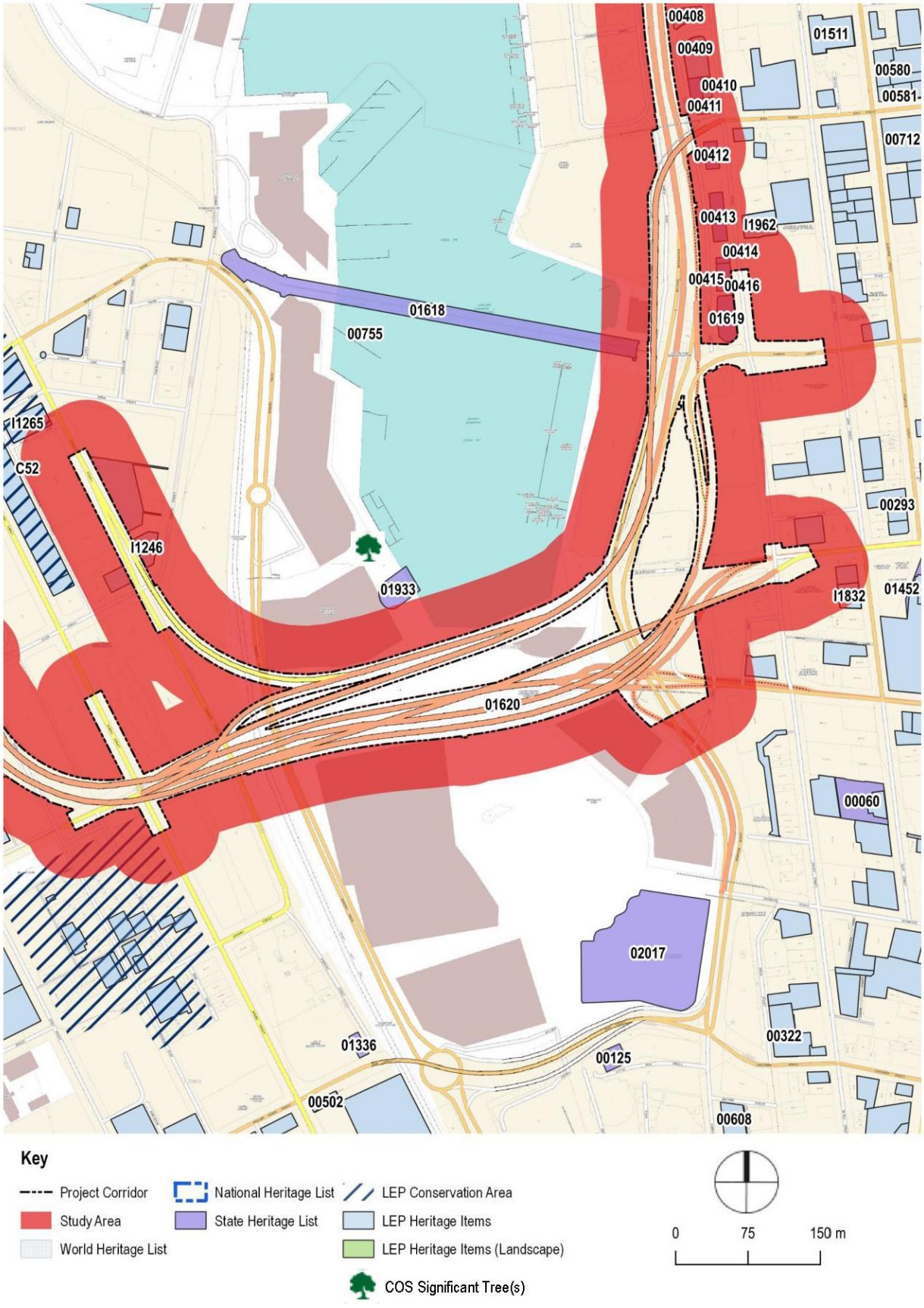


Figure 6-9: Heritage items – map 3

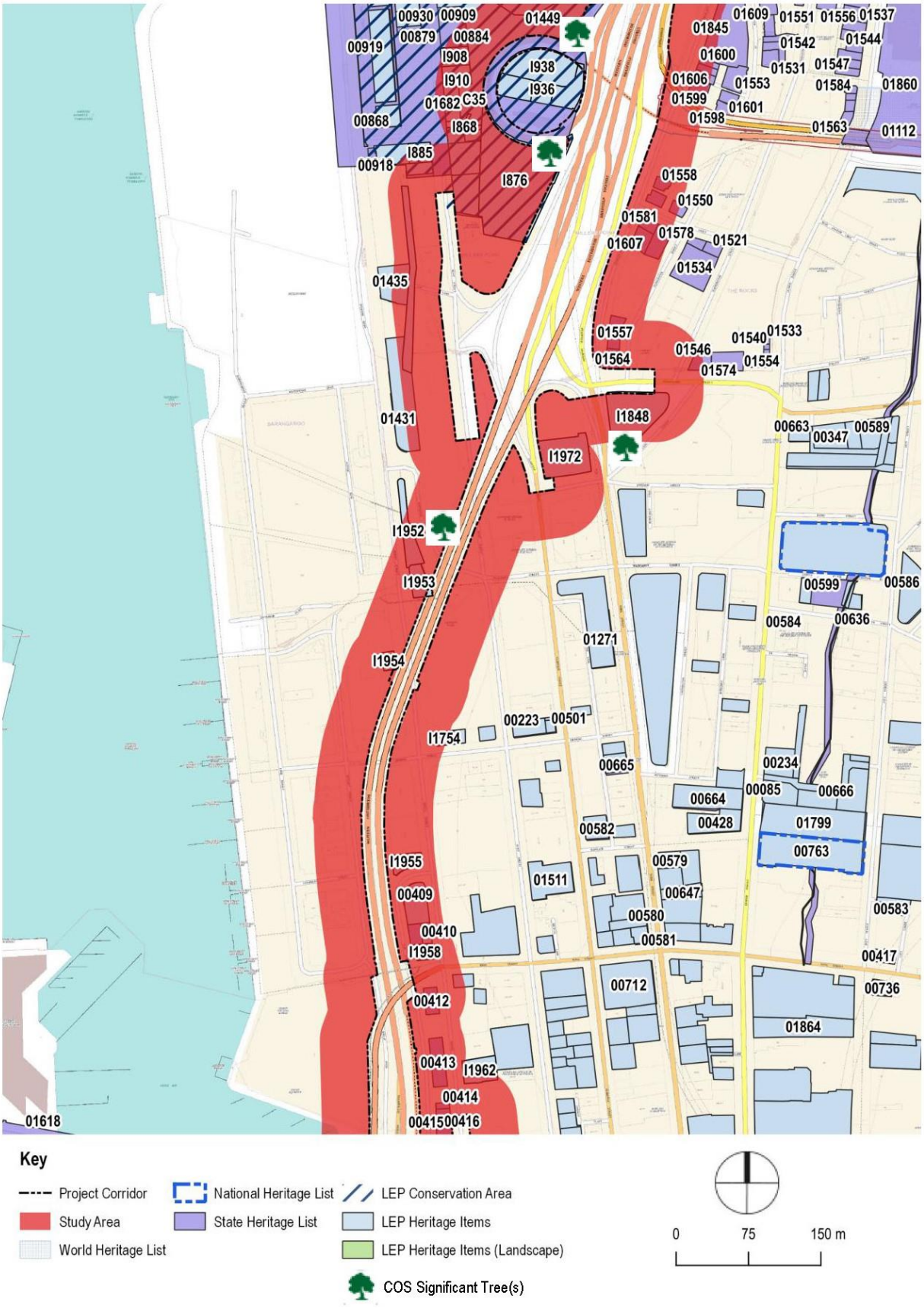


Figure 6-10: Heritage items – map 4

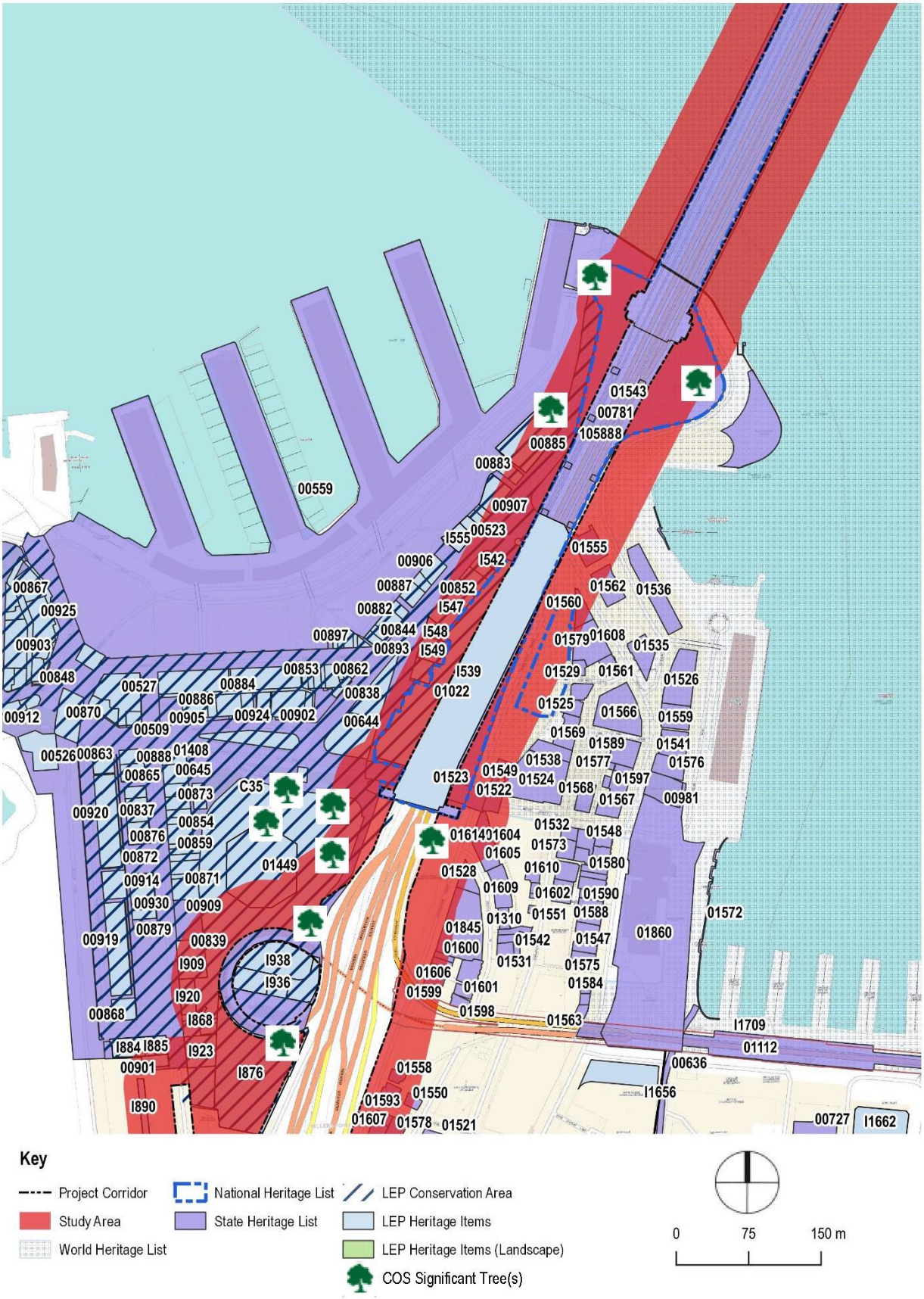


Figure 6-11: Heritage items – map 5

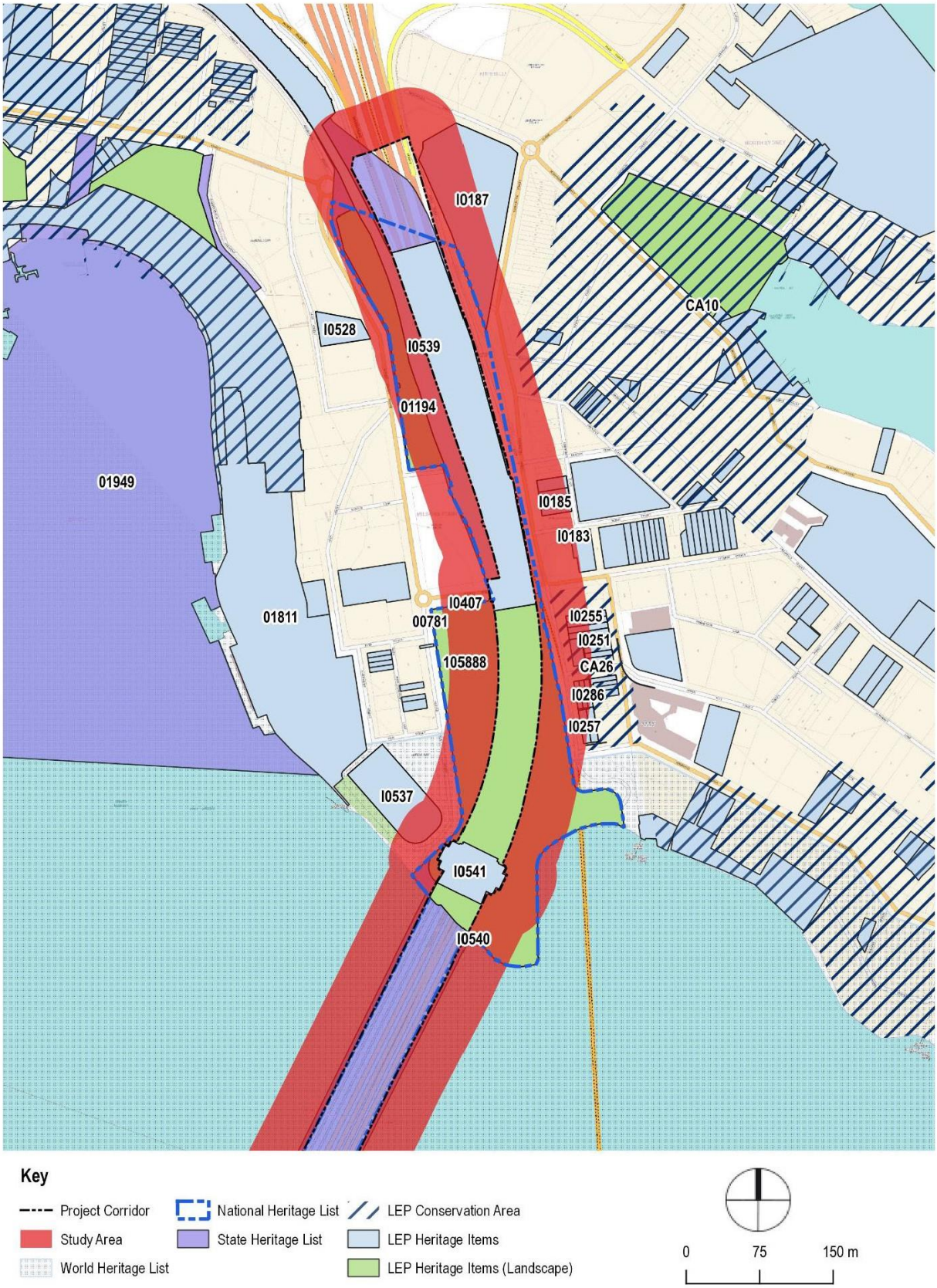


Figure 6-12: Heritage items – map 6

Non-statutory listings / recognition

The Sydney Harbour Bridge also has several non-statutory heritage listings as follows:

- National Trust of Australia (NSW) – Register of the National Trust of Australia (NSW)
- Australian Government – Register of the National Estate
- Australian Institute of Architects – Register of Significant Buildings in NSW
- Engineering Heritage Australia – National Engineering Landmark
- American Society of Civil Engineers – International Historic Civil Engineering Landmark

Archaeological potential

The following areas that may have archaeological potential and which could be affected by ground works, were identified as part of the desktop assessment:

- Areas to the east of the Bridge Road / Western Distributor interchange, Pyrmont, where disturbance would not be limited to the footprint of existing infrastructure or areas of known impact.
- Areas to the north and south of the Western Distributor near Harris Street and Upper Fig Street, Pyrmont, where disturbance would not be limited to the footprint of existing infrastructure or areas of known impact.
- Pyrmont Street, Pyrmont, where disturbance would not be limited to the footprint of existing infrastructure or areas of known impact.
- Eastern side of the Western Distributor on Clarence Street near the intersection with Jamison Street. 43 Clarence St was identified in the archaeological zoning plan (Lavelle & Mider, 1992) as having been previously disturbed but retaining the potential for archaeological remains
- 20 Grosvenor Street in the north of the Sydney CBD. Moderate disturbance but potential for archaeological evidence from the 1820s.
- 125 Kent Street, Millers Point. Identified in archaeological management plan as having had buildings by the 1820s, with later widening and the current road encroaching on former town allotments, including Lease No. 11 to Captain Waterhouse by 1807. Disturbed but potential for archaeological evidence from the 1820s.
- West of the Bradfield Highway, Millers Point. Land associated with a Military Hospital (1815) and Model School (1849) identified in the archaeological management plan (Higginbotham, Kass, & Walker, 1991) as being only partially disturbed
- Areas near State Heritage Register listed Royal Botanic Gardens and Domain
- Areas near the intersection of Macquarie Street and Bridge Street. Close to State Heritage Register listed Royal Botanic Gardens and Domain. Areas near a building that was identified in the archaeological zoning plan as having archaeological potential with deeper sub-surface features (99-113 Macquarie Street). Areas on Bridge Street may be within the archaeological footprint of the former Treasury Building.

6.3.3 Potential impacts

The proposal corridor extends along existing road corridors that contain a wide range of extant road infrastructure, including gantries, signage and traffic control devices. Much of the proposed work involves replacing and upgrading existing infrastructure, generally with limited or no heritage impact. The project also involves the removal of some existing infrastructure, with a potential positive impact where the infrastructure is located near heritage items or within

conservation areas. However, the proposal also involves the installation of new infrastructure in locations that have the potential for new heritage impacts.

The proposal has been designed with heritage input that has generally resulted in the impact of the works being avoided. One non-Aboriginal heritage item may still be potentially impacted by the proposal, being the Sydney Harbour Bridge

Impacts on Sydney Harbour Bridge

The heritage values of the Sydney Harbour Bridge would be retained and not substantially affected by the proposal. However, there would be some minor adverse impacts resulting from proposed new infrastructure on the approaches and main bridge structure (refer Figure 3-9 to Figure 3-15), and changes to the visual setting of the bridge.

The proposed works within the statutory curtilage of Sydney Harbour Bridge (which includes its approaches and pylons) involve new dynamic signage replacing existing static signage on existing gantries, located at various locations on the bridge and approaches. The introduction of new fabric to the bridge would be clearly visible, because the gantries and signage already exist in these locations and the proposed signage is not substantially larger than the existing, the impact of these works has been assessed as moderate to moderate-high visually but as minor non-Aboriginal heritage impact. The change in views due to Gantry 24 and Gantry 25 is shown by Figure 6-13.

	
Existing view of gantry location 24	Proposed view of gantry location 24
	
Existing view of gantry location 25	Proposed view of gantry location 25

Figure 6-13: Visual change due to Gantry 24 and Gantry 25

Works proposed near the bridge and in its wider visual catchment include a new gantry (Gantry 18), signage, directional devices and incident detection equipment. These are generally located such that significant views are retained. Some distant views on the southern approach to the bridge would be impacted by the proposed Gantry 18; however, these approach views are less iconic and still retained north of the gantry. The impact of these works has been assessed as moderate to moderate-high visually but as minor non-Aboriginal heritage impact. The change in views due to Gantry 18 is shown by Table 6-17.

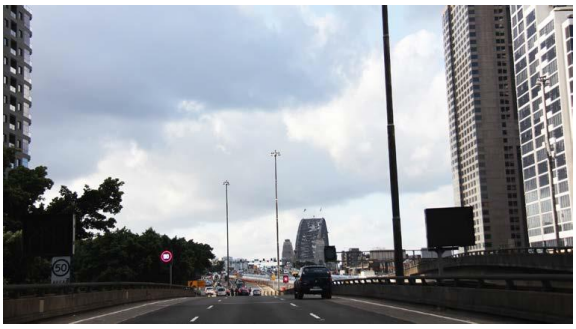
	
Existing view of gantry location 18	Proposed view of gantry location 18

Table 6-17: Visual change at gantry 18 location

There has been considerable effort in recent years to reduce supplementary and additional infrastructure on the bridge itself (including gantries and previous signage) to reduce visual clutter and reinforce the experience of crossing the bridge. The proposal would implement new signage on existing gantries on the approaches to the bridge (Gantries 24 and 25). While better than introducing new structures onto the main bridge span itself, these new signs do alter and impede views to the bridge on the approaches, which is an adverse impact.

Additional gantries, infrastructure and elements have been added to the bridge throughout its history to accommodate operational changes, security upgrades, changes in road user requirements, etc. The proposal would help maintain and improve the bridge's vital role as the main Sydney Harbour vehicular crossing and there would be no significant fabric removed. It is concluded that the impact of the proposal on the Sydney Harbour Bridge would have minor adverse impact.

The proposal is in accordance with the Sydney Harbour Bridge Conservation Management Plan (Godden Mackay Logan, 2007) Conservation Policy 21.1:

New work must aim to enhance the functional effectiveness and use of the SHB as the main Sydney Harbour vehicular crossing without obscuring or adversely affecting the integrity of the original design, significant fabric or its heritage values.

The proposal is consistent with the site-specific exemptions issued by the NSW Heritage Council which include:

(b) minor modification to road, rail, navigational and other service operating infrastructure on the bridge and approaches;

(c) operation of rail service, traffic management and toll collection infrastructure on the bridge and approaches;

(e) installation of signage not being for commercial or advertising purposes.

As such, no further approvals are required for the potential non-Aboriginal heritage impacts.

Neutrally impacted items

Detailed heritage impact assessments were carried out for all other items within the proposal corridor (refer to Table 6-18). In all cases the potential heritage impacts are limited to the indirect visual impacts or impacts on the setting and were identified as neutral.

Table 6-18: Review of potential impacts on other items

ID	Name	Impact	Comment
I0187	Greenway Flats	Neutral	Nearby works limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Bradfield Highway to the west of the building. As the gantry and

ID	Name	Impact	Comment
			signage already exist in this location (which is a substantial distance from the Greenway Apartments), the impact of these works on the setting of Greenway is neutral.
I0185	St John the Baptist Anglican Church	Neutral	Nearby works are limited to renewed signage on an existing gantry, and additional traffic management and incident detection infrastructure, located on the Cahill Expressway to the west of the building. Broughton Street and the church are set below the motorway and only the roof of the church is visible above the bridge approaches. As the gantry and signage already exist in this location, and the signage is not substantially larger than the existing, the impact of these works on the setting of the church is neutral.
01194 4801026 I0539	Milson Point Railway Station Group	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Warringah Freeway to the north and south of the station. As the gantries and signage already exist in this location, and the signage is not substantially larger than the existing, the impact of these works on the setting of the station is neutral.
I0538	Bradfield Park (including northern section)	Neutral	Nearby works limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the park. The gantries and signage already exist in this location, and the new signage is not substantially larger than the existing. The impact of these works on the setting of the park is neutral.
01543	Dawes Point Battery Remains	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the site. The gantries and signage already exist in this location, and the new signage is not substantially larger than the existing. The impact of these works on the setting of the site is neutral.
	Dawes Point Heritage Precinct	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the Precinct. The impact of these works on the setting of the Precinct is neutral.
01682 C35	Millers Point and Dawes Point Village Precinct Millers Point/Dawes Point Heritage Conservation Area	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the Precinct. The impact of these works on the setting of the Precinct is neutral.

ID	Name	Impact	Comment
00884	Millers Point Heritage Conservation Area	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the Conservation Area. The impact of these works on the setting of the Conservation Area is neutral.
	The Rocks Heritage Conservation Area	Neutral	Nearby works limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the Conservation Area. The impact of these works on the setting of the Conservation Area is neutral.
01555	Mining Museum (Former)	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the building. The impact of these works on the setting of the building is neutral.
01022 4800006	The Argyle Street Railway Substation (and Switchhouse)	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above these buildings. The impact of these works on the setting of these buildings is neutral.
4801821	The Rocks (Argyle Street) Railway Underbridge	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the Arch. The impact of these works on the setting of the Arch is neutral.
01523	Argyle Cut	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the Cut. The impact of these works on the setting of the Cut is neutral.
01522	Argyle Bridge	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches that are elevated above the Argyle Bridge. The impact of these works on the setting of the Argyle Bridge is neutral.
01449 I934	Sydney Observatory	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the Observatory. These works are not located within the curtilage of the Observatory and sufficiently separated to ensure that they will not impact on views of the heritage item.
I935	Observatory Park including Boer War Memorial, Bandstand,	Neutral	are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the Observatory Park.

ID	Name	Impact	Comment
	fences and landscaping		These works are not located within the curtilage of the Observatory Park and sufficiently separated to ensure that they will not impact on views of the heritage item.
I936	Bureau of Meteorology including interior	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the building. These works are sufficiently separated such that they will not impact on views of the heritage item.
I937	Messengers Cottage for Sydney Observatory including interior	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the cottage. These works are sufficiently separated such that they will not impact on views of the heritage item.
I938	Fort Street Primary School	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the School. These works are sufficiently separated such that they will not impact on views of the heritage item.
I1876	National Trust Centre including buildings and their interiors, retaining walls and grounds	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the Centre. These works are sufficiently separated such that they will not impact on significant views of the heritage item.
I923	House “Richmond Villa”	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the Villa. These works are sufficiently separated such that they will not impact on the heritage item.
I925	Terrace Group “Glover Cottages”	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the east of the Cottage. These works are sufficiently separated such that they will not impact on the heritage item.
01606	Terrace	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Terrace. These works are sufficiently separated such that they will not impact on the heritage item.
01592	Terraces	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Terraces. These works are sufficiently separated such that they will not impact on the heritage item.

ID	Name	Impact	Comment
01592	Shops and Residences	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Shops and Residences. These works are sufficiently separated such that they will not impact on the heritage item.
1599	Tenements	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Tenements. These works are sufficiently separated such that they will not impact on the heritage item.
	Longs Lane Precinct	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Precinct. These works are sufficiently separated such that they will not impact on the heritage precinct.
01598	Tenements	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Tenements. These works are sufficiently separated such that they will not impact on the heritage item.
I1848	Lang Park including plaques, fountain and archaeology	Neutral	Nearby works include removal and/or alterations to existing signs, installation of new signs on the Sydney Harbour Bridge exit roads, and other traffic management and incident detection infrastructure. These would not be dissimilar to the current context for Lang Park.
01558	Lilyvale	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Cottage. These works are sufficiently separated such that they will not impact on the heritage item.
01593	Shop and Residences	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Shops and Residences. These works are sufficiently separated such that they will not impact on the heritage item.
01581	Shop and Residence	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Shops and Residence. These works are sufficiently separated such that they will not impact on the heritage item
01607	Terraces	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the Sydney Harbour Bridge and approaches to the west of the Terrace.

ID	Name	Impact	Comment
			These works are sufficiently separated such that they will not impact on the heritage item.
01557	Lawson House	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the southern approach to the Sydney Harbour Bridge to the west of Lawson House. These works are sufficiently separated such that they will not impact on the heritage item.
01564 B090 AR121	NSW Housing Board Building (former)	Neutral	Nearby works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the entry and exit ramps to the Sydney Harbour Bridge to the south and west of the building. These works are sufficiently separated such that they will not impact on the heritage item.
I1972	St Philip's Church of England including interior and grounds	Neutral	Nearby works are limited to renewed signage located to the south of the Church. The size of the new sign is not substantially different from the existing so it would have a neutral impact on the Church.
0513 I1952	Big House Hotel (Former "New Hunter River Hotel" including interiors)	Neutral	Proposed works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the approach to the Sydney Harbour Bridge to the east and elevated above the building. These works are sufficiently separated such that they will not impact on the heritage item.
I1954	Former MWS&B pumping station	Neutral	Proposed works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the approach to the Sydney Harbour Bridge to the east and elevated above the Pumping Station. These works are sufficiently separated such that they will not impact on the heritage item
I1955	"Bristol Arms" Hotel including interior	Neutral	Proposed works are limited to renewed signage on existing gantries, and additional traffic management and incident detection infrastructure, located on the southern approach to the Sydney Harbour Bridge to the west and elevated above the building. These works are sufficiently separated such that they will not impact on the heritage item.
I1956	Former "Hawken & Vance Produce Exchange" facades and exterior form	Neutral	are limited to new signage on a new gantry (Gantry 16) located on the southern approach to the Sydney Harbour Bridge to the southwest beside the building. These works are sufficiently separated and screen by extant trees such that they will not impact on the heritage item.
I1957	Former "Cuthbert's Patent Slip" warehouse including interiors	Neutral	are limited to new signage on a new gantry (Gantry 16) located on the southern approach to the Sydney Harbour Bridge to the west beside the building. These works are sufficiently separated and screen by extant trees such that they will not impact on the heritage item.

ID	Name	Impact	Comment
00411 I1958	Royal George Hotel	Neutral	are limited to new signage on a new gantry (Gantry 16) located on the southern approach to the Sydney Harbour Bridge to the west beside the building. These works are sufficiently separated and screen by extant trees such that they will not impact on the heritage item.
00413	Warehouses (former)	Neutral	No proposed works in the vicinity of 139-153 Sussex Street.
00416	Dundee Arms	Neutral	There are no proposed works in Sussex Street adjacent the Dundee Arms.
01619	Corn Exchange	Neutral	There is no proposed works in the vicinity of the Corn Exchange.
01618	Pyrmont Bridge	Neutral	Nearby proposed works include traffic control devices and signs on the Motorway, which is directly adjacent to the bridge. There are no works proposed within the Bridge's curtilage. The works on the motorway are sufficiently separated from the bridge to ensure that there is no impact on its setting or views.
C69	Ultimo Heritage Conservation Area	Neutral	There are no works proposed within the Ultimo Conservation Area.
I1205	Former industrial building elements and industrial components "Edwin Davey & Sons Flour Mill"	Neutral	The proposed works near the Flour Mill include two new gantries (Gantry 4 and 5) on the Motorway to the north east and traffic control devices. These works are located at a sufficient distance to ensure that they do not impact on the former Flour Mill.
1	Glebe Island Wheat Silos	Neutral	Nearby proposed works include new gantries and traffic control devices on the Anzac bridge and its approaches. These works are elevated and sufficiently separated from the Grain Terminal to ensure they have no impact.
01015 11 74	White Bay Power Station	Neutral	Nearby works are limited to the new gantries and ITS infrastructure on the Anzac Bridge, which would have very limited visibility.

6.3.4 Safeguards and management measures

Table 6-19: Non-Aboriginal heritage environmental management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Contactor	Detailed design Pre-construction	QA G36 Environment Protection

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime Services, 2015) will be followed in the event any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contactor	Construction	Section 4.10 of QA G36 Environment Protection
Non-Aboriginal heritage	Further assessment of potential archaeological impacts will be carried out following refinement of proposed ground disturbance areas. This will include identification of any permit requirements under the *Heritage Act 1977*.	Transport for NSW	Detailed design	Additional measure

6.4 Noise and vibration

6.4.1 Methodology

Noise

The proposal has the potential to affect the community due to noise and vibration during construction. The following methodology has been implemented to assess the impacts. For construction noise impacts from the proposed activity, the Transport for NSW Construction Noise Estimator Tool based on the Roads and Maritime (now TfNSW) Construction Noise and Vibration Guideline (2016) was used. The following key tasks were completed during assessment:

- Identification of representative background noise levels
- Identification of the noise management level (NML)
- Identification of type of sensitive receivers
- Identification of the noise impacts
- Identification of feasible and reasonable additional mitigation measures

Construction Noise Estimator was used to identify an appropriate background noise level and NML for each time period of proposed works. Common receivers were grouped into noise catchment areas (NCA) for construction noise assessment. NCA combines the receivers affected by the same works to assist with assessment, consultation or notification. NCAs are the areas that are affected by the same works and located at similar distances from the noise generating activity.

The assessment focused on the worst-case noise-producing scenarios during construction near sensitive receivers. The distance based (scenario) worksheet in the noise estimator tool was used and the following scenarios were assessed as night work:

- Bridge works (includes bored piling, welding equipment, generator, mobile crane and concrete truck)
- Paving / asphalting (includes trucks, pavement laying machine, roller and concrete saw).

The output of the assessment can be found in sections below and Appendix G.

Vibration

Potential vibration impacts of the proposal are assessed in accordance with the Roads and Maritime Services (now Transport for NSW) Construction Noise and Vibration Guideline (2016) which estimates the minimum safe working distances for common construction plant. These estimates are based on:

- BS 7385-2: British Standard – Evaluation and measurement for vibration in buildings – Part 2 Guide to Damage Levels from Ground-borne Vibration (addresses potential structural damage to buildings, in general, from ground-borne vibration)
- DIN 4150-3: *German Standard – Vibrations in building – Effects on structures* (addresses potential structural damage to heritage buildings from ground-borne vibration).

6.4.2 Existing environment

The areas surrounding the proposal corridor mainly include commercial and residential receivers with some individual non-residential noise sensitive receivers.

Most residential receivers near the proposal corridor are in the suburbs of Pyrmont, Ultimo, The Rocks and Circular Quay, with residential towers and some isolated residential premises scattered throughout the Sydney CBD. Residential premises within Pyrmont, Ultimo and The Rocks are in the form of medium to high density housing, whereas residences in Circular Quay are generally high-rise apartments.

Noise sensitive receivers (represented by NCAs) identified as being potentially worst affected by proposal (and which have been used for assessment) are identified in Figure 6-14 and

Table 6-20.

Figure 6-14: Location of noise sensitive receivers (worst affected) (Note: this figure depicts an outdated proposal area. Refer to Figure 1-2 for an accurate proposal depiction)

Table 6-20: Noise sensitive receivers and existing noise environment

ID	Type	Location	Noise Environment
3	Residential	55 Pyrmont Bridge Road, Pyrmont	Ambient noise is dominated by road traffic, noise from birds is also noticeable.
4	Residential	320 Harris Street, Pyrmont	Road traffic from M1 dominant noise with some ambient noise from residents across the way on balconies and some birds.
5	Residential	320 Harris Street, Pyrmont	Ambient noise dominated by road traffic with some construction being undertaken on Sussex Street nearby.
6	Child care	Honey Bee Child Care, 201 Sussex St, Sydney	Heavy road traffic is dominant noise source with some people sounds and pedestrian noise
7	Residential	157-161 Gloucester Street, The Rocks	M1 road traffic noise is dominant with intermittent noise from patrons on balcony.
8	Residential	Upper Fort Street, Millers Point	Noise from road traffic is dominant, with some ambient bird noise.
9	Education	Fort Street Public School, 1005 Upper Fort St, Millers Point	Heavy traffic is dominant noise source with some people talking nearby.

6.4.3 Criteria

Construction noise criteria

Noise management levels (NMLs) for the proposal were established in accordance with the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009). The guideline prescribes noise management goals for receivers. As a guide, construction noise for residential receivers should not exceed the background noise levels by more than 10 dB(A) during standard hours, and by more than 5 dB(A) out-of-hours (that is, for evening and night-time work). The level of 75 dB(A) is identified as the point above which noise receivers are expected to be highly affected and there may be a strong community reaction to construction noise.

The project specific NMLs for the sensitive receivers identified for the proposal are provided in Table 6-21. Relevant noise management levels for non-residential receivers are also provided. The noise area category R4 from the Construction Noise Estimator was selected as the representative noise area category for all identified residential receivers. This is based on observations that the noise environment at all locations was dominated by transportation noise, namely the M1 Motorway, which has average daily traffic volumes of over 50,000 vehicles along the proposal extent.

Table 6-21: Noise management levels

Receiver type	Assessment period	RBL (db LA_{90})	NML (db LA_{eq})
Residential	Standard hours	55	65
Residential	Out-of-hours Period 1[1]	50	55
Residential	Out-of-hours Period 1[2]	45	50
Commercial	When in use	N/A	70

Receiver type	Assessment period	RBL (db LA_{90})	NML (db LA_{eq})
School classrooms	When in use	N/A	55[3]

[1] Out-of-hours Period 1: Monday to Friday 6pm to 10pm, Saturday 7am to 8am and 1pm to 10pm, Sunday / Public Holiday 8am to 6pm

[2] Out-of-hours period 2: Monday to Friday 10pm to 7am, Saturday 10pm to 8am, Sunday / Public Holiday 6pm to 7pm

[3] Assumed equivalent external noise level with windows open.

Construction traffic noise criteria

When construction related traffic moves onto the public road network, vehicle movements are regarded as additional road traffic and are assessed under the Road Noise Policy (Department of Environment, Climate Change and Water, 2011). An initial screening test is applied by evaluating if noise levels would increase by more than 2 dB (an increase in the number vehicles of approximately 60 per cent) due to construction traffic or a temporary detour due to a road closure.

Construction vibration criteria

As a guide, safe working distances for the proposed items of vibration intensive plant are provided in the Construction Noise and Vibration Guideline (Roads and Maritime Services, 2016). Safe working distances to achieve the DIN 4150.3 criteria for heritage structures are about double the safe working distance for cosmetic damage.

Table 6-22: Minimum working distances for relevant vibration intensive plant

Plant item	Rating / description	Cosmetic damage (BS7385)	Heritage item (DIN 4150)	Human response
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5m	14m	15m to 20m
	< 100 kN (Typically 2-4 tonnes)	6m	16m	20m
	< 200 kN (Typically 4-6 tonnes)	12m	33m	40m
	< 300 kN (Typically 7-13 tonnes)	15m	41m	100m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2m	5m	7m
Pile boring	≤ 800 mm	2m (nominal)	5m	4m
Jackhammer	Hand held	1m (nominal)	2m	2m

Sleep disturbance

The maximum noise level assessment (sleep disturbance) criterion of 65dB LA_{max} is established in accordance with the Transport for NSW Environmental Impact Assessment Procedure: Preparing an Operation Traffic and Construction Noise and Vibration Assessment Report. This criterion relates to both operational phase and construction phase sleep disturbance impacts.

Operational road traffic noise criteria

The NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011) sets out road traffic noise criteria for residential land uses.

Under the Noise Criteria Guideline (Roads and Maritime Services, 2015), the proposal is classified as minor work. The Noise Criteria Guideline states that the existing road criteria may

be applied where minor work increases noise levels by more than 2.0 dB(A) relative to existing noise levels at the worst affected receiver. Where the total noise level for the 'build' year exceeds the criterion, and there is an increase of more than 2.0 dB(A) (i.e. 2.1 dB(A)), relative to the 'no-build' year, then the receiver should be considered for provision of noise mitigation.

6.4.4 Potential impacts

Construction

The Transport for NSW Construction Noise Estimator tool was used to assess the noise impacts during construction from use of the proposed compound site, gantry works and paving / asphalting.

Based on the selected noise area category, construction noise estimator tool produced representative background noise levels (L90) together with the noise management levels (NML). These values are recorded in Table 6-21.

The distance based assessment (scenario) was selected for assessment as it considers a number of plant items operating together during a certain construction activity.

The noise estimator tool produced predicted noise levels at different locations for the residential receivers near work locations. The results of the construction noise assessment are summarised in the Table 6-23 below and shown in Figure 6-15. The closest receivers in each NCA have a direct line of sight to the noise source, while other receivers in each NCA are located behind the rows of other buildings. It can be seen from the table that NCAs 3-5, 7-8 would have noise levels exceeding NML. Hence a number of additional safeguards will be applied to mitigate the impacts.

It is expected that most works near NCA 6 (child care centre) and NCA 9 (Fort Street Public School) would occur at night when these facilities are not in use.

Table 6-23: Construction noise assessment results

Catchment distances	NML, dB(A) (night)	Noise levels dB(A) above background	Distance NML exceeded dB(A)	Recommended additional mitigation measures
NCA3 (*25m*) (bridgeworks) – in line of sight	50	>30 (highly intrusive)	500	AA, N, PC, SN, R2, DR
NCA3 (*25m*) (bridgeworks) – behind the rows of buildings	50	20-30 (moderately intrusive)	330	N, PC, SN, R2, DR
NCA4 (*40m*) (bridgeworks) – in line of sight	50	>30 (highly intrusive)	500	AA, N, PC, SN, R2, DR
NCA4 (*40m*) (bridgeworks) – behind the rows of buildings	50	20-30 (moderately intrusive)	330	N, PC, SN, R2, DR
NCA5 (*85m*) (paving) – in line of sight	50	10-20 (clearly audible)	280	N, R2, DR
NCA7 (*35m*) (bridgeworks)– in line of sight	50	>30 (highly intrusive)	500	AA, N, PC, SN, R2, DR
NCA8 (*95m*) (bridgeworks) – in line of sight	50	20-30 (moderately intrusive)	500	N, PC, SN, R2, DR

Figure 6-15: Construction noise assessment results (Note: this figure depicts an outdated proposal area. Refer to Figure 1-2 for an accurate proposal depiction)

Review of construction noise mitigation

On the basis of the construction noise calculations, the Construction Noise Estimator has recommended additional mitigation measures from Appendix C of the Construction Noise and Vibration Guideline. These are reviewed in Table 6-24.

Table 6-24: Review of additional noise mitigation measures

Code	Measure	Description	Comment
N	Notification	Letterbox drop (or equivalent) detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification occurs a minimum of five working days prior to the start of works.	Notification is proposed for residences within the following distances: • 405m of compound • 440m of gantry works in NCA2 • 330m of gantry works in Pyrmont and Ultimo • 280 metres of paving works • 330 metres of gantry works near Kent Street
SN	Specific notification	Letterbox drop (or equivalent) to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. The specific notification provides additional information when relevant and informative to more highly affected receivers than covered by the standard notification.	Not considered reasonable to undertake separate notifications for this proposal as this may cause confusion. Instead, a single coordinated message should be delivered to the affected community.
PC	Phone calls	Phone calls detailing relevant information made to identified / affected stakeholders within seven calendar days of proposed work.	Not considered practical in this case due to high density of receivers, which includes apartment buildings.
IB	Individual briefings	Project representatives visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities.	Not considered practical in this case due to high density of receivers, which includes apartment buildings.
RO	Respite offer	Proposes that works should be carried out in continuous blocks that do not exceed three hours each, with a minimum respite period of one hour between each block. The purpose of such offer is to provide residents with respite from an ongoing impact.	Not proposed during evening and night works as the stopping and restarting of work may be a nuisance to residents during those periods. R1 and R2 to apply to evening and night works.
R1	Respite period 1	Evening works limited to no more than three consecutive evenings per week, separated by not less than one week and no more than six evenings per month except where duration respite occurs.	Works prefer implementation of duration respite.
R2	Respite period 2	Night works limited to two consecutive nights separated by not less than one week and no more than six nights per month except where duration respite occurs.	Works prefer implementation of duration respite.

Code	Measure	Description	Comment
DR	Duration respite	Used where respite periods cannot be implemented. Involves increase in the work duration (number of evenings or nights worked) so that the project can be completed more quickly.	Preferred for the proposal to reduce the overall construction duration to about 18 months and facilitate efficient programming of works during delivery.
V	Verification	Measurement of the background noise level and construction noise. Followed by consideration of further mitigation.	Proposed in response to any construction noise related complaints.
AA	Alternative accommodation	Offer of alternative accommodation to residents living near construction works.	Not considered practical in this case due to high density of receivers, which includes apartment buildings.

Construction traffic noise

The peak expected construction traffic associated with the proposal is anticipated to be less than 50 light vehicle and 10 heavy vehicle movements per night. The night time period has been identified as the critical period of this assessment due to the increases sensitivity of the community to noise, as well as need for substantial works to take place at night to minimise traffic disruption.

Examination of the existing traffic flows along the Western Distributor shows that the addition of the construction traffic onto the Western Distributor would result in a negligible increase of traffic volumes and as such, construction traffic impacts are also expected to be negligible.

Construction vibration

Primary sources of construction vibration may be vibratory rollers, bored piling and jackhammering.

Construction plant would be selected to ensure minimum safe working distances set by the Construction Noise and Vibration Guideline (Roads and Maritime Services, 2016) are complied with where possible, in relation to cosmetic damage, heritage structures and human response to vibration. If minimum safe working distances cannot be complied with, additional measures including vibration monitoring would be implemented.

Operation

The proposal would not attract higher traffic volumes to the proposal corridor or reduce the distance between traffic and sensitive receivers. The benefits of the smart motorway included improved traffic flow may reduce the amount of congestion-related noise pollution including compression braking and honking though this may be balanced by the increased noise produced by improved travel speeds. It is not expected that road traffic noise levels would increase by more than 2 dBA and therefore operational noise mitigations have not been considered.

6.4.5 Safeguards and management measures

Table 6-25: Noise and vibration environmental management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction noise and vibration	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP.	Contractor	Pre-construction	Section 4.6 of QA G36 Environment Protection

Impact	Environmental safeguards	Responsibility	Timing	Reference
	The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: • all potential noise and vibration generating activities associated with the activity • feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement: urban design policy, process and principles (Transport for NSW, 2014) • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.			
Construction noise	All sensitive receivers likely to be affected will be notified at least five working days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: • the project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information.	Contractor	Pre-construction	Standard measure
Construction noise	Noisy works such as sawcutting and jackhammering to be completed by midnight	Contractor	Construction	Standard measure

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction noise	Noise curtains are to be placed between sources of construction noise and sensitive receivers during night works where noise sources are stationary and near to the ground.	Contractor	Construction	Additional measure

Construction vibration	Prior to the start of construction, a Ground Vibration Risk Assessment shall be carried out by a suitably qualified person to identify all vibration generating tasks, duration and predicted vibration levels and to determine reasonable and feasible vibration mitigation and management measures to address the potential impacts of ground vibration on adjacent buildings during construction. The assessment shall also identify which properties contain buildings which would require building condition surveys. The Vibration Risk Assessment must include (as a minimum): i. Identification of construction ground vibration criteria under BS7385 and DN4150 as described in this REF. ii. Identification of the ground type and topography in the vicinity of the works location (in terms of its susceptibility to ground vibration); iii. Identification and description of potentially affected buildings on adjacent properties which may be impacted by ground vibration during construction; iv. Identification of the types of activities to be carried out (including compound sites and active work sites), machinery and equipment to be used, including the predicted vibration emission levels from each plant and the required buffer distances needed between the machinery/equipment and potentially affected buildings; v. A risk assessment to determine the potential for discrete work	Contractor	Construction	Additional measure

Impact	Environmental safeguards	Responsibility	Timing	Reference
	activities to affect buildings on adjacent properties; vi. An assessment of the potential vibration impacts on the potentially affected buildings on adjacent properties due to vibration; vii. A map indicating the buildings on adjacent properties considered likely to be impacted by ground vibration and those requiring building condition inspections; viii. Details on which buildings on adjacent properties will require building condition surveys; ix. Identification of potential mitigation measures to be incorporated during construction to address round vibration impacts on buildings.			

Construction vibration	Based on the results of the Ground Vibration Risk Assessment, a Ground Vibration Management Plan must be prepared prior to construction as part of the CEMP to address how construction will be carried out to minimise the impact of ground vibration on affected buildings within adjacent properties. The Vibration Management Plan must detail how construction vibration will be managed for various plant items working adjacent to the potentially affected buildings (as identified in the Vibration Risk Assessment). The Plan must show the locations of all occupied and unoccupied buildings which are potentially impacted on surrounding properties (including relevant heritage items) on a map, and provide details of control measures to be undertaken during construction, including: a) Identification of all vibration generating tasks, duration and predicted vibration levels (based on the Vibration Risk Assessment); b) A schedule of properties where building condition inspections are required to be undertaken (based on the Vibration Risk Assessment); c) Location and type of mitigation measures to reduce excessive ground vibration such as: • Maximising the offset distance between high vibration plant items and nearby buildings;	Contractor	Construction	Additional measure

- Substitution by alternative equipment, plant and processes;
- Screening or enclosures;
- Restricted times when work is being carried out;
- Work setback distances, for example different vibration levels and machinery;
- Consultation with affected residences and business owners;
- Orienting equipment away from vibration-sensitive areas; and
- Selecting site access points and roads as far as possible from sensitive receptors.

d) Specific physical and managerial measures for controlling ground vibration to comply with the relevant OEH guidelines and best practice;

e) Vibration monitoring, reporting and response procedures;

f) Procedures for notifying residents and business premises about vibration-generating activities likely to affect buildings on their property;

g) Contingency plans to be implemented in the event of non-compliances and/or vibration complaints;

Procedures for regularly reviewing the effectiveness of the Vibration Management Plan;

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction vibration	Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site shall be undertaken in relation those properties identified as being particularly sensitive to ground vibration (as identified in the Vibration Risk Assessment) prior to their commencement of construction to validate the acceptable buffer distances to the nearest affected receiver locations.	Contractor	Construction	Additional measure
Construction vibration	Building conditions surveys shall be conducted at receivers determined, by the Contractor, to be sensitive to ground vibration impacts. The determination should be based on the results of a Vibration Risk Assessment plan for the project prior to construction, where the results of this will also feed into the Vibration Management Plan. These measures are to address potential community concerns that perceive vibration may cause damage to building.	Contractor	Construction	Additional measure

6.5 Other impacts

6.5.1 Existing environment and potential impacts

Table 6-26: Existing environment and potential impacts – other issues

Environmental factor	Existing environment	Potential impacts
Soils and water	The soil landscape broadly replicates the underlying geology whereby three soil landscapes underlie the proposal footprint. Most of the proposal corridor is underlain by Gymea soil, comprising moderately deep yellow earthy sands and shallow silicon-based sands. The exceptions include: • Disturbed Terrain. A soil type created by manmade fill of waste materials capped with a sandy loam or compacted clay over fill. • Deep Creek. A fluvial soil landscape, comprising deep podzolic soils on well-drained terraces. The foreshore areas of Blackwattle Bay and Darling Harbour are identified as disturbed terrain. Assessment of environmental risk in areas of disturbed terrain requires soil investigation based on the nature of the existing land disturbance and elevation of the site.	There is the potential soil disturbance associated with excavation of sign footings (where required), however quantities of spoil generated would be small. Potential impacts on surface water and hydrology during construction of the proposal would include: • Release of sediment to waterways and drainage lines during earthworks • Temporary changes to onsite drainage • Localised inundation of work sites during high rainfall events • Pollution as a result of fuel or oil spills. Given the minor nature of ground disturbance proposed, it is considered that the potential for the release of sediments off site is minimal provided the implementation of appropriate controls. Risk associated with potential acid sulfate soils in areas of disturbed terrain are considered manageable.
Contamination	The proposal corridor traverses over or within 30 metres of several significant waterbodies including Sydney Harbour, Cockle Bay and Blackwattle Bay. The search of the NSW Environment Protection Authority contaminated land record identified two sites within one kilometre of the proposal corridor: • Decommissioned Pyrmont Power Station at Pyrmont Road • Former AGL Gasworks, Hickson Road, Millers Point	The preliminary site investigation suggests that encountering extensive contamination within the proposal footprint is unlikely. Interaction with known contaminated sites is not expected. Construction activities such excavation could pose potential health risks and impacts to construction workers, nearby residents and the surrounding environment due to: • Direct contact with or ingestion of impacted surface or near surface soils by construction workers during the

Environmental factor	Existing environment	Potential impacts
	A review of contaminated sites notified to the Environment Protection Authority identified no sites within the proposal corridor, but the following nearby sites: • Interpro House (447 Kent Street) – other petroleum – regulation not required • Former AGL Gasworks, Hickson Road, Millers Point – regulation not required or being managed via EP&A Act planning processes. A review of historical aerial photography indicated that within the proposal footprint there were changes consistent with what would be expected from a major city (e.g. precinct redevelopment, major road constructions, land/waterside transport, extensive cut/fill activities). Based on the desktop assessment, potential sources of contamination within the proposal footprint may include the following: • Acid sulfate soil • Potential residual/unidentified contamination in soil and groundwater from previous industrial activities associated with historic industrial facilities in and around the waterfronts (e.g. underground tank leakages, chemical spills) and businesses • Uncontrolled fill • Leaded paint flakes and asbestos fibres from previous widespread use • Roads (e.g. lead and vehicle emissions from vehicles using nearby roads, road bitumen) • Rail line (e.g. ballast material, train emissions). These sources may have resulted in localised contamination with the potential contaminants of concern including acid sulfate soils, heavy metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), phenols and asbestos containing material (ACM).	road construction or maintenance workers following construction • Inhalation of dust, vapour or fibres by construction workers during the road construction or maintenance workers following construction • Inhalation of dust, vapour or fibres by users of the road or of nearby land • Ingestion of or dermal contact with impacted groundwater if extracted for beneficial use by nearby site users • Migration of impact into the groundwater or into Sydney Harbour. Construction activities, if not properly managed, may result in soil contamination through accidental fuel and/or chemical spills or leaks. Operation of the smart motorway technology is not expected to result in any potential impacts to soil or water.

Environmental factor	Existing environment	Potential impacts
Air quality	Sensitive receivers near the proposal site include residential receivers, pedestrians, cyclists and retail premises. The dominant source of emissions near the proposal site is from motor vehicles travelling along the local road network.	Emissions from work vehicles/equipment would be minor. The potential for dust generation from excavation would be minimal and dependent on soil moisture content, prevailing weather conditions and the types of activities being carried out.
Aboriginal heritage	The proposal corridor does not encroach upon a declared Aboriginal place and has a low density of previously recorded Aboriginal sites. Areas potentially disturbed by the proposal are expected to have low archaeological potential due to previous disturbance. A search of the Aboriginal Heritage Information Management System (AHIMS) conducted by Transport for NSW and returned two Aboriginal sites within the proposal area. Site 45-6-0030 (Dawes Point Park rock engraving) is listed as destroyed while Site 45-6-1853 would not be affected as the proposal is on an elevated structure at this location.	The proposal would have no impacts on Aboriginal heritage. There is no requirement to proceed to Stage 2 of the Transport for NSW PACHCI.
Socio-economic	The proposal site is in a busy part of the Sydney that generates economic activity, offers a variety of services and provides access to employment. The proposal corridor represents an important link between communities and is an important means by which people gain accesses to and from their places of employment.	The proposal would deliver better travel time reliability and improved safety, both of which represent a social benefit. The proposal would not directly affect access to or use of any key social infrastructure (such as schools, places of worship, medical centres, community centres etc). Potential amenity impacts have been considered as follows: • Noise and vibration (refer section 6.4) • Air quality (refer this table) • Visual impacts (refer section 6.2)
Biodiversity	The proposal is largely confined to elevated structures and would not affect vegetation or other habitat on which native fauna (including threatened species) would be reliant. A search of biodiversity databases was undertaken on 13 May 2021:	Potential impacts would be limited to fauna such as bats which may be use bridge elements for nesting and/or shelter. Noise, light and vibration impacts are already present within the proposal corridor and adjacent areas due to existing infrastructure (e.g. major roads) and

Environmental factor	Existing environment	Potential impacts
	• The Bionet Atlas has records of 544 threatened fauna and flora sightings within a 10 kilometre radius of the proposal corridor • The EPBC Act Protected Matters Search Tool listed nine threatened ecological communities, 88 threatened species and 68 migratory species within five kilometres of the proposal corridor.	development. These qualities of the existing environment are likely to deter fauna from nesting or sheltering in bridge elements. Operation of the proposal is unlikely to alter the existing environment for biodiversity due to noise, light or vibration as the smart motorway technology would affect traffic and illumination along the road corridor above the bridge decks, not underneath where urban fauna may forage and shelter. One planted street tree is to be removed at the location of Gantry 13. This tree is in a location of generally sparse vegetation between lanes of the Western Distributor. As such, the tree is not expected to provide any foraging or habitat opportunity for fauna. The biodiversity impact of this tree removal is considered low.
Climate change	At Sydney Observatory Hill, data indicates that average maximum summer temperatures are around 26 degrees Celsius. The summers at this location are wet, although June has the highest average mean rainfall (133 millimetres) of all months. July is the coldest month and September has the lowest mean monthly rainfall (68 millimetres). The Australian climate is likely to experience a greater frequency and severity of extreme weather events due to climate change. Increased average temperatures and reduced annual rainfall are also expected (Intergovernmental Panel on Climate Change, 2013).	The following construction activities would result in the release of greenhouse gas emissions: • Fossil fuel combustion related to use of plant, equipment and vehicles • Electricity use • Embedded emissions from manufacture and delivery of materials • Given the scope and duration of the proposal, the impact of the emissions would be minor in nature. • Operation of the proposal would reduce the congestion-related emissions from road traffic idling or travelling at inconsistent speeds. No climate change adaption requirements have been identified for the proposal.
Waste and resource use	Transport for NSW is committed to ensuring the responsible management of unavoidable waste and promotes the reuse of such waste in accordance with the resource management hierarchy principles outlined in the *Waste Avoidance and Resource Recovery Act 2001*. These	The proposal is not expected to generate large quantities of waste materials. The following waste streams have been identified: • Spoil • Demolition material

Environmental factor	Existing environment	Potential impacts
	resource management hierarchy principles, in order of priority are: • Avoid unnecessary resource consumption as a priority • Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) • Disposal is undertaken as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act 2001*). By adopting the above principles, Transport for NSW aims to efficiently reduce resource use, reduce costs, and reduce environmental harm in accordance with the principles of ecologically sustainable development.	• Redundant signage • Removed vegetation • Waste concrete / asphalt • General garbage and refuse.

6.5.2 Safeguards and management measures

Table 6-27: Safeguards and management measures – other issues

Environmental factor	Environmental safeguards	Responsibility	Timing	Reference
Soils and water	Erosion and sediment measures will be implemented and maintained to: • Minimise sediment moving off-site and sediment laden water entering any waterways, drainage lines or drainage pits • Reduce water velocity and capture sediment on-site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).	Contractor	Pre-construction	Section 2.1 of QA G38 Soil and Water Management

Environmental factor	Environmental safeguards	Responsibility	Timing	Reference
Soils and water	A site-specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP. The ESCP(s) will address the requirements of Transport for NSW specification G38.	Contractor	Pre-construction	Section 2.2 of QA G38 Soil and Water Management
Soils and water	The Erosion and Sediment Control Plan/s will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather. The Plan/s will also include measures to minimise the impact of discharging site water to the adjacent watercourses.	Contractor	Pre-construction	Section 2.2 of QA G38 Soil and Water Management
Soils and water	A site-specific emergency spill plan will be developed and include spill management measures in accordance with the Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).	Contractor	Detailed design / pre-construction / construction	Section 4.3 of QA G36 Environment Protection
Soils and water	Where required, designated, fully contained concrete washout areas would be established away from drainage lines and waterways.	Contractor	Construction	Additional safeguard
Contamination	An unexpected finds procedure will be developed in the proposal CEMP for contamination. The procedure will ensure that if contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 Environment Protection

Environmental factor	Environmental safeguards	Responsibility	Timing	Reference
	site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager and/or EPA.			
Air quality	Air quality management measures will be identified and implemented as part of the CEMP. These measures must include, but may not be limited to: • Potential sources of air pollution (including compound operation) • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions.	Contactor	Pre-construction	Section 4.4 of QA G36 Environment Protection
Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport for NSW does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contactor	Pre-construction	Section 4.9 of QA G36 Environment Protection
Aboriginal heritage	A 50 metre exclusion zone will apply to all registered AHIMS sites within and adjacent to the proposal corridor.	Contactor	Pre-construction	Additional measure
Socio-economic	A Communication Plan will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The Communication Plan will include (as a minimum):	Transport for NSW	Pre-construction	Standard safeguard

Environmental factor	Environmental safeguards	Responsibility	Timing	Reference
	• Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints • Notification requirements for noise generating activities • Procedures for communicating with other projects to determine the potential for concurrent activities and associated cumulative impacts.			
Biodiversity	If unexpected flora or fauna are discovered on site stop work immediately and implement the Transport for NSW Unexpected Threatened Species Find Procedure in the Biodiversity Guidelines, Guide 1.	Contractor	Construction	Additional measure
Biodiversity	Offset of removed street vegetation at Gantry 13 will be designed in consultation with City of Sydney Council.	Transport for NSW	Detailed design	Additional measure
Waste	A Waste Management and Resource Recovery Management Plan (WMRRP) will be prepared and implemented as part of the CEMP. The WMRRP will include but not be limited to: • Measures to avoid and minimise waste associated with the project • Classification of wastes and management options (re-use, recycle, stockpile, disposal) • Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting.	Contactor	Detailed design / pre-construction	Section 4.2 of QA G36 Environment Protection

6.6 Cumulative impacts

6.6.1 Study area

The cumulative impacts assessment has considered the suburbs of Milsons Point, Dawes Point, The Rocks, Sydney and Pyrmont. Potentially interacting projects were identified by reference to the Transport for NSW website and the Department of Planning, Industry and Environment major projects register.

6.6.2 Other projects and developments

Table 6-28 identifies those projects with the potential to have consecutive or cumulative impacts in association with the proposal.

Table 6-28: Past, present and future projects

Project	Construction impacts	Operational impacts
New Sydney Fish Market	• Water quality risks associated with construction disturbance • Construction noise and vibration • Additional construction traffic • Temporary visual impacts	• Increased traffic generation •
Extension to Longitude Office Building – 36 James Craig Road	• Construction noise and vibration • Additional construction traffic • Temporary visual impacts	• No substantial impacts
Glebe Island Multi-User Facility	• Construction noise and vibration • Additional constriction traffic • Temporary visual impacts	• Additional traffic to services the importation of construction materials (dry bulk materials).
Western Harbour Tunnel and Beaches Link	• Additional construction traffic including in The Bays Precinct • Construction noise and vibration • Water quality risks associated with construction disturbance	• Accounted for in traffic modelling
M4-M5 Link Rozelle Interchange	• Additional construction traffic including in The Bays Precinct • Construction noise and vibration • Water quality risks associated with construction disturbance	• Accounted for in traffic modelling

Project	Construction impacts	Operational impacts
Sydney Metro West	• Additional construction traffic including in The Bays Precinct • Construction noise and vibration • Water quality risks associated with construction disturbance	• Enhanced public transport access. • Increased pedestrian flows around new station locations. • Improved pedestrian and cyclist arrangements would likely be required to access the new metro stations at The Bays
Sydney Metro City & Southwest (Chatswood to Sydenham)	• Additional construction traffic in the Sydney CBD • Construction noise generated in Sydney CBD locations • Temporary visual impacts	• Enhanced public transport access. • Increased pedestrian flows around new station locations. • Improved pedestrian and cyclist arrangements would likely be required to access the new metro stations at The Bays
Replacement of Sydney Harbour Bridge arch maintenance units.	• Additional construction traffic • Construction noise • Heritage impacts (including some direct impacts to fabric)	• Improved maintenance access • Permanent visual impacts
Periodic Sydney Harbour Bridge, Cahill Expressway, Western Distributor and Anzac Bridge maintenance.	• Traffic impacts at night from lane closures • Temporary cyclist detours • Construction noise Temporary visual impacts	• Improved management of bridge operation

6.6.3 Potential impacts

Construction

Community concerns regarding impacts on amenity from construction activities may be exacerbated when considered cumulatively with impacts of other projects under construction or planned to be constructed in the study area. In particular, community concerns may arise from extended duration of these effects over a number of years due to the subsequent construction of multiple projects.

Traffic and transport

As a result of multiple construction projects being carried out within and adjacent to the proposal corridor and within a similar time period, there is a potential for impacts on traffic and transport to be greater than those that were identified for the proposal in isolation.

Impacts would primarily be a result of road or lane closures and an increase in construction-related traffic. Potential cumulative impacts include:

- Increased travel time on the road network
- Increased traffic volumes on alternative routes, resulting in congestion or gridlock

- Decreased traffic speed on the road network

Impacts are expected to be minor given the short-term duration of works at each site and the small number of construction vehicles required.

Noise, vibration and air quality

Noise, vibration and air quality impacts associated with the other nearby projects are expected to be identified and managed at project level through appropriate noise, vibration and air quality mitigation measures. Cumulative impacts are unlikely as noise and air quality impacts are generally confined to sensitive receivers near each construction area.

Non-Aboriginal heritage

Multiple projects which introduce new visual elements to the Sydney Harbour Bridge or visible changes to fabric would have potential cumulative impacts on the heritage values of the bridge. The potential for cumulative heritage impacts due to the proposal is however considered low because proposal related impacts have been assessed as minor and consistent with the Sydney Harbour Bridge Conservation Management Plan (Godden Mackay Logan, 2007), and would fall within the approval exemptions established under the *Heritage Act 1977*.

Operation

During operation, the proposal is not anticipated to have any long-term negative cumulative impacts. The traffic and transport assessment for the proposal included consideration of planned land use changes and relevant major transport infrastructure projects.

6.6.4 Safeguards and management measures

Table 6-29: Cumulative impacts environmental management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impacts	Current and upcoming projects with the potential to interact with the proposal will be monitored. Where potential cumulative impacts are identified, the scheduling of works will be coordinated with interacting projects to minimise potential impacts. This will include • Scheduling works to allow suitable respite periods for construction noise • Scheduling of works to minimise consecutive construction noise impacts, where feasible • Coordinating lane closures and pedestrian/cyclist diversions to minimise the overall number of occasions where disruption occurs.	Transport for NSW Project Manager	Construction	Additional measure

7 Environmental management

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer, Greater Sydney Project Office, prior to the commencement of any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP would be developed in accordance with the specifications set out in the QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing, QA Specification G10 – Traffic Management.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager prior to commencement of the activity. • As a minimum, the CEMP will address the following: • any requirements associated with statutory approvals • details of how the project will implement the identified safeguards outlined in the REF • issue-specific environmental management plans • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • procedures for emergency and incident management • procedures for audit and review. The endorsed CEMP will be implemented during the undertaking of the activity.	Contractor Transport for NSW project manager	Pre-construction Detailed design	
GEN2	General - notification	All businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor Transport for NSW project manager	Pre-construction	

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
GEN3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular 'toolbox' style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include the proximity of works the State and National listed heritage items.	Contractor Transport for NSW project manager	Pre-construction	
TT1	Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Traffic Control at Work Sites Manual (Roads and Maritime, 2018) and QA Specification G10 Control of Traffic (Roads and Maritime, 2008). The TMP will include: • confirmation of construction traffic routes • measures to maintain access to local roads and properties • site-specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access • requirements and methods to consult and inform the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic monitoring, review and amendment mechanisms	Contractor	Pre-construction	Section 4.8 of QA G36 Environment Protection
TT2	Emergency services vehicles and buses	Traffic management measures will be implemented to ensure emergency services vehicles and buses can negotiate work areas during construction. Where access is not possible, emergency services would be notified at least five business days prior to closures.	Contractor	Construction	Additional measure

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
TT3	Property and parking access	Footpath and or cycleway impacts would be communicated to the public, City of Sydney Council and North Sydney Council at least five business days in advance and suitable alternative routes would be clearly signposted.	Contractor	Construction	Additional measure
TT4	Pedestrian and cyclist access	Advance notice of footpath and or cycleway impacts will be communicated to the public and the City of Sydney and suitable alternative routes will be clearly signposted.	Contractor	Construction	Additional measure
LCV1	Visual impacts during construction	Suitable barriers will be provided to screen the visibility of construction activities from adjacent areas where appropriate.	Contractor	Construction	Additional measure
LCV2	Visual impacts during construction	Construction site compound areas will be returned to at least their preconstruction state following completion of the project.	Contractor	Construction	Additional measure
LCV3	Visual impacts during construction	Following the completion of construction works, plant/equipment will be removed, and disturbed areas will be revegetated, turfed or otherwise restored as appropriate.	Contractor	Construction	Additional measure
LCV4	Impact from lighting	Temporary site lighting will be installed and operated in accordance with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting, and an approved Traffic Management Plan.	Contractor	Construction	Additional measure
LCV5	Impacts on street trees	Establishment of Tree Protection Zones and tree protection measures consistent with AS4970-2009 Protection of Trees on Development Sites will be implemented for all trees within or immediately adjacent to the construction footprint.	Contractor	Construction	Additional measure
LCV6	Visual impacts	Where illuminated signage is located adjacent to more sensitive residential uses at Bulwara Road, investigate screening to minimise potential light spill.	Transport for NSW	Detailed design	Additional measure
LCV7	Visual impacts	The following will occur during the detailed design of proposed new gantries: • Minimise the number signs required in order to minimise visual clutter and the overall bulk and massing of the gantries	Transport for NSW	Detailed design	Additional measure

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
		• Provide minimal depth and width for structural post and beams for the gantry structure • Conceal fixings to streamline appearance • Utilise a visually recessive colour on posts and fixings so that the visual impact on the skyline is minimised, such as Sydney Harbour Bridge Grey.			
LCV8	Visual impacts	Offset any street trees removed for the proposal in consultation with local Council.	Transport for NSW	Detailed design	Additional measure
NAH1	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Contactor	Detailed design Pre-construction	QA G36 Environment Protection
NAH2	Non-Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime Services, 2015) will be followed in the event any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contactor	Construction	Section 4.10 of QA G36 Environment Protection
NAH3	Non-Aboriginal heritage	Further assessment of potential archaeological impacts will be carried out following refinement of proposed ground disturbance areas. This will include identification of any permit requirements under the *Heritage Act 1977*.	Transport for NSW	Detailed design	Additional measure
NV1	Construction noise and vibration	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: • all potential noise and vibration generating activities associated with the activity • feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement:	Contractor	Pre-construction	Section 4.6 of QA G36 Environment Protection

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
		urban design policy, process and principles (Transport for NSW, 2014) • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.			
NV2	Construction noise	All sensitive receivers likely to be affected will be notified at least five working days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: • the project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information.	Contractor	Pre-construction	Standard measure
NV3	Construction noise	Noisy works such as sawcutting and jackhammering to be completed by midnight	Contractor	Construction	Standard measure
NV4	Construction noise	Noise curtains are to be placed between sources of construction noise and sensitive receivers during night works where noise sources are stationary and near to the ground.	Contractor	Construction	Additional measure
NV5	Construction vibration	Prior to the start of construction, a Ground Vibration Risk Assessment shall be carried out by a suitably qualified person to identify all vibration generating tasks, duration and predicted vibration levels and to determine reasonable and feasible vibration mitigation and management measures to address the potential impacts of ground vibration on adjacent buildings during construction. The assessment shall also identify which properties contain buildings which would require building condition surveys.	Contractor	Construction	Additional measure

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
		The Vibration Risk Assessment must include (as a minimum): x. Identification of construction ground vibration criteria under BS7385 and DN4150 as described in this REF. xi. Identification of the ground type and topography in the vicinity of the works location (in terms of its susceptibility to ground vibration); xii. Identification and description of potentially affected buildings on adjacent properties which may be impacted by ground vibration during construction; xiii. Identification of the types of activities to be carried out (including compound sites and active work sites), machinery and equipment to be used, including the predicted vibration emission levels from each plant and the required buffer distances needed between the machinery/equipment and potentially affected buildings; xiv. A risk assessment to determine the potential for discrete work activities to affect buildings on adjacent properties; xv. An assessment of the potential vibration impacts on the potentially affected buildings on adjacent properties due to vibration; xvi. A map indicating the buildings on adjacent properties considered likely to be impacted by ground vibration and those requiring building condition inspections; xvii. Details on which buildings on adjacent properties will require building condition surveys; Identification of potential mitigation measures to be incorporated during construction to address round vibration impacts on buildings.			
NV6	Construction vibration	Based on the results of the Ground Vibration Risk Assessment, a Ground Vibration Management Plan must be prepared prior to construction as part of the CEMP to address how	Contractor	Construction	Additional measure

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
		construction will be carried out to minimise the impact of ground vibration on affected buildings within adjacent properties. The Vibration Management Plan must detail how construction vibration will be managed for various plant items working adjacent to the potentially affected buildings (as identified in the Vibration Risk Assessment). The Plan must show the locations of all occupied and unoccupied buildings which are potentially impacted on surrounding properties (including relevant heritage items) on a map, and provide details of control measures to be undertaken during construction, including: h) Identification of all vibration generating tasks, duration and predicted vibration levels (based on the Vibration Risk Assessment); i) A schedule of properties where building condition inspections are required to be undertaken (based on the Vibration Risk Assessment); j) Location and type of mitigation measures to reduce excessive ground vibration such as: • Maximising the offset distance between high vibration plant items and nearby buildings; • Substitution by alternative equipment, plant and processes; • Screening or enclosures; • Restricted times when work is being carried out; • Work setback distances, for example different vibration levels and machinery; • Consultation with affected residences and business owners;			

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
		• Orienting equipment away from vibration-sensitive areas; and • Selecting site access points and roads as far as possible from sensitive receptors. k) Specific physical and managerial measures for controlling ground vibration to comply with the relevant OEH guidelines and best practice; l) Vibration monitoring, reporting and response procedures; m) Procedures for notifying residents and business premises about vibration-generating activities likely to affect buildings on their property; n) Contingency plans to be implemented in the event of non-compliances and/or vibration complaints; Procedures for regularly reviewing the effectiveness of the Vibration Management Plan;			
NV7	Construction vibration	Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site shall be undertaken in relation those properties identified as being particularly sensitive to ground vibration (as identified in the Vibration Risk Assessment) prior to their commencement of construction to validate the acceptable buffer distances to the nearest affected receiver locations.	Contractor	Construction	Additional measure
NV8	Construction vibration	Building conditions surveys shall be conducted at receivers determined, by the Contractor, to be sensitive to ground vibration impacts. The determination should be based on the results of a Vibration Risk Assessment plan for the project prior to construction, where the results of this will also feed into the Vibration Management Plan. These measures are to address potential community concerns that perceive vibration may cause damage to building.	Contractor	Construction	Additional measure

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
SWQ1	Soils and water	Erosion and sediment measures will be implemented and maintained to: • Minimise sediment moving off-site and sediment laden water entering any waterways, drainage lines or drainage pits • Reduce water velocity and capture sediment on-site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).	Contractor	Pre-construction	Section 2.1 of QA G38 Soil and Water Management
SWQ2	Soils and water	A site-specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP. The ESCP(s) will address the requirements of Transport for NSW specification G38.	Contractor	Pre-construction	Section 2.2 of QA G38 Soil and Water Management
SWQ3	Soils and water	The Erosion and Sediment Control Plan/s will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather. The Plan/s will also include measures to minimise the impact of discharging site water to the adjacent watercourses.	Contractor	Pre-construction	Section 2.2 of QA G38 Soil and Water Management
SWQ4	Soils and water	A site-specific emergency spill plan will be developed and include spill management measures in accordance with the Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).	Contractor	Detailed design / pre-construction / construction	Section 4.3 of QA G36 Environment Protection

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
SWQ5	Soils and water	Where required, designated, fully contained concrete washout areas would be established away from drainage lines and waterways.	Contractor	Construction	Additional safeguard
CL1	Contamination	An unexpected finds procedure will be developed in the proposal CEMP for contamination. The procedure will ensure that if contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager and/or EPA.	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 Environment Protection
AQ1	Air quality	Air quality management measures will be identified and implemented as part of the CEMP. These measures must include, but may not be limited to: • Potential sources of air pollution (including compound operation) • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions.	Contactor	Pre-construction	Section 4.4 of QA G36 Environment Protection
AH1	Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport for NSW does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contactor	Pre-construction	Section 4.9 of QA G36 Environment Protection

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
AH2	Aboriginal heritage	A 50 metre exclusion zone will apply to all registered AHIMS sites within and adjacent to the proposal corridor.	Contactor	Pre-construction	Additional measure
SEO1	Socio-economic	A Communication Plan will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The Communication Plan will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints • Notification requirements for noise generating activities • Procedures for communicating with other projects to determine the potential for concurrent activities and associated cumulative impacts.	Transport for NSW	Pre-construction	Standard safeguard
BIO1	Biodiversity	If unexpected flora or fauna are discovered on site stop work immediately and implement the Transport for NSW Unexpected Threatened Species Find Procedure in the Biodiversity Guidelines, Guide 1.	Contractor	Construction	Additional measure
BIO2	Biodiversity	Offset of removed street vegetation at Gantry 13 will be designed in consultation with City of Sydney Council.	Transport for NSW	Detailed design	Additional measure
WM1	Waste	A Waste Management and Resource Recovery Management Plan (WMRRP) will be prepared and implemented as part of the CEMP. The WMRRP will include but not be limited to: • Measures to avoid and minimise waste associated with the project • Classification of wastes and management options (re-use, recycle, stockpile, disposal) • Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal Monitoring, record keeping and reporting.	Contactor	Detailed design / pre-construction	Section 4.2 of QA G36 Environment Protection

No.	Impacts	Environmental safeguards	Responsibility	Timing	Reference
CU1	Cumulative impacts	Current and upcoming projects with the potential to interact with the proposal will be monitored. Where potential cumulative impacts are identified, the scheduling of works will be coordinated with interacting projects to minimise potential impacts. This will include • Scheduling works to allow suitable respite periods for construction noise • Scheduling of works to minimise consecutive construction noise impacts, where feasible Coordinating lane closures and pedestrian/cyclist diversions to minimise the overall number of occasions where disruption occurs.	Transport for NSW Project Manager	Construction	Additional measure

7.3 Licensing and approvals

Table 7-2 provides a summary of the licensing and approval requirements relevant to the proposal.

Table 7-2: Summary of licencing and approvals required

Instrument	Requirement	Timing
Roads Act 1993 (section 138)	Road occupancy licence	Prior to start of activity

8 Conclusion

8.1 Justification

The proposal is needed to improve traffic and hazard management and enhance corridor messaging and wayfinding on the M1 road corridor between Milsons Point and Allen Street in Pyrmont.

A 'do nothing' approach was not considered appropriate as it does not address the identified need and does not meet the proposals objectives.

There would be some short-term disruption while the proposal is being built, for example due to noise, traffic and amenity-based impacts. These potential impacts are consistent with similar road-development proposals and would be addressed through standard safeguards and mitigation measures.

The proposal would result in some longer-term visual change with the new gantries, signage and ramp metering infrastructure contributing to moderate-high or high at some locations that would require mitigation as part of the design process. There would also be some impacts on non-Aboriginal heritage, including low level impacts on the nationally listed Sydney Harbour Bridge.

Overall, the proposal is considered to be justified. It has been developed through an options assessment and refinement process (see Section 2.4) to identify a preferred option that best meets the proposal objectives, while minimising the construction and operational impact.

8.2 Objectives of the EP&A Act

Table 8-1 reviews the consistency of the proposal with the objects of the EP&A Act.

Table 8-1: Objects of the EP&A Act

Environmental factor	Construction
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal would improve safety. Social and economic impacts are assessed in Section 6.6. The assessment includes management measures to avoid and/or minimise impacts
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The principles of ecological sustainable development are considered in Section 8.2.1.
1.3(c) To promote the orderly and economic use and development of land.	The proposal supports growth (and associated increases in travel demand) in the Eastern Economic Corridor, extending from Macquarie Park to Sydney Airport, which contains close to one-third of Greater Sydney's jobs.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the project.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal involves the use of land which has primarily been zoned for road purposes. Potential biodiversity impacts would be limited to fauna which may be use bridge elements for nesting and/or shelter.

Environmental factor	Construction
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	There would be some impacts on non-Aboriginal heritage including low level impacts on the nationally listed Sydney Harbour Bridge. Mitigation measures have been proposed to address these impacts. Refer to Section 6.3. There is not expected to be any impacts on Aboriginal heritage. Refer to Section 6.6.
1.3(g) To promote good design and amenity of the built environment.	As part of the design development of the proposal, consideration of the environment, landscape and visual impacts occurred. Landscape character and visual impacts are considered in Section 6.2.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the project.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	The proposal has been developed with the involvement of relevant local councils.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Consultation carried out to date and proposed ongoing consultation is outlined in Chapter 5.

8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during options development (refer to Chapter 2). The precautionary principle has guided the assessment of environmental impacts for this assessment and the development of mitigation measures. A key focus has been minimising impacts on State and National heritage values associated with the Sydney Harbour Bridge.

8.2.2 Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The impacts of the proposal have been identified primarily short term and manageable. Benefits road users in terms of improved safety and reduced travel times would be experienced over a longer period.

8.2.3 Conservation of biological diversity and ecological integrity

The twin principles of biodiversity conservation and ecological integrity have been a consideration during the design and assessment process with a view to identifying, avoiding, minimising and mitigating impacts.

The proposal is not expected to have significant biodiversity impacts.

8.2.4 Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by a project, including air, water, land and living things.

While it is often difficult to place a reliable monetary value on the residual, environmental and social effects of the project, the value placed on environmental resources within and around the corridor is evident in the extent of environmental investigations, planning and design of impact mitigation measures to prevent adverse environmental impacts.

The value of the project to the community in terms of improved safety is recognised.

8.3 Conclusion

The proposed M1 North Smart Motorway is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some visual, heritage, construction noise and traffic impacts. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. On balance the proposal is considered justified and the following conclusions are made.

8.3.1 Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

8.3.2 Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Agriculture, Water and the Environment is not required.

9 Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Jarita Zeng

Environment Officer

Transport for NSW

Date: 27 May 2021

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.

H Mandic

Haris Mandic

Project Manager

Date: 27 May 2021

10 References

Department of Environment and Climate Change. (2009). *Interim Construction Noise Guideline.* Sydney: Department of Environment and Climate Change.

Department of Environment, Climate Change and Water. (2010). *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 .* Sydney: Department of Environment, Climate Change and Water.

Department of Environment, Climate Change and Water. (2011). *NSW Road Noise Policy.* Sydney: Department of Environment, Climate Change and Water.

Department of Planning. (1995). *Is an EIS required?* Sydney: Department of Planning.

Department of Urban Affairs and Planning. (1996). *Roads and Related Facilities EIS Guideline.* Sydney: Department of Urban Affairs and Planning.

Godden Mackay Logan. (2007). *Sydney Harbour Bridge Conservation Management Plan 2007.* Sydney: Roads and Traffic Authority of NSW.

Greater Sydney Commission. (2018). *Eastern City District Plan .* Sydney: Greater Sydney Commission.

Greater Sydney Commission. (2018). *Greater Sydney Region Plan – A Metropolis of Three Cities.* Sydney: Greater Sydney Commission.

Greater Sydney Commission. (2018). *Greater Sydney Regional Plan - A Metropolis of Three Cities.* Sydney: Greater Sydney Commission.

Heritage Council of NSW. (2002). *Statements of Heritage Impact.* Sydney: Heritage Council of NSW.

Higginbotham, E., Kass, T., & Walker, M. (1991). *The Rocks and Millers Point Archaeological Management Plan.*

Infrastructure NSW. (2018). *State Infrastructure Strategy 2018-2038: Building Momentum.* Sydney: Infrastructure NSW.

Intergovernmental Panel on Climate Change. (2013). *Intergovernmental Panel on Climate Change Fifth Assessment Report.* Intergovernmental Panel on Climate Change.

Lavelle, S., & Mider, D. (1992). *The Central Sydney Archaeological Zoning Plan.*

NSW Government. (2018). *NSW Freight and Ports Plan.* Sydney: NSW Government.

NSW Heritage Office and Department of Urban Affairs and Planning. (1994). *NSW Heritage Manual.* Sydney: NSW Heritage Office.

Roads and Maritime Services. (2011). *Procedure for Aboriginal Cultural Heritage Consultation and Investigation.* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2015). *Noise Criteria Guideline.* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2015). *Standard Management Procedure - Unexpected Heritage Items.* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2016). *Construction Noise and Vibration Guideline.* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2018). *Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment .* Sydney: Roads and Maritime Services.

Transport for NSW. (2013). *Sydney City Centre Access Strategy.* Sydney: Transport for NSW.

Transport for NSW. (2013). *Sydney's Bus Future.* Sydney: Transport for NSW.

Transport for NSW. (2016). *Future Transport Technology Roadmap.* Sydney: Transport for NSW.

Transport for NSW. (2018). *Future Transport Strategy 2056.* Sydney: Transport for NSW.

Transport for NSW. (2018). *Future Transport Strategy 2056 .* Sydney: Transport for NSW.

Transport for NSW. (2018). *Road Safety Plan 2021.* Sydney: Transport for NSW.

Transport for NSW. (2019). *Connected and Automated Vehicles Plan.* Sydney: Transport for NSW.

Wang, B., Gorlick, C., Taylor, J., & Elaurant, S. (2017). Economic benefits of Smart Motorway applications. *39th Australasian Transport Research Forum.* Auckland: Australasian Transport Research Forum.

Terms and acronyms used in this REF

Term / Acronym	Description
ACM	Asbestos containing material
BC Act	Biodiversity Conservation Act 2016 (NSW).
BTEX	Benzene, toluene, ethylbenzene, xylene
CCTV	Closed circuit television camera
CEMP	Construction environmental management plan
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
Heritage Act	Heritage Act 1977 (NSW)
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
ISLUS	Integrated Speed and Lane Use Sign
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LoS	Level of service. measure of average delay across all movements.
NML	Noise management Level
NPW Act	National Parks and Wildlife Act 1974 (NSW)
QA Specifications	Specifications developed by Roads and Maritime Services for use with road work and bridge work contracts let by Roads and Maritime Services.
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
TRH	Total recoverable hydrocarbons
VMS	Variable Message Sign
VSLS	Variable Speed Limit Signs

Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance and Commonwealth land

Clause 228(2) Checklist

In addition to the requirements of the Is an EIS required? guideline (DUAP 1995/1996) and the Roads and Related Facilities EIS Guideline (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the Environmental Planning and Assessment Regulation 2000, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
a) Any environmental impact on a community? The proposal would have the potential for short-term traffic and transport and noise impacts on nearby residents and road users during construction.	Short-term negative
b) Any transformation of a locality? The proposal would not transform a locality.	Nil
c) Any environmental impact on the ecosystems of the locality? The proposal is largely confined to elevated structures and would not affect vegetation or other habitat on which native fauna (including threatened species) would be reliant.	Nil
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The impact of the proposal on landscape character varies from negligible to moderate–high. The visual impact is moderate-high or high in areas where adjoining land uses are more visually sensitive, such as areas with residential buildings, where there are scenic views or areas with heritage significance.	Long-term negative
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? There would be some impacts on non-Aboriginal heritage including low level impacts on the nationally listed Sydney Harbour Bridge and moderate impacts on the Anzac Bridge. Mitigation measures have been proposed to address these impacts.	Long-term negative
f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? No important habitat for native species is present at the site. Impacts on native species are not expected.	Nil
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal would not endanger animals, plants or other forms of life. No plants or animals of national or state conservation are present at the proposal site. Similarly, area to be disturbed is not considered suitable for any threatened species known to occur within the broader region.	Nil
h) Any long-term effects on the environment? Long-term negative impacts would include the visual and heritage impacts described above. There would be long benefits in terms of improved road safety and improved traffic management (reducing congestion and assisting travel time reliability).	Long-term negative Long-term positive

Factor	Impact
j) Any risk to the safety of the environment? The proposal would have some potential for temporary degradation of the quality of the environment through the generation of dust, potential release of sediment and noise generation during construction. Safeguards have been proposed to address this risk.	Short-term negative
k) Any reduction in the range of beneficial uses of the environment? The proposal would not reduce the range of beneficial uses of the environment.	Nil
l) Any pollution of the environment? The proposal would not result in pollution of the environment. There would be short-term minor risks to local water quality in the event of a spill of release of sediment off site. Noise would be generated during construction and there would be potential for dust generation. Safeguards have been proposed to address the risk of pollution.	Short-term negative
m) Any environmental problems associated with the disposal of waste? Waste generated during construction would be removed from site and disposed of legally. No environmental problems are anticipated for the disposal of waste.	Nil
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal would not increase demand for resources, which are, or are likely to become, in short supply.	Nil
o) Any cumulative environmental effect with other existing or likely future activities? During construction, the proposal is not expected to result in substantial cumulative impacts given its relatively small scale at each works location. Interaction with other major transport infrastructure projects was considered as part of the traffic and transport assessment.	Nil
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal would not influence coastal processes and/or coastal hazards.	Nil

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act 1999, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment and Energy.

A referral is not required for proposed actions that may affect nationally listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
a) Any impact on a World Heritage property? The Sydney Opera House is a declared World Heritage property and the Sydney Harbour Bridge is located within the declared buffer zone. With reference to the significant impact criteria in Matters of National Environmental Significance - Significant impact guidelines 1.1 (Department of the Environment, 2013) it is noted that: • one or more of the World Heritage values would not be lost • one or more of the World Heritage values would not be degraded or damaged, and • one or more of the World Heritage values would not be notably altered, modified, obscured or diminished. There would be no direct impacts on the Sydney Opera House, no noticeable changes to its setting and no obscuring of views (either to or from the item). The visual impacts of the proposal are discussed in Section 6.2 of this REF.	Nil
b) Any impact on a National Heritage place? The Sydney Harbour Bridge is on the National Heritage List. With reference to the significant impact criteria *in Matters of National Environmental Significance - Significant impact guidelines 1.1* It is noted that: • one or more of the National Heritage values would not be lost • one or more of the National Heritage values would not be degraded or damaged, and • one or more of the National Heritage values would not be notably altered, modified, obscured or diminished. Potential heritage impacts are discussed in section 6.3 of this REF.	Not significant
c) Any impact on a wetland of international importance? The proposal would not affect a wetland of international importance.	Nil
d) Any impact on a listed threatened species or communities? Some Commonwealth listed threatened species have the potential to occur in the local area. However, no plants or animals of national or state conservation significance would be affected. Similarly, the area to be disturbed is not considered suitable for any threatened species known to occur within the broader region. The nature, scale and location of the proposal is such that direct impacts on these species or their habitats are not expected. Indirect impacts are also not expected	Nil

Factor	Impact
e) Any impacts on listed migratory species? Some Commonwealth listed migratory species have the potential to occur in the local area. The nature, scale and location of the proposal is such that impacts on these species or their habitats are not expected. Indirect impacts are also not expected.	Nil
f) Any impact on a Commonwealth marine area? The proposal would not have any impact on a Commonwealth marine area.	Nil
g) Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	Nil
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land? The proposal would not impact Commonwealth land.	Nil

Appendix B

Statutory consultation checklists

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No		ISEPP cl. 95A
Bus Depots	Does the project propose a bus depot?	No		ISEPP cl. 95A
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No		ISEPP cl. 95A

Development within the coastal zone

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No		ISEPP cl. 15A

Council related infrastructure or services

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Stormwater	Are the works likely to have a substantial impact on the stormwater management services which are provided by council?	No		ISEPP cl.13(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will strain the capacity of the existing road system in a local government area?	No		ISEPP cl.13(1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a substantial impact on the capacity of any part of the system?	No		ISEPP cl.13(1)(c)

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a substantial volume of water?	No		ISEPP cl.13(1)(d)
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a minor or inconsequential disruption to pedestrian or vehicular flow?	No		ISEPP cl.13(1)(e)
Road & footpath excavation	Will the works involve more than minor or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	City of Sydney	ISEPP cl.13(1)(f)

Local heritage items

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential?	No Impacts on local heritage assessed as neutral	Relevant council	ISEPP cl.14

Flood liable land

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a minor extent?	No	Relevant council	ISEPP cl.15

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance.	No	State Emergency Service	ISEPP cl.15AA

Public authorities other than councils

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act*?*	No	Office of Environment and Heritage	ISEPP cl.16(2)(a)
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Office of Environment and Heritage	ISEPP cl.16(2)(b)
Aquatic reserves	Are the works adjacent to an aquatic reserve or a marine park declared under the *Marine Estate Management Act 2014*?	No	Department of Industry	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the *Sydney Harbour Foreshore Authority Act 1998?*	No	Sydney Harbour Foreshore Authority	ISEPP cl.16(2)(d)
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	ISEPP cl.16(2)(f)
Artificial light	Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	ISEPP cl.16(2)(g)

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	ISEPP cl.16(2)(h)
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Mine Subsidence Board	ISEPP cl.16(2)(i)

Appendix C

Design drawings

Appendix D

Traffic and transport assessment

Appendix E

Landscape character and visual impact assessment

Appendix F

Statement of heritage impact

Appendix G

Construction noise assessment

Appendix H

Biodiversity database search results

transport.nsw.gov.au/

13 22 13

Customer feedback
Transport for NSW
Locked Bag 928,
North Sydney NSW 2059

May 2021