



# EDGECLIFF COMMERCIAL CENTRE TRANSPORT STUDY

Final Report

7 AUGUST 2019



## Quality Assurance

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## Executive Summary

### Purpose of study

SCT Consulting was engaged by Woollahra Municipal Council (WMC) to prepare a Transport Study which evaluates, tests and informs the preparation of new planning controls for the Edgecliff Commercial Centre (ECC). The study will investigate all aspects of transport use, but also propose transport management strategies for the ECC in association with these proposed planning controls.

The ECC is currently a combination of B4 Mixed Use and B2 Local Centre zones located at the heart of Edgecliff. The B2 Local Centre zone is described in the *Woollahra Development Control Plan 2015* (Woollahra DCP 2015) as the Edgecliff Centre. To avoid confusion, in this report the zone is referred to as the Commercial Core, and includes two large developments:

- The “Edgecliff Centre” office building at 203-233 New South Head Road.
- The “Eastpoint Centre” at 235-285 New South Head Road, which incorporates a shopping centre, residential tower, Edgecliff Train Station and a bus interchange.

The ECC sits on the state road, New South Head Road, which serves as a link between Sydney CBD, the Cross City Tunnel and the eastern suburbs. The Commercial Core is the focal point of the ECC, providing a valuable connection to the Sydney Trains network and destinations across Sydney.

The purpose of this Transport Study is to assess the transport impacts and needs of the proposed planning controls for the ECC, based on the preferred development option (as presented in the draft Edgecliff Commercial Centre Study, prepared by SJB Architects in September 2018).

### Existing conditions

The 2016 Method of Travel to Work data was analysed to determine current travel behaviour and patterns to and from the Edgecliff Community Centre during peak travel periods. For the Sydney GMA, a total of 67 per cent, 11 per cent and 4 per cent use private vehicle, train and walk respectively to get to work. By comparison, the public transport mode share for Edgecliff is 44 per cent, by far the most dominant mode of transport. This is reflective of the close walking distance to Edgecliff Train Station, with the entirety of the analysed travel zones falling within a one-kilometre walking radius.

The major access to the ECC from the Sydney Metropolitan area is via New South Head Road which runs in the middle of and through the ECC. New South Head Road is the only State Road controlled and maintained by Roads and Maritime Services (RMS), in the vicinity of the ECC. All other roads within the vicinity of the ECC are local roads, under the control of WMC, with the main local roads providing access to the ECC being New Beach Road, Glenmore Road, Mona Road, Darling Point Road, New McLean Street and Ocean Avenue / Ocean Street.

Traffic modelling for the weekday scenarios indicates that the network performs close to capacity, with New South Head Road / Ocean Street / Ocean Avenue the most constrained of the junctions evaluated. The degree of saturation is close to one for this intersection across multiple peaks. This indicates that there is limited capacity for the network to accommodate more traffic. However, the bus and rail network do have spare capacity, making the centre an ideal location to deliver growth for Woollahra.

### Impacts of potential development

The potential land use uplift estimated by SJB Architects comprises an additional 6,400sqm commercial, 5,450 sqm of retail and 440-545 dwellings. This equates to a range of an additional 186 – 201 vehicles in the AM peak.

A review of these impacts on the public transport network indicates that there is spare capacity as majority of trips are towards Sydney CBD. For the footpath network, there could be an additional 870 walking trips in the network. The footpaths are generally wide and able to accommodate this volume, however, have some deficiencies which are outlined in the report. Due to high pedestrian demands, improvements to the road network need to avoid having significant impact on pedestrians.

## Proposed works

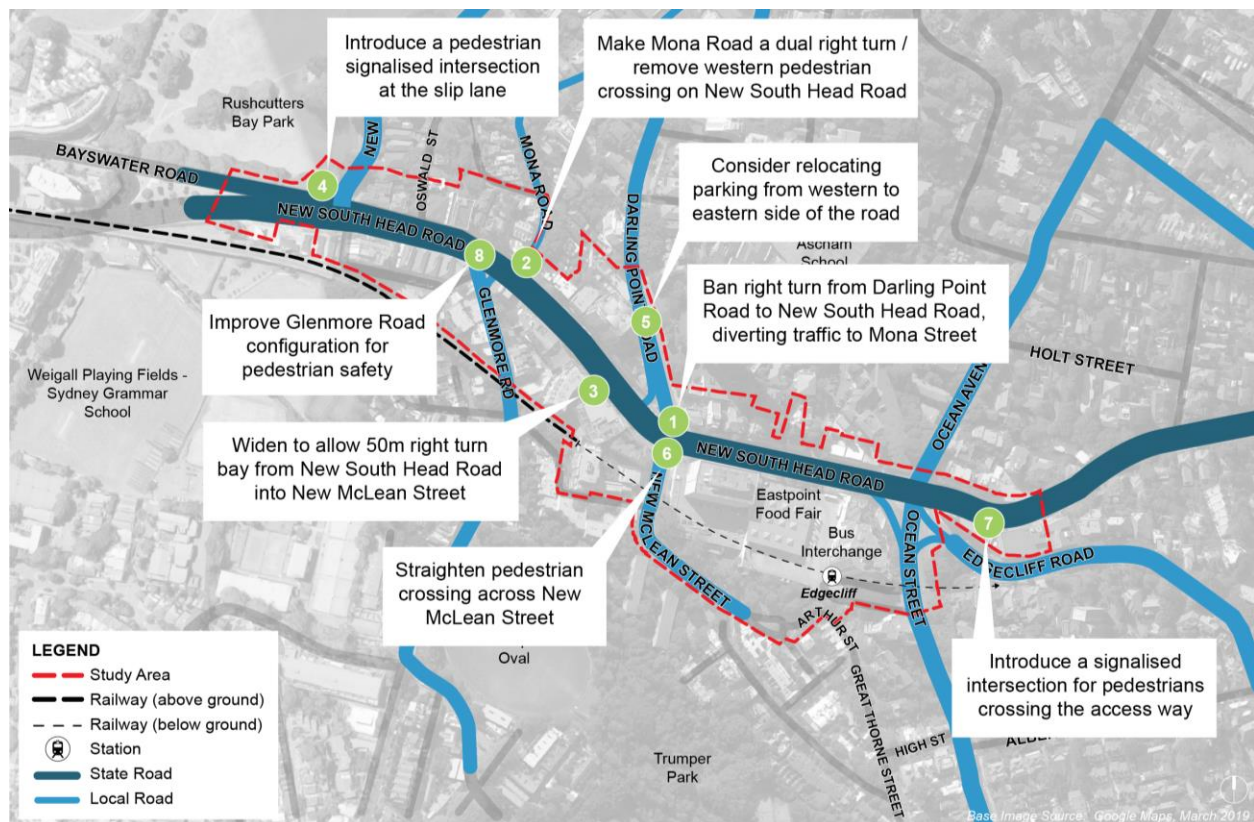
Traffic modelling indicates the network will perform with significant delays after the introduction of the additional vehicle trips. Several junctions will perform at demands significantly over capacity, resulting in significant queues. Several modifications are proposed to mitigate these impacts:

- ID1: Ban right turn from Darling Point Road to New South Head Road, diverting traffic to Mona Street (time-limited / permanent).
- ID 2: Make Mona Road a dual right turn and remove the western pedestrian crossing on New South Head Road.
- ID 3: Widen the southern side of the New South Head Road to allow 50m right turn bay from New South Head Road into New McLean Street via repurposing underutilised open space / modified urban design.

The following improvements are recommended to the pedestrian network, to enhance the pedestrian environment in ECC, improve safety for pedestrians and cater for the increase in pedestrian trips generated by the potential development:

- ID 4: Introduce a new signalised intersection at the slip lane at the north western corner of the New South Head Road / New Beach Road intersection, to continue the existing signalised crossing across New Beach Road and further improve safety for pedestrians crossing the slip lane.
- ID 5: Potentially relocate parking from the western to the eastern side of Darling Point Road where the footpath is wider, to improve access and safety for people leaving and accessing their cars.
- ID 6: Straighten the pedestrian crossing on the southern side of the New South Head Road / Darling Point Road / New McLean Street intersection (across New McLean Street) to improve safety for pedestrians crossing the road, in particular visually impaired pedestrians.
- ID 7: Introduce a new signalised intersection for pedestrians crossing the bus access way east of Ocean Street, to improve safety for pedestrians crossing the access way on the southern side of New South Head Road.
- ID 8: Improve Glenmore Road configuration for pedestrian safety.

**Figure E-1 Recommended infrastructure improvements**



Source: SCT Consulting, 2019

Despite these changes, the road network is still forecast to be over capacity with the development. Several policy recommendations were developed to absorb this impact:

- Support delivery of mixed use;
- Reduce maximum parking rates for units;
- Cap parking to current number of spaces for development in the Commercial Core;
- Introduce a travel plan program for businesses;
- Support additional car share; and
- Deliver a pedestrian wayfinding strategy.

With these interventions, the proposed development supports the strategic policy objectives of WMC and the NSW Government transport agencies.



## 1.0 Introduction

### 1.1 Background

SCT Consulting was engaged by WMC to prepare a transport study which evaluates, tests and informs the preparation of new planning controls for the ECC. The study will investigate all aspects of transport use, but also propose transport management strategies for the ECC in association with these proposed planning controls.

In November 2017, GTA Consultants prepared a Transport Assessment for the ECC which aimed to assess the impact of three potential development scenarios and recommend options to manage and minimise the transport impact of these. Since then a preferred development option has been recommended as presented in the draft ECC Study (prepared by SJB Architects for WMC in September 2018). This transport study will assess that preferred development option and also provide an independent evaluation of the GTA Transport Assessment (November 2017).

The ECC is currently a combination of B4 Mixed Use and B2 Local Centre zones located at the heart of Edgecliff. The Commercial Core includes two large developments:

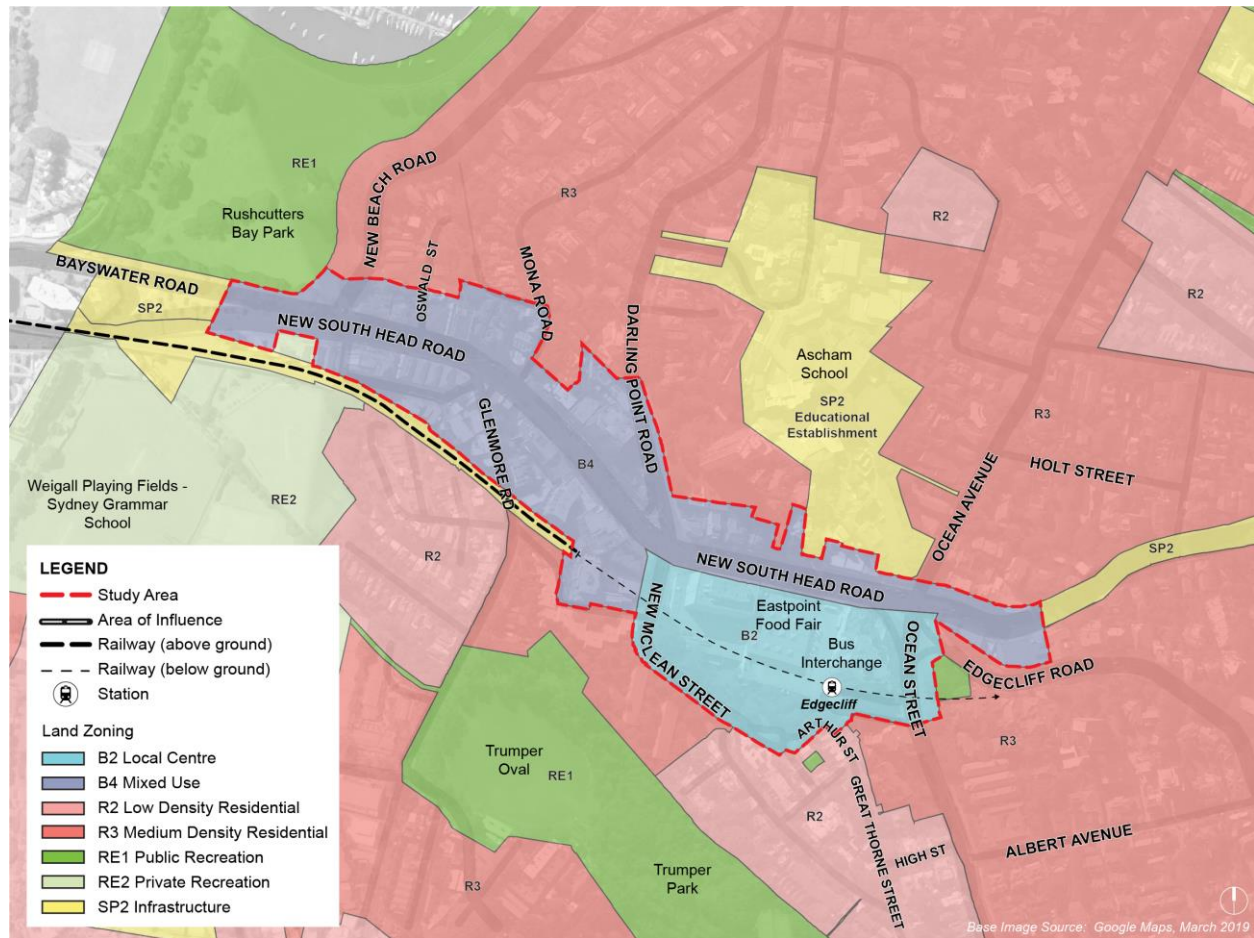
- The “Edgecliff Centre” office building at 203-233 New South Head Road.
- The “Eastpoint Centre” at 235-285 New South Head Road, which incorporates a shopping centre, residential tower, Edgecliff Train Station and a bus interchange.

The ECC sits on the state road, New South Head Road, which serves as a link between Sydney CBD, the Cross City Tunnel and the eastern suburbs. The Commercial Core is the focal point of the ECC, providing a valuable connection to the Sydney Trains network and destinations across Sydney.

The purpose of this Transport Study is to assess the transport impacts and needs of the proposed planning controls for the ECC, based on the preferred development option (as presented in the draft Edgecliff Commercial Centre Study, prepared by SJB Architects in September 2018).

The ECC and surrounding area of influence is shown in **Figure 1–1**.

Figure 1–1 Edgecliff Commercial Centre and surrounding areas



Source: SCT Consulting, 2018

## 1.2 Purpose of Report

The purpose of this Transport Study is to assess the transport impacts and needs of the potential development resulting from the proposed planning controls for the ECC, based on the preferred development option (as presented in the draft Edgecliff Commercial Centre Study, prepared by SJB Architects in September 2018). The report will assess the impact of the net increase in vehicle and person trips generated by the preferred development option, connectivity and access to the surrounding road network, car parking requirements, public and active transport requirements and any mitigation measures required as a result of the potential development. It will also propose transport management strategies for the ECC in association with the proposed planning controls.

In addition, the report will present a review of the Edgecliff Commercial Centre Study Transport Assessment prepared by GTA Consultants in November 2017, which formed an input to this report.

This report presents:

- Background research to inform the strategic context of the proposal;
- Existing traffic and travel pattern data;
- Review of existing traffic and transport conditions;
- Status of any planned and committed infrastructure upgrades as well as land use changes;
- Trip generation and trip distribution to understand likely implications of the potential development;
- Likely infrastructure upgrades required to cater for the potential development; and
- Public and active transport measures and sustainable travel initiatives for the development, as well as the likely required parking provision.

### 1.3 Report Structure

This report has been structured into the following sections:

- **Section 2** provides an overview of the strategic context of the ECC and a summary of the review of all relevant background documents;
- **Section 3** provides an overview of the existing conditions for all transport modes, an overview of the ECC and a description of the existing transport demographics in the area;
- **Section 4** describes the preferred development option and the proposed change in yield for the ECC;
- **Section 5** presents the increase in trip generation and likely trip distribution as a result of the potential development;
- **Section 6** describes the likely traffic and transport impact on all modes of transport as a result of the potential development;
- **Section 7** proposes future potential traffic and transport solutions for the ECC, such as policy changes and required infrastructure upgrades;
- **Section 8** summarises the report and proposes the next steps to be undertaken as a result of the outcome of the report;
- **Appendix A: SIDRA Calibration and Validation Report:** provides evidence that the SIDRA models appropriately reflect local conditions; and
- **Appendix B: SIDRA Results:** provides excerpts of SIDRA results for each scenario.

## 2.0 Strategic Context

Several relevant planning documents have been reviewed to provide background context for guiding the development of the concept plan and traffic and transport initiatives.

### 2.1 Future Transport 2056 Strategy

The *Future Transport Strategy 2056* (Transport for NSW, March 2018) is an update of NSW's Long-Term Transport Master Plan. It is a vision for how transport can support growth and the economy of New South Wales over the next 40 years. The Strategy is underpinned by the *Regional NSW Services and Infrastructure Plan* and the *Greater Sydney Services and Infrastructure Plan*, March 2018, as well as a number of supporting plans including Road Safety and Tourism.

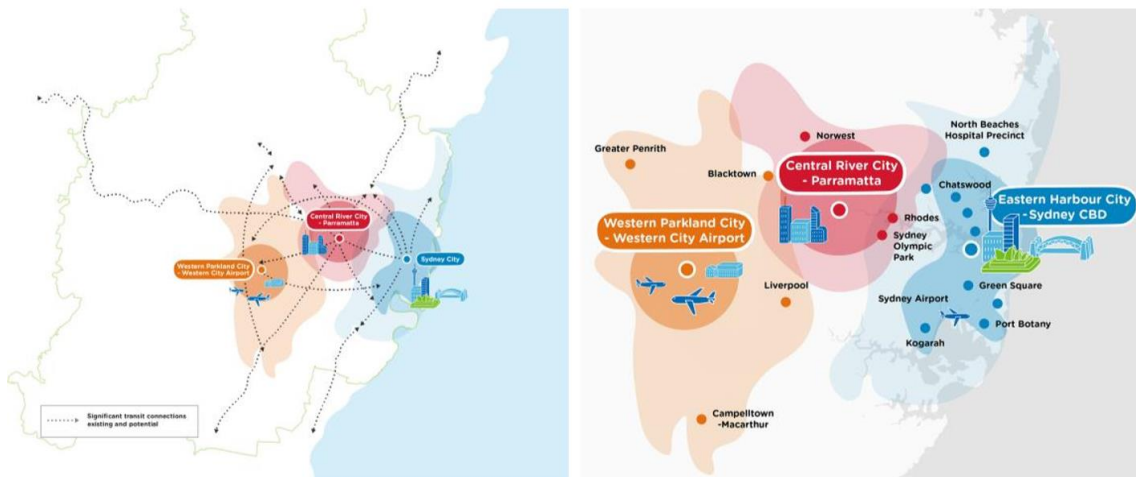
The Future Transport Strategy 2056 sets the long-term vision for mobility provision in NSW, explains how the customer experience of transport will change and what this means for NSW. The *Future Transport Strategy 2056* identifies that Sydney will grow as a global metropolis with benefits distributed more evenly across the City. It sets out a vision of three cities to guide many of the planning, investment and customer outcomes including faster, convenient and reliable travel times to major centres, as shown in **Figure 2–1**.

Existing and potential transit connections, together with new technology and innovation, will make the network surrounding the Site more responsive to demand and better able to manage congestion in the future.

For the three cities identified, more specific outcomes listed as part of the Strategy which will benefit the transport context of the ECC, include:

- A 30 minutes access for customers to their nearest Centre by public transport 7-days a week;
- Fast and convenient interchanging with walking times no longer than 5 minutes between services;
- Walking or cycling as the most convenient option for short trips around centres and local areas, supported by a safe road environment and attractive paths; and
- Fully accessible transport for all customers.

**Figure 2–1 A future metropolis of three cities**



Source: Future Transport 2056 Strategy

### 2.2 Eastern City District Plan

The *Eastern City District Plan* (March 2018) (the District Plan) provides a vision for the Eastern City District (as presented in **Figure 2–2**) to become more innovative and globally competitive. It looks to enhance the District's lifestyle and environmental assets. This will in part be achieved by aligning growth with infrastructure, including transport, and delivering sustainable and adaptable solutions. The District Plan projects a population growth of 325,000 people and demand for an additional 157,500 dwellings in the next 20 years.



Figure 2–2 Eastern City District Plan



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

The District Plan informs local strategic planning statements and local environmental plans, the assessment of planning proposals as well as community strategic plans and policies. The District Plan also assists Councils to plan for and support growth and change and align their local planning strategies to place-based outcomes. It guides the decisions of State agencies and informs the private sector and the wider community of approaches to manage for growth and change. Community engagement on the District Plan has contributed to a plan for growth that reflects local values and aspirations, in a way that balances regional and local considerations.

The vision for Greater Sydney is one where people can access jobs and services in their nearest metropolitan and strategic centre. The 30-minute city is a long-term aspiration that will guide decision-making on locations for new transport, housing, jobs, tertiary education, hospitals and other amenities. It means that they will be planned for



metropolitan and strategic centres and more people will have public transport access to their closest metropolitan or strategic centre within 30 minutes. This will enable more efficient access to workplaces, services and community facilities.

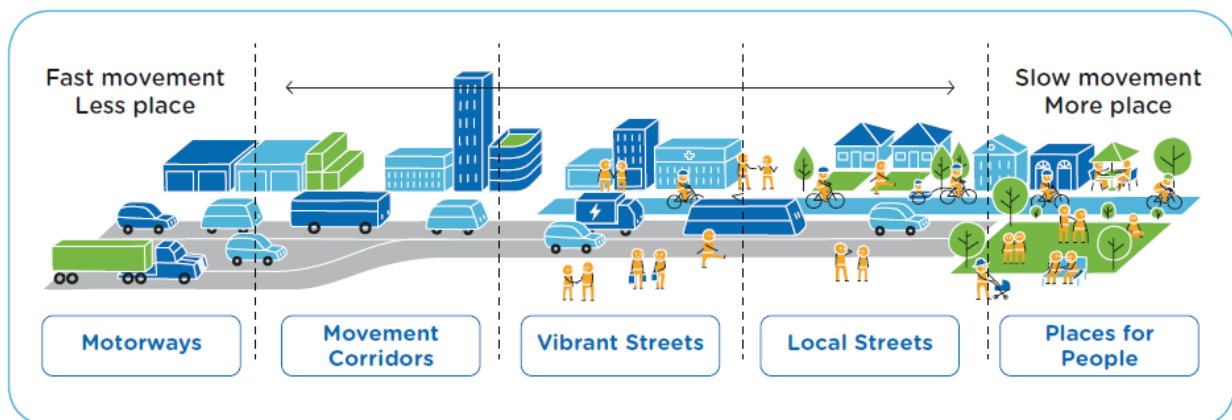
**Implication for the ECC:** Development in WMC's area needs to deliver access to a strategic centre within 30 minutes. Edgecliff is well-positioned to achieve this, being fifteen minutes from the city.

## 2.3 Greater Sydney Services Infrastructure Plan

The *Greater Sydney Services and Infrastructure Plan* is a 40-year plan for transport in Sydney. It is designed to support the land use vision for Sydney. Building on the state-wide transport outcomes identified in the *Future Transport Strategy 2056*, the Plan establishes the specific outcomes transport customers in Greater Sydney can expect and identifies the policy, service and infrastructure initiatives to achieve these.

To support the liveability, productivity and sustainability of places for the transport network, a Movement and Place Framework was developed, as presented in **Figure 2–3**. The Framework acknowledges that transport networks have different functions and roles and serve as both a destination and as a means to move people and goods. The Movement and Place Framework will enable us to plan, design and operate the transport network to meet these different needs by providing greater transparency, supporting collaboration between those responsible for land use, transport and roads while also encouraging input from the community. Through the framework we will be able to design a future network that is better used and supports the safe, efficient and reliable movement of goods and the need for liveability of places along it.

**Figure 2–3 Different movement environments under the Movement and Place Framework**



Source: [https://future.transport.nsw.gov.au/wp-content/uploads/2018/plans/Greater\\_Sydney\\_Services\\_Infrastructure\\_Plan.pdf](https://future.transport.nsw.gov.au/wp-content/uploads/2018/plans/Greater_Sydney_Services_Infrastructure_Plan.pdf) (April, 2018)

**Implication for the ECC:** sitting on a major road corridor with significant traffic as well as a significant place, New South Head Road has place as well as movement objectives. Any infrastructure changes need to balance the often competing design requirements between movement and place.

### 2.3.1 Future Transport network

The future transport network vision, as presented in the Greater Sydney Services Infrastructure Plan (shown in **Figure 2–4** and **Figure 2–5**), and the implications the implementation these visions would have for the ECC and surroundings, are described in the following sections.

#### City-shaping network

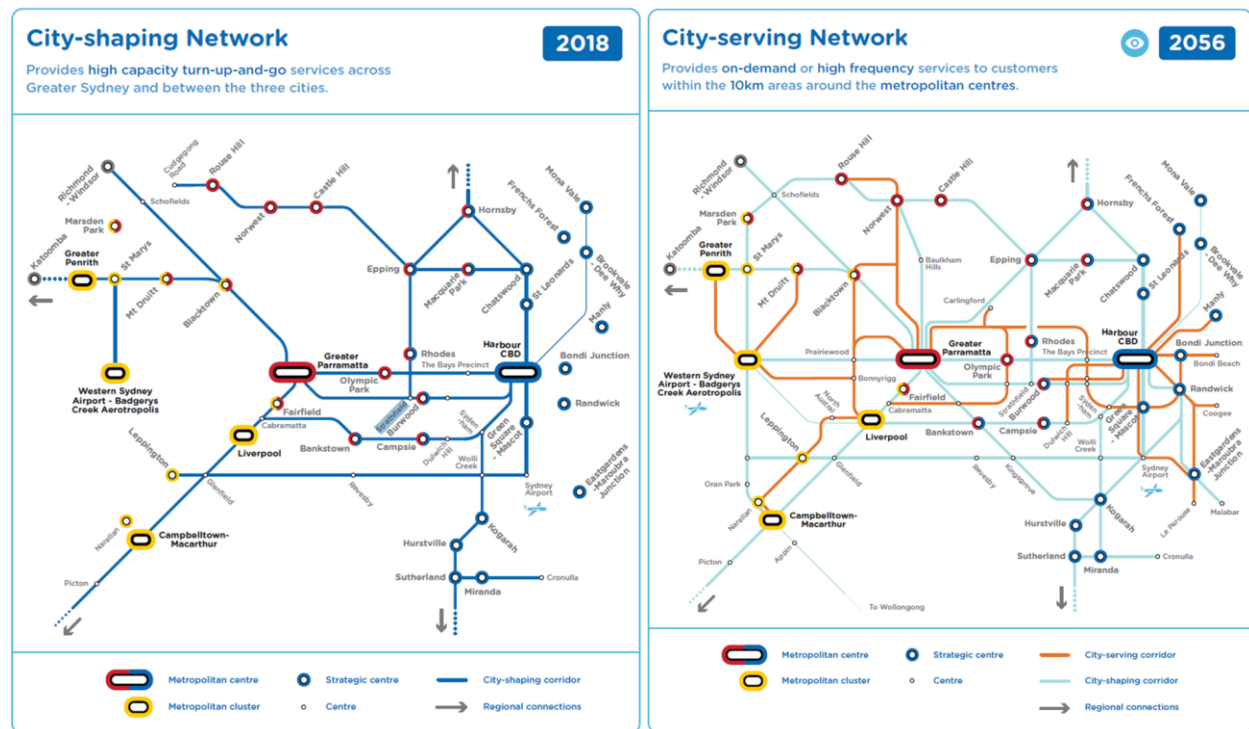
The city-shaping network includes higher speed and volume linkages between future cities and centres. The function of this network is to enable people living in any of the three cities to access their nearest metropolitan centre within 30 minutes and to be able to travel efficiently between these metropolitan centres.

As Greater Sydney transitions to a metropolis of three cities, the city-shaping network will need to expand to provide improved access to and between each metropolitan city/centre, particularly Greater Parramatta and centres in the metropolitan cluster in the Western Parkland City.

## City-serving network

The city-serving network will provide high-frequency services within a ~10km radii of the three metropolitan cities/centres. This will support access within some of the densest land use in Greater Sydney where demand for travel is most concentrated. As these inner urban areas in each of the three cities develop and become denser, the government will investigate the prioritisation of on-street public transport services and invest in higher frequency services.

Figure 2–4 Greater Sydney and 2056 transport network vision



Source: [https://future.transport.nsw.gov.au/wp-content/uploads/2018/plans/Greater\\_Sydney\\_Services\\_Infrastructure\\_Plan.pdf](https://future.transport.nsw.gov.au/wp-content/uploads/2018/plans/Greater_Sydney_Services_Infrastructure_Plan.pdf) (April, 2018)

**Implication for the ECC:** Edgecliff enjoys a key location between the Harbour CBD and eastern strategic centre of Bondi Junction and is part of city-serving networks that would bring the ECC into reach of Greater Sydney and all three cities by high frequency and high capacity public transport links.

## Bicycle Network

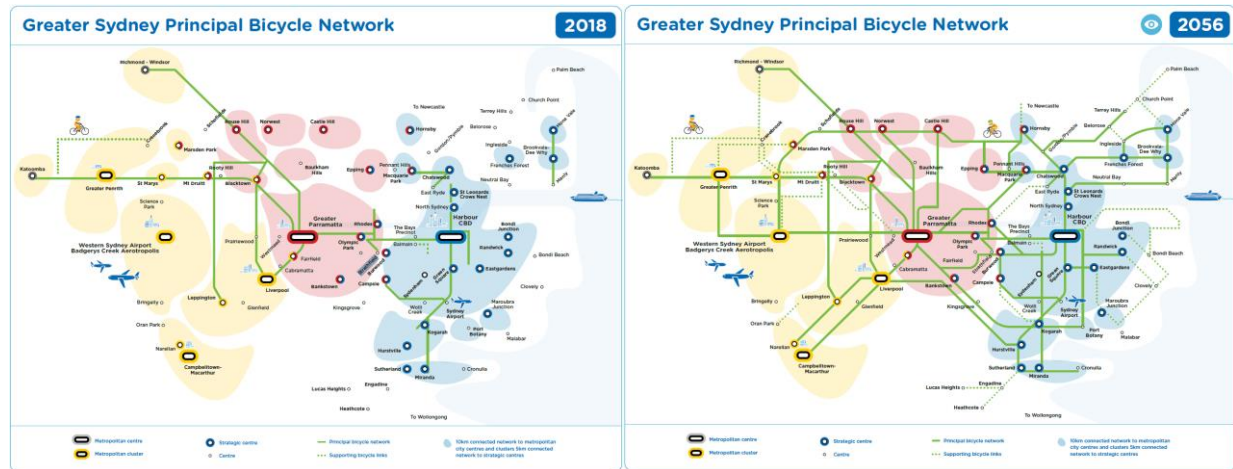
Building on the existing network, the immediate focus with regards to future bicycle transport links, is to work with local Councils to deliver committed Priority Cycleway projects, to address key missing links around the Harbour CBD, Greater Parramatta, Greater Penrith, Blacktown and Liverpool (such as the Nepean River Green Bridge and Inner West Greenway). Council partnership programs are delivering local bicycle infrastructure, and bicycle parking is also being rolled out at interchanges.

By 2056:

- Walking and cycling network coverage will be improved by using state held corridors for public transport, pipelines, waterways, crown land and service easements for bicycle network infrastructure; and
- All strategic centres will have connected walking and cycling networks, including strategic centres across the Western Parkland City.

Further investment in connections to strategic centres and in the Principal Bicycle Network will support walking or cycling being the most convenient option for short trips, improving health outcomes, safety and convenience for customers as well as boosting the productivity, liveability and sustainability of Greater Sydney. **Figure 2–5** shows the current/committed Greater Sydney Bicycle Network alongside the envisioned 2056 Bicycle Network.

Figure 2–5 Current/committed and 2056 Greater Sydney Principal Bicycle Network



Source: [https://future.transport.nsw.gov.au/wp-content/uploads/2018/plans/Greater\\_Sydney\\_Services\\_Infrastructure\\_Plan.pdf](https://future.transport.nsw.gov.au/wp-content/uploads/2018/plans/Greater_Sydney_Services_Infrastructure_Plan.pdf) (April, 2018)

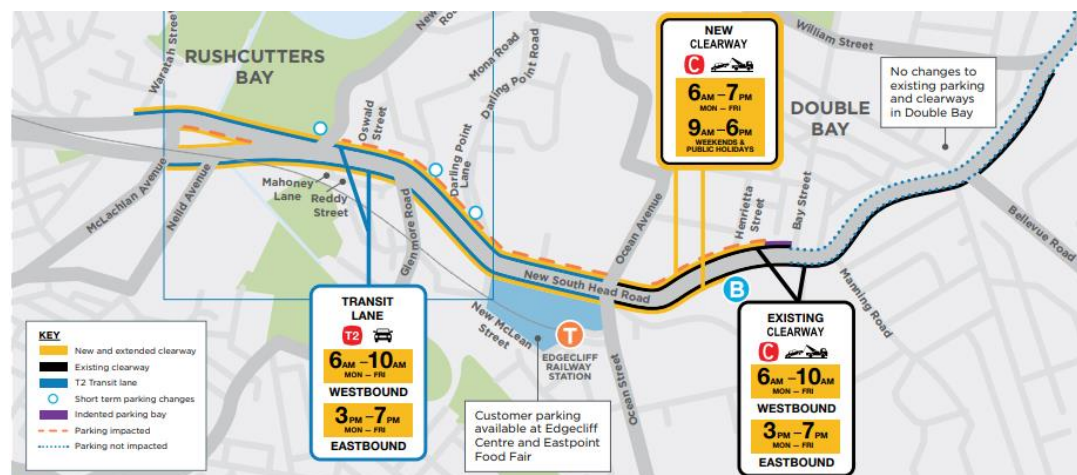
**Implication for the ECC:** The bicycle network in Edgecliff should support connectivity to the Greater Sydney Principal Bicycle Network and Edgecliff Train Station.

## 2.4 Clearways

In order to reduce congestion and delays on Sydney's road network, *Sydney Clearways Strategy* was published by the NSW Government and implemented by Road and Maritime Service since 2013. A total of 521 kilometres of clearways have been installed on the city's busiest corridors by around mid-2018. New South Head Road is a key state road connecting Sydney CBD to the eastern suburbs, which was initially identified in the Sydney Clearway Strategy (2013). Over the past few years, its congestion was worsening, particularly during weekends.

After collaboration between stakeholders, the RMS and WMC, from Monday 12 November 2018 clearways were introduced to New South Head Road for the section between Waratah Street/ McLachlan Avenue, Rushcutters Bay and Bay Street, Double Bay. New and extended clearway hours are shown in **Figure 2–6**, in addition to existing parking restrictions outside the new clearway hours.

Figure 2–6 Proposed New South Road clearways

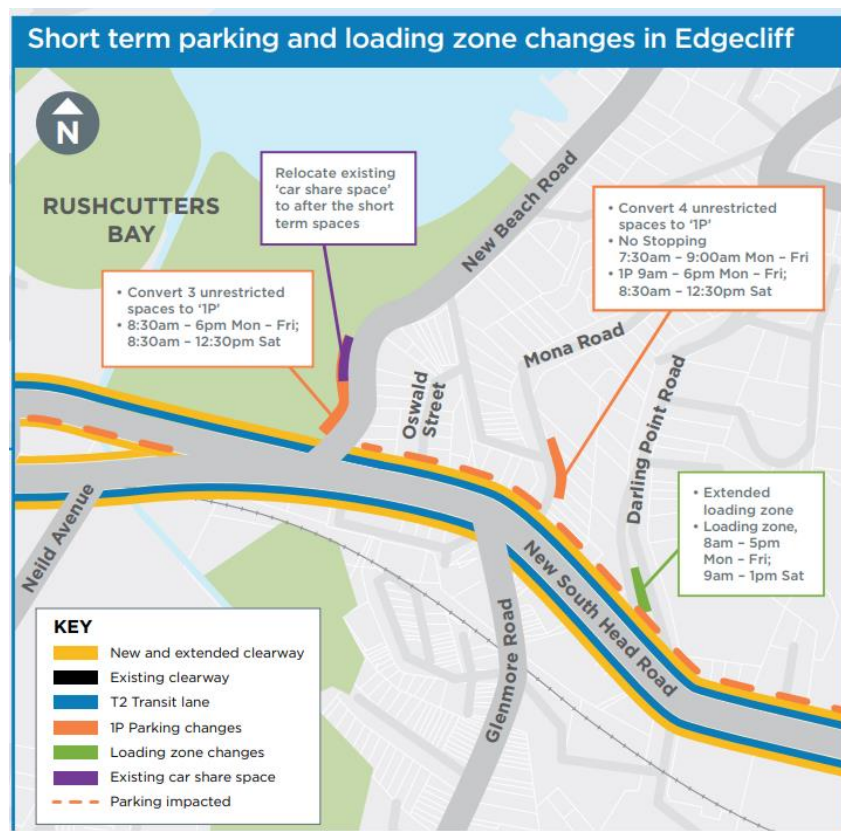


Source: <https://www.rms.nsw.gov.au/documents/projects/sydney-south/new-south-head-rd-clearway-rushcutters-bay-double-bay/new-south-head-rd-rushcutters-bay-double-bay-project-update-2018-10.pdf> (October 2018)

Following the implementation of the clearway, the road capacity increased, which has improved travel times for private and public road users. However, it also causes inconvenience for customers accessing the centre as well as pedestrians due to reduced supply of temporary parking, loading / unloading bays and reduced buffers to fast moving vehicles.

As shown in **Figure 2-7**, parking and loading zone changes were implemented for three spaces on New Beach Road ('1P'), four spaces on Mona Road ('1P') and extending the length of a loading zone on Darling Point Lane.

**Figure 2-7 Short Term parking and loading zone changes**



Source: <https://www.rms.nsw.gov.au/documents/projects/sydney-south/new-south-head-rd-clearway-rushcutters-bay-double-bay/new-south-head-rd-rushcutters-bay-double-bay-project-update-2018-10.pdf>, 2018

**Implication for the ECC:** delivery of clearways on New South Head Road has improved throughput for vehicles and buses, particularly for weekends.

## 2.5 Woollahra 2030 Plan

The *Woollahra 2030 Plan* (WMC, June 2018) is a strategic document which focuses on the long-term vision for the Woollahra local government area (LGA). It identifies current goals and challenges, presents strategies to deliver these goals and has a key focus on ensuring a sustainable future for the LGA. One of the key themes 'quality places and spaces' in particular relates to transport and reflects on the importance of making Woollahra liveable and convenient. Three of the key measures for this theme, relating to transport, are outlined in **Table 2-1**.

**Table 2-1 Quality Places and Spaces Goal – Measures and Targets**

Measure	Target
Increase in bike paths	<ul style="list-style-type: none"> <li>30km integrated network of bike paths by 2025</li> <li>2.4km of new off-road cycleways by 2020</li> </ul>
Condition of civil infrastructure	<ul style="list-style-type: none"> <li>98% of Civil Infrastructure rated at Condition rating 1, 2 or 3 (IPR Manual)</li> </ul>
Renewal of civil infrastructure	<ul style="list-style-type: none"> <li>100% of Civil Infrastructure rated at Condition rating 4 or below (IPR Manual) scheduled for renewal with 24 months</li> </ul>

Source: WMC, 2018



The key strategies to be implemented to achieve these goals by 2030 are outlined in **Table 2-2**.

**Table 2-2 Woollahra 2030 Plan Transport Strategies**

Strategy Number	Strategy
5.2	Provide and maintain safe, clean, serviceable public infrastructure including roads, footpaths, bicycle facilities, parks, open space, stormwater drains and seawalls.
5.7	Renew and upgrade ageing infrastructure including roads, footpaths, stormwater drains and seawalls.
6.1	Facilitate an improved network of accessible and safe alternate transport options.
6.2	Improve the management of on-street and off-street public parking.
6.3	Promote provision of better, more integrated public and community transport.
6.4	Reduce traffic congestion, noise and speeding.

Source: WMC, 2018

**Implication for the ECC:** develop the ECC as a major transport hub that provides sustainable means of transport, promoting walking, cycling and public transport. Car parking controls should be managed to encourage people's switch to public transport and mitigate road congestion.

## 2.6 Environmental Sustainability Action Plan 2013 – 2025

WMC developed the *Environmental Sustainability Action Plan* (ESAP) for the years 2013-2025, to document their targets and commitments in relation to their key priority areas. These key priority areas are energy and emissions, water, biodiversity, waste and transport. The key future goals and actions for transport in the document are:

- 30km of roads within the LGA have designated bike lanes by 2025;
- 100 per cent of the cars offered in carshare programs are fuel-efficient vehicles by 2017; and
- Community Engagement, by supporting schools, residents are WMC staff to adopt sustainable transport behaviours.

The current goal is for 30 kilometres of roads within the LGA to have designated bike lanes by 2025. This goal is supported through the implementation of the WMC's 2009 Bike Strategy.

**Implication for the ECC:** additional cycle facilities should be considered.

## 2.7 Woollahra Development Control Plan 2015

The *Woollahra Development Control Plan 2015* (DCP) provides objectives, controls and design criteria to achieve desirable development outcomes in line with WMC's vision for the LGA. The following guidance is highly relevant to the potential development of the ECC:

- Benchmarking of parking generation rates;
- Integration of retail and commercial uses with housing for New South Head Road; and
- Improving pedestrian connections for the Commercial Core.

**Implication for the ECC:** the subsequent sections contain the minimum design requirements currently enforced by WMC. These requirements can be changed as part of the LEP amendment process.

### 2.7.1 Parking requirements

The DCP outlines guidance and controls for the provision of parking in new development. This includes maximum rates for residential development and minimum parking generation rates for non-residential development. Other



requirements related to parking are also identified such as bicycle and motorcycle parking. A non-compliance parking provision maybe allowed based on the satisfaction that the development will:

- Minimise and manage the impact of traffic generation;
- Reasonably reduce the on-street parking demand;
- Consider the existing context capacity.

### Residential Car Parking

The parking rates below are maximum standards for high density residential development defined in the DCP. Justification must be presented if either more or fewer parking spaces are designed.

**Table 2-3 Residential Parking Rates**

Performance Criteria	Performance Measures
Mixed use development (residential component) Spaces based on number of bedrooms per dwelling	1-bedroom or studio – 0.5 space 2-bedroom unit – 1 space 3-bedroom unit – 1.5 spaces Visitor parking – 0.2 space

Source: The Woollahra DCP Chapter E1 Parking and Access, 2016

### Non-residential Car parking

The parking provision for non-residential development needs to be consistent with the desired future character for the centre and are set out as minimum requirement in **Table 2-4**.

**Table 2-4 Non - Residential Parking Rates**

Performance Criteria	Performance Measures^
The base parking generation rates are calculated per 100 sqm of gross floor area of a development	Business premises – 2.5 spaces Office premises – 2.5 spaces Retail – 3.3 spaces Food and drink premises – 7 spaces Supermarkets – 3.5 spaces

^Where a land use fits into a group term but is also separately defined as a sub-term, the parking generation rate for the sub-term should be applied.

Source: The Woollahra DCP Chapter E1 Parking and Access, 2016

It should be noted that a parking multiplier of 0.6 can be adopted for Edgecliff Commercial Core B2 Zone and New South Head Road Edgecliff commercial corridor B4 Zone, which will take account of the availability of public transport and planning strategy that WMC is pursuing.

### Bicycle Parking

The provision of bicycle parking must adhere to the minimum parking rates in **Table 2-5**.

**Table 2-5 Bicycle Parking Rates**

Land use	Performance Measures	
	Residents/ Employees	Customers/ Visitors
Residential accommodation	1 per dwelling	1 per 10 dwellings
Office / business premises	1 per 150 sqm GFA	1 per 400 sqm GFA
Shop, restaurant or cafe	1 per 250 sqm GFA	2 + 1 per 100 sqm over 100 sqm GFA
Shopping centre	1 per 200 sqm GFA	1 per 1,000 sqm GFA

Source: The Woollahra DCP Chapter E1 Parking and Access, 2016

Additional controls include:

- One secure locker is required for each bicycle parking space.
- One shower and change cubicle is provided for between 5 and up to 10 bicycle parking spaces, two for 11-20 bicycle parking spaces and one additional shower and cubicle for each additional 10 bicycle parking spaces.
- A charging point is provided for every five bicycle parking spaces for electric bicycles.

### Motorcycle parking rates

The development should accommodate a minimum of 1 motorcycle parking space per 10 car spaces for all land use. The motorcycle parking areas need to be located close to the pedestrian access of the development.

### Variations to the parking generation rates

When a mixed-use development is introduced, possible reduction on parking rates for car parking, bicycle parking and motorcycle parking may be considered by WMC due to overlapping parking demand by land use or complementary usage of the parking space with different peak period.

### Other parking related controls

Further parking-related controls in the DCP are summarised in the below table.

**Table 2-6 Other Parking Related Controls in the DCP**

Control	Provision	Notes / Location
Car share	<ul style="list-style-type: none"> <li>– On-site car share may be permitted at the discretion of Council.</li> <li>– A car share parking space has the potential to replace a maximum of 4 regular car parking spaces.</li> <li>– Car share spaces must be placed in publicly accessible locations within the development.</li> </ul>	
Tandem parking	Residential development allows tandem parking when two spaces are allocated to a single dwelling whereas tandem parking for non-residential development should be allocated for employee use only to satisfy long term parking demand.	Generally not preferred by Council
Small car parking spaces	Number of small car parking spaces should not exceed 5% of the overall parking spaces and follow the dimension set out in Australian Standard AS/NZS 2890.1 Off-street car parking.	
Off-street loading and servicing facilities	<ul style="list-style-type: none"> <li>– Generally, a minimum of one loading bay is required for retail such as supermarket, food and drink over 50 seats etc.</li> <li>– Loading bays and service areas should operate independently of other parking areas and should ensure the loading and unloading operations entirely within site boundary.</li> </ul>	Variation of loading bays depends on the scale and type of use, having particular regard to the anticipated volume and frequency of deliveries
Mechanical parking	<ul style="list-style-type: none"> <li>– The installation of mechanical parking structure such as car lifts and car stackers should comply with national standards.</li> <li>– Waiting bays should be designed to avoid impacting on the driveway, footway or roadway.</li> </ul>	Generally, not desirable unless considered in exceptional cases

Source: The Woollahra DCP Chapter E1 Parking and Access, 2016

## 2.7.2 Improving connections

The Commercial Core (referred to as the Edgecliff Centre in the DCP) is part of the ECC. The centre contains the Edgecliff Train Station and a bus Interchange. As has been identified in the Woollahra DCP Chapter D4, there is a need to enhance pedestrian links across the centre, and through the centre to the bus interchange and train station to provide an attractive and comfortable pedestrian environment. The connections to the ECC and surrounding residential land will increase activity and convenience. This includes:

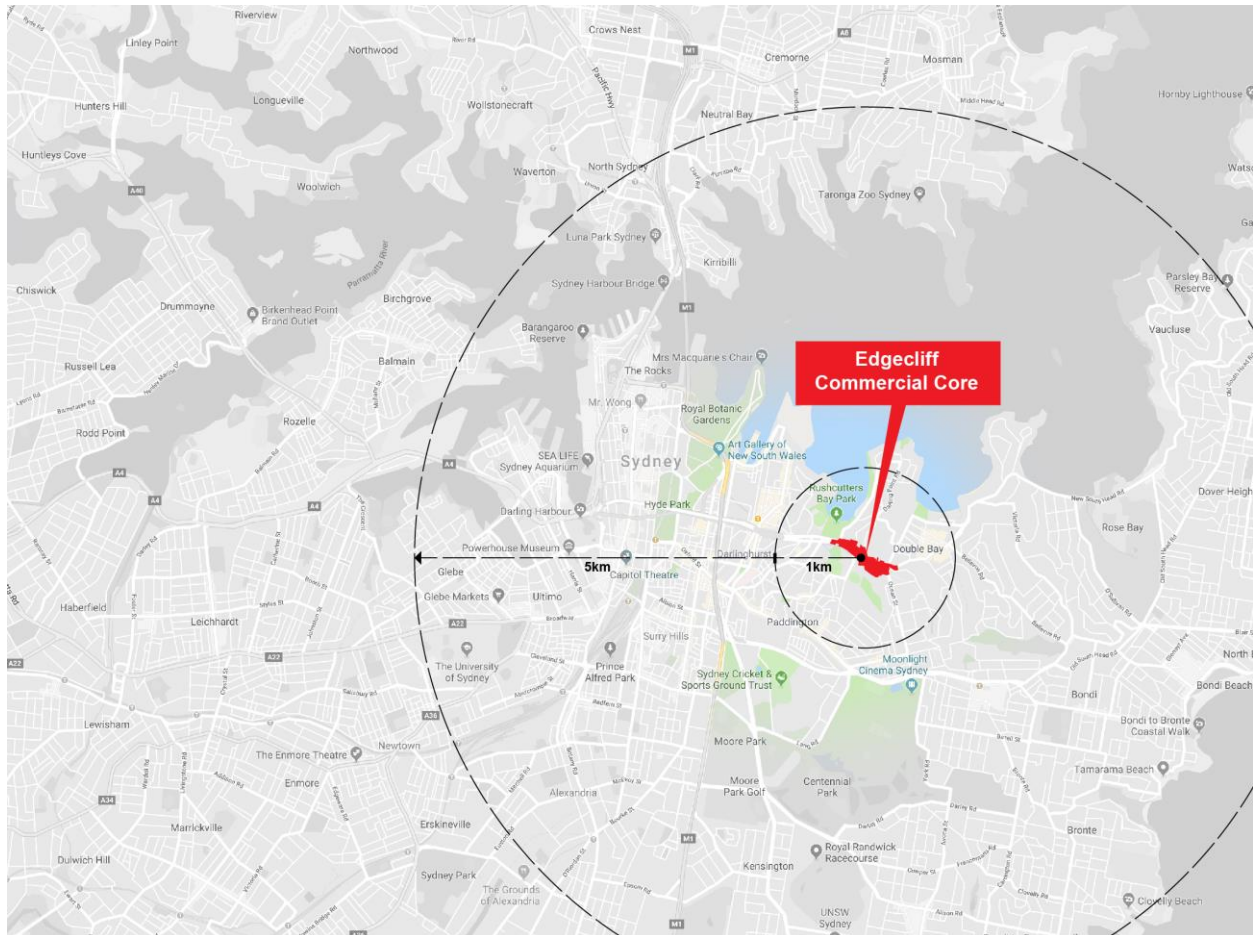
- providing north-south thoroughfares and improving links between retailing spaces and public transport facilities;
- integrating access to public car parking areas from different buildings; and
- designing and constructing of awnings with sufficient depth for pedestrians.

## 3.0 Existing Conditions

### 3.1 The site

ECC is located approximately 4km east of Sydney CBD, whilst Bondi Junction is located approximately 3km to the south-east. The regional context of the site is shown in **Figure 3–1**.

**Figure 3–1 The Edgecliff Commercial Centre in a regional context**



Source: Sydway, modified by SCT Consulting; 2019

The existing zoning of the ECC is shown in **Figure 3–2**. The ECC is zoned as a combination of B4 Mixed Use and B2 Local Centre zones. The ECC sits on the state road, New South Head Road, which serves as a link between Sydney CBD, the Cross City Tunnel and the eastern suburbs.

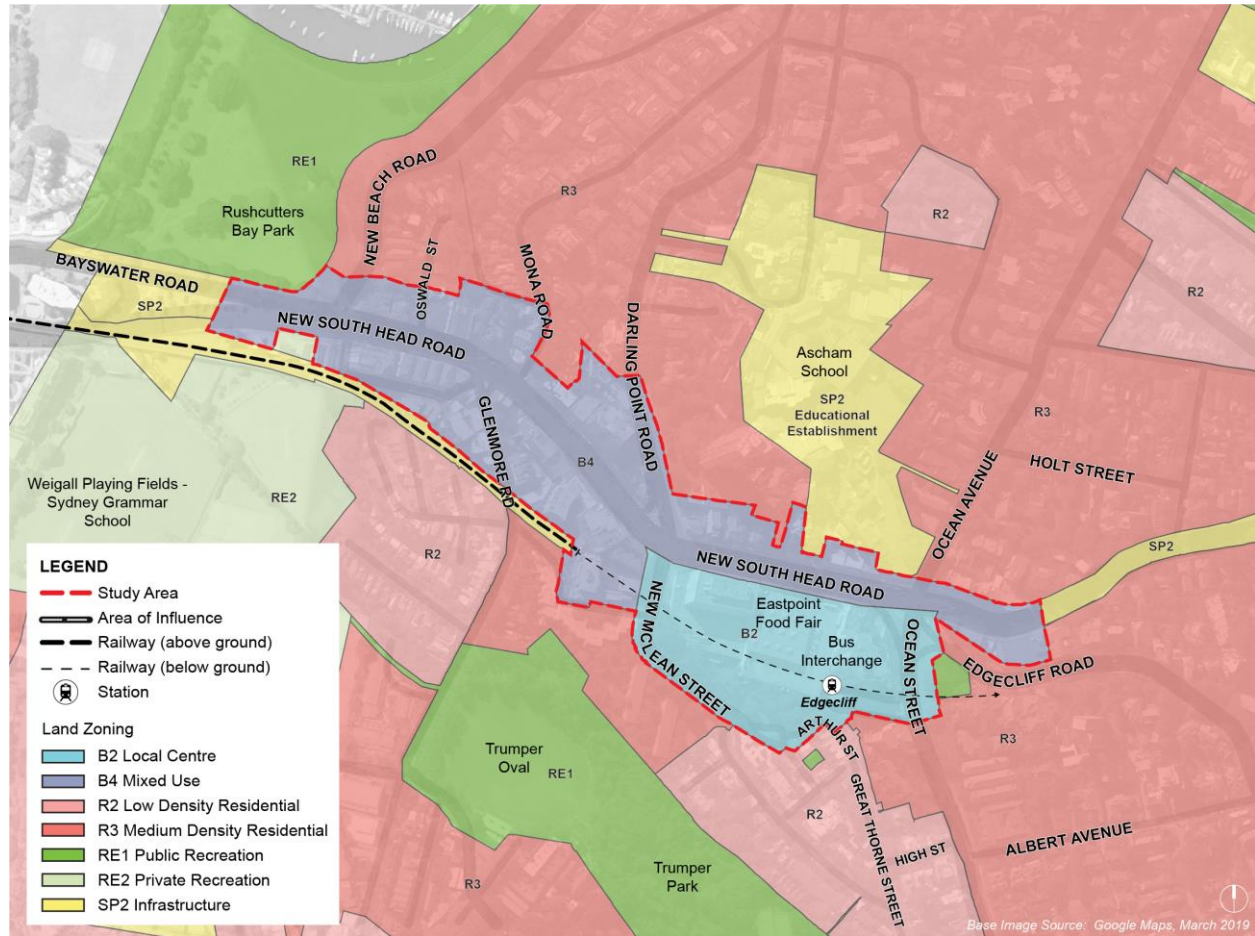
The Commercial Core is the focal point of the ECC, providing a valuable connection to the Sydney Trains network and destinations across Sydney. The core includes two large developments:

- The “Edgecliff Centre” office building at 203-233 New South Head Road.
- The “Eastpoint Centre” at 235-285 New South Head Road, which incorporates a shopping centre, residential tower, Edgecliff Train Station and a bus interchange.

The Commercial Core is the largest retail, business, office and residential development in Edgecliff and serves as a convenient place for people to meet, work, shop and use services. The core provides a good range of convenience retailing opportunities, including supermarkets and speciality stores and services to the surrounding residential suburbs including; Edgecliff, Darling Point, Double Bay, Paddington, and Woollahra.

The Edgecliff Train Station provides train services to Greater Sydney and bus interchange, which is located above the Eastpoint Shopping Centre, provides and local and regional bus routes services.

Figure 3-2 The existing Edgecliff Commercial Centre Zoning



Source: NSW Legislation, modified by SCT Consulting; 2019

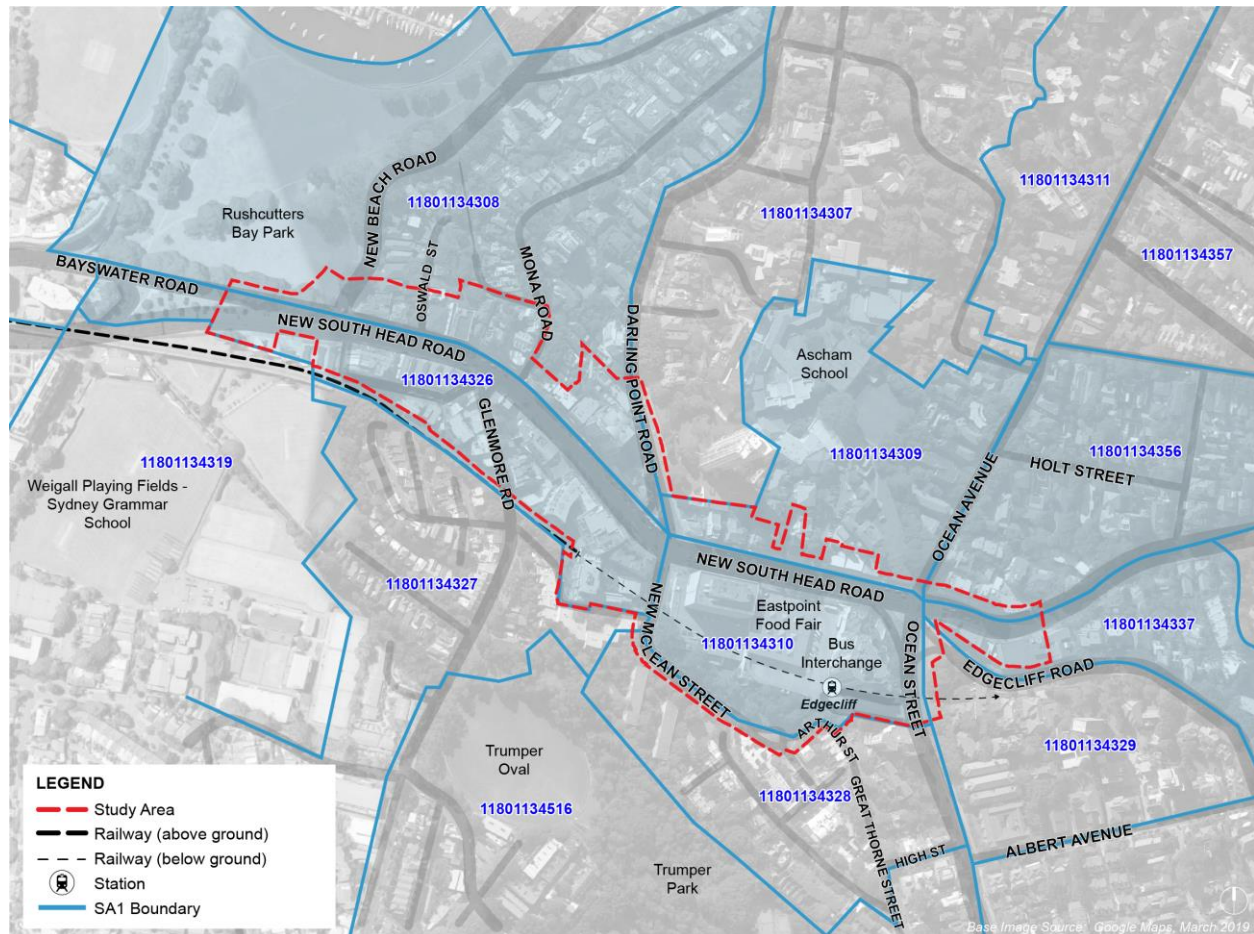


## 3.2 Travel behaviour

### 3.2.1 Method of Travel to Work data

The 2016 Method of Travel to Work data was analysed to determine current travel behaviour and patterns to and from the ECC during peak travel periods. The smallest geographical area for which data is available currently is the Statistical Area 1 (SA1) and the areas used to analyse the method of travel to work is shown in **Figure 3–3** (including the SA1s for the ECC and the surrounding mixed use and retail developments).

**Figure 3–3 Edgecliff Community Centre SA1 Geographies**

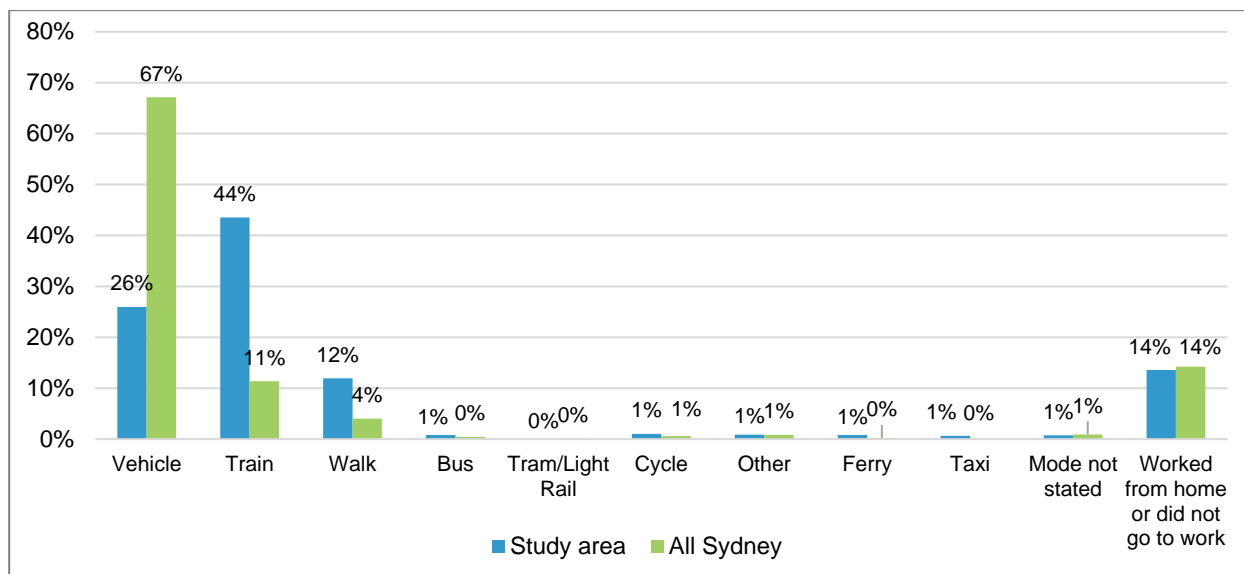


Source: Australian Bureau of Statistics, modified by SCT Consulting; 2019



**Figure 3–4** shows a comparison of the primary departure mode split for residents travelling to work within the selected SA1s and the Sydney Greater Metropolitan Area (GMA).

**Figure 3–4 Primary Travel Modes by Residents from ECC and all Sydney**

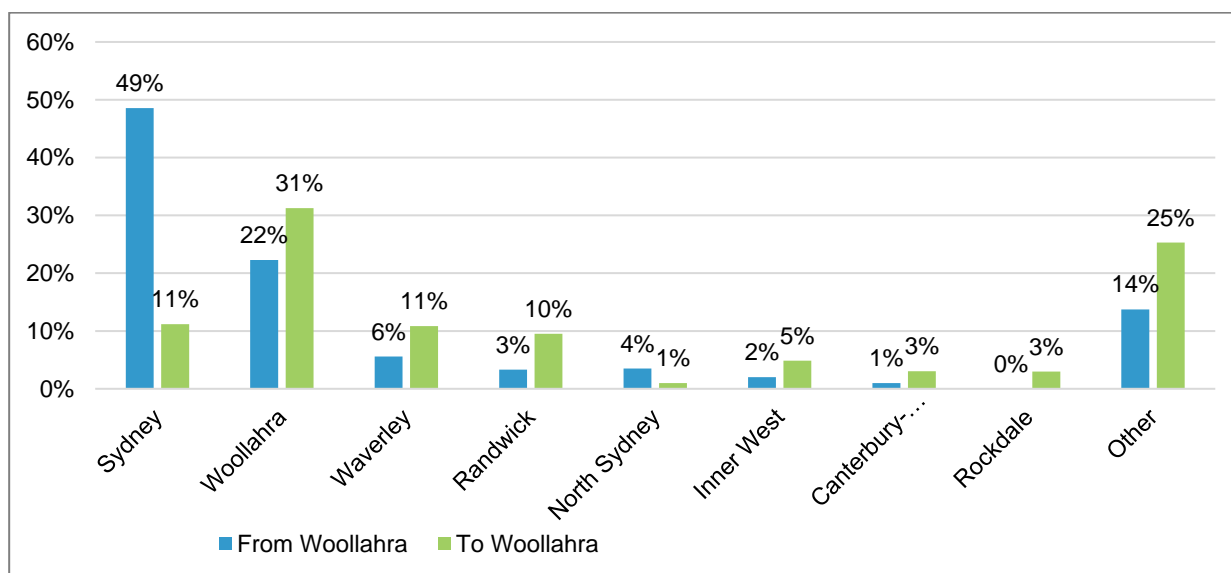


Source: Australian Bureau of Statistics, modified by SCT Consulting; 2019

For the Sydney GMA, a total of 67 per cent, 11 per cent and 4 per cent use private vehicle, train and walk respectively to get to work. By comparison, the train mode share for Edgecliff is 44 per cent. This is by far the most dominant mode of transport. This is reflective of the close walking distance to Edgecliff Train Station, with the entirety of the analysed travel zones falling within a one-kilometre walking radius.

Destination data is unavailable by SA1 geography, so was analysed at the LGA geography level. **Figure 3–5** shows a comparison of the major Journey to Work 2016 destinations / origins for departures from / arrivals at Woollahra LGA.

**Figure 3–5 Major Destination/ Origin LGAs for Workers Commuting to and from Woollahra LGA**



Source: Australian Bureau of Statistics, modified by SCT Consulting; 2019

As shown **Figure 3–5**, the majority (49 per cent) of residents head to the Sydney CBD for work. This is likely to be due to expensive parking restrictions in the CBD and good public transport links to the ECC, leading to less vehicle dependence (which corresponds with the high number of people traveling from the ECC via train, and not private vehicle). This is followed by Woollahra (22 per cent), Waverley (6 per cent), North Sydney (4 per cent), and Randwick (3 per cent). The remaining 14 per cent of departures are very fragmented across Sydney and attract less than 2 per

cent of workers per destination. The relatively short commute length for workers travelling within the Woollahra LGA supports walking as mode of travel.

### 3.2.2 Household Travel Survey

The site is located within the statistical area “Eastern Suburbs (North)”, as defined by the Australian Bureau of Statistics within the 2015/2016 Household Travel Survey (HTS). However, for the purpose of analysis, it has been assumed that JTW data provides a suitable reflection of the travel characteristics during AM and PM peak hour periods, due to the high proportion of trips during this timeframe associated with journey to work trips.

Analysis of the 2015/2016 HTS indicates that over 50 per cent of trips made by residents of Eastern Suburbs (North) are likely to be associated with shopping, personal, business, social and recreational activities. Trips of this nature are likely to account for a high proportion of trips that are made on a Saturday peak. On this basis, the HTS for “Eastern Suburbs (North)” is considered reflective of the trips likely to be made in Edgecliff during a Saturday peak period. **Table 3-1** and **Table 3-2** provide a summary of the purpose of travel and overall mode choice by residents of Eastern Suburbs (North) associated with these trip purposes compared against the Sydney average and the districts of Parramatta and Penrith. There is a relatively consistent comparison regarding trip purpose between Eastern Suburbs (North) and Sydney, with the main differences being within the social / recreation trip purpose which is higher in the Eastern Suburbs (North) area, compared to Sydney (overall percent of total trips 26 per cent compared to 22 per cent).

The Eastern Suburbs (North) has a higher proportion of walk trips (30 per cent), compared to Sydney with 17 per cent, which could be due to a higher density of the eastern suburbs. It is also reflected in the lower proportion of trips recorded in the Eastern Suburbs for the vehicle driver and vehicle passenger categories.

**Table 3-1 Household Travel Survey: Trip Purpose – Residents within Eastern Suburbs (North), Sydney, Parramatta and Penrith**

Travel by purpose	Eastern Suburbs (North)	Sydney	Parramatta	Penrith
Commute	11%	11%	13%	14%
Work related business	9%	8%	5%	13%
Education / childcare	5%	8%	9%	10%
Shopping	13%	14%	13%	11%
Personal business	3%	4%	3%	4%
Change mode of travel	14%	14%	17%	8%
Social / recreation	26%	22%	17%	18%
Serve passenger	14%	17%	19%	19%
Other	5%	3%	4%	2%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Source: Transport for NSW, modified by SCT Consulting; 2019

**Table 3-2 Household Travel Survey: Mode Choice – Residents within Eastern Suburbs (North), Sydney, Parramatta and Penrith**

Mode	Eastern Suburbs (North)	Sydney	Parramatta	Penrith
Vehicle (Driver)	41%	48%	42%	57%
Vehicle (Passenger)	13%	21%	20%	24%
Train	6%	6%	7%	3%
Bus	5%	6%	7%	5%
Walk only	30%	17%	23%	9%
Other	4%	2%	1%	1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Source: Transport for NSW, modified by SCT Consulting; 2019

### 3.3 Road network

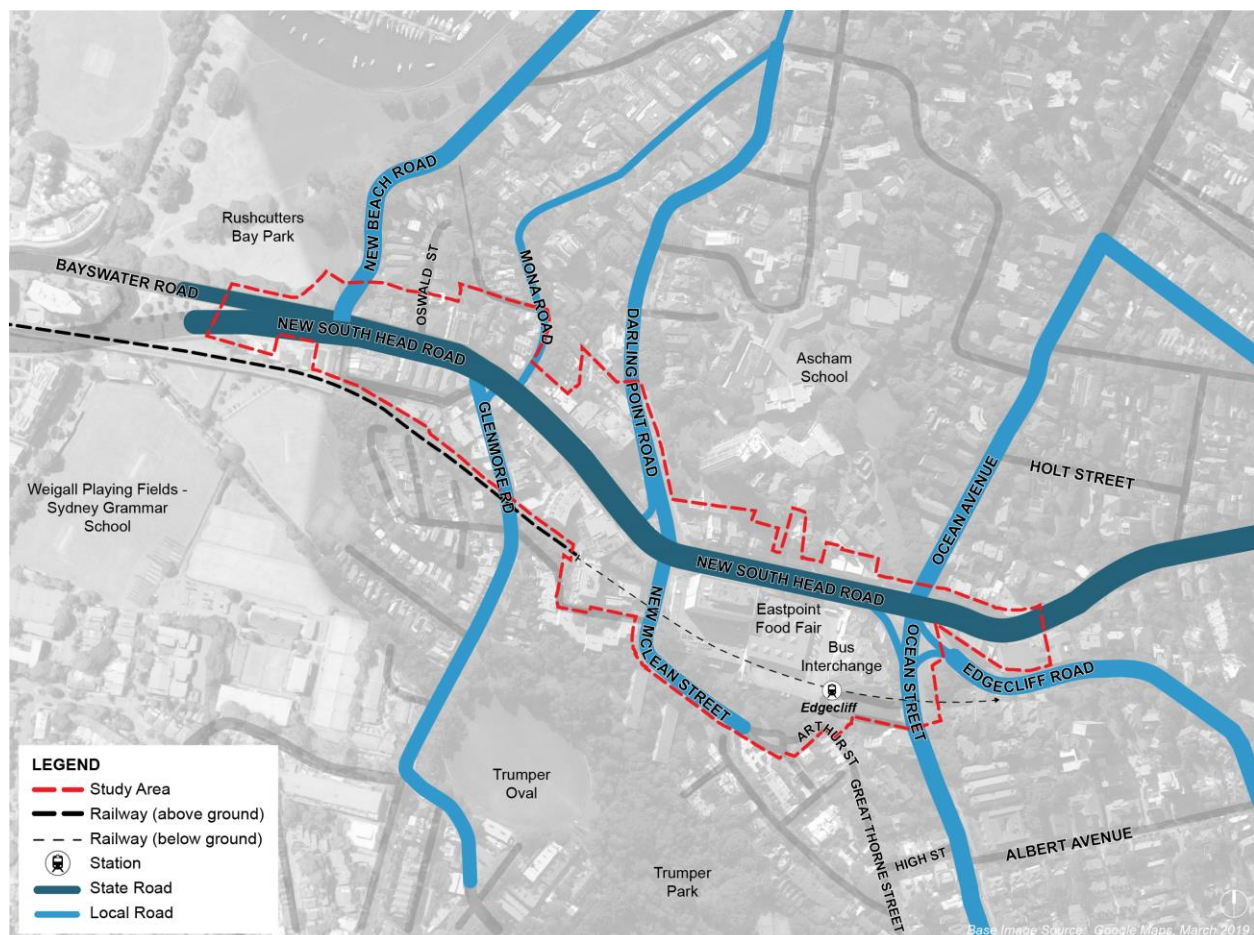
#### 3.3.1 Road classification

The major access to the ECC from the Sydney Metropolitan area is via New South Head Road which runs through the middle of the ECC. As indicated in **Figure 3–6**, New South Head Road is the only State Road (controlled and maintained by the RMS), in the vicinity of the ECC. All other roads within the vicinity of the ECC are Local Roads, under the control of WMC, with the main local roads providing access to the ECC being New Beach Road, Glenmore Road, Mona Road, Darling Point Road, New McLean Street and Ocean Avenue / Ocean Street.

The key intersections along New South Head Road within the ECC are as follows:

- New South Head Road / New Beach Road – signalised intersection, 370 metres west of the Edgecliff Centre;
- New South Head Road / Glenmore Road/ Mona Road – signalised intersection, 220 metres to the west of the Edgecliff Centre;
- New South Head Road / Darling Point Road/ New McLean Street– signalised intersection, directly west of the Edgecliff Centre; and
- New South Head Road/ Ocean Street / Ocean Avenue – signalised intersection, directly east of the Edgecliff Centre.

**Figure 3–6 Road Classification in the vicinity of the ECC**



Source: SCT Consulting, 2019

#### 3.3.2 Functional hierarchy

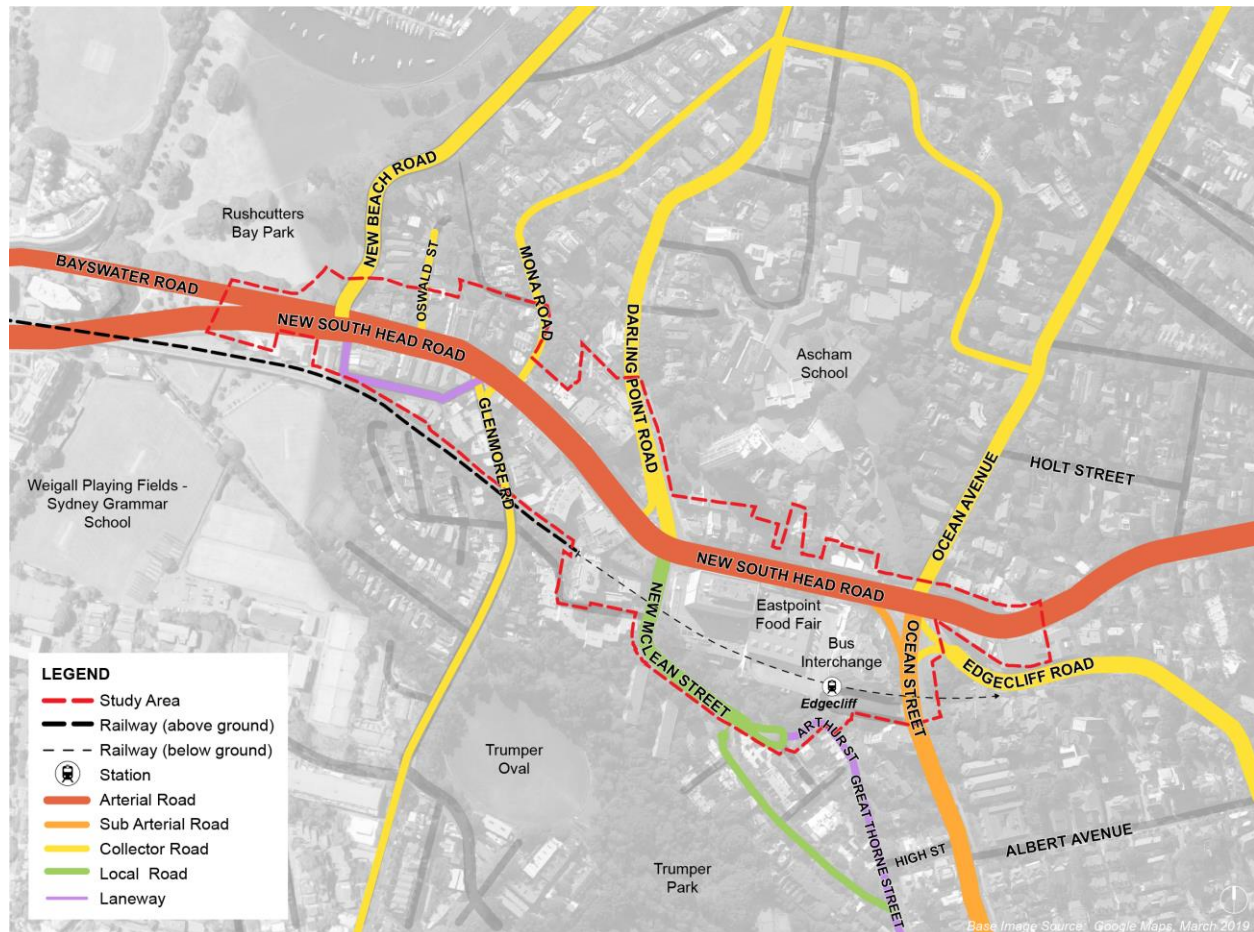
The formal classification of the roads, as described above, outlines the ownership and authority of the road. However, the functional hierarchy describes the use and characteristics of a particular road. **Figure 3–7** outlines the road hierarchy in the vicinity of the ECC.



New South Head Road functions as an arterial road, configured as a dual carriageway. Ocean Street to the south of New South Head Road functions as a sub-arterial road. New South Head Road and Ocean Street combined serve as major traffic corridors which carry traffic generated outside the ECC.

New Beach Road, Mona Road, Darling Point Road and Ocean Avenue to the north of New South Head Road and Glenmore Road to the south of New South Head Road serve as collector roads, whilst all other roads are local roads.

**Figure 3–7 Road Functional Hierarchy in the vicinity of the ECC**



Source: SCT Consulting, 2019

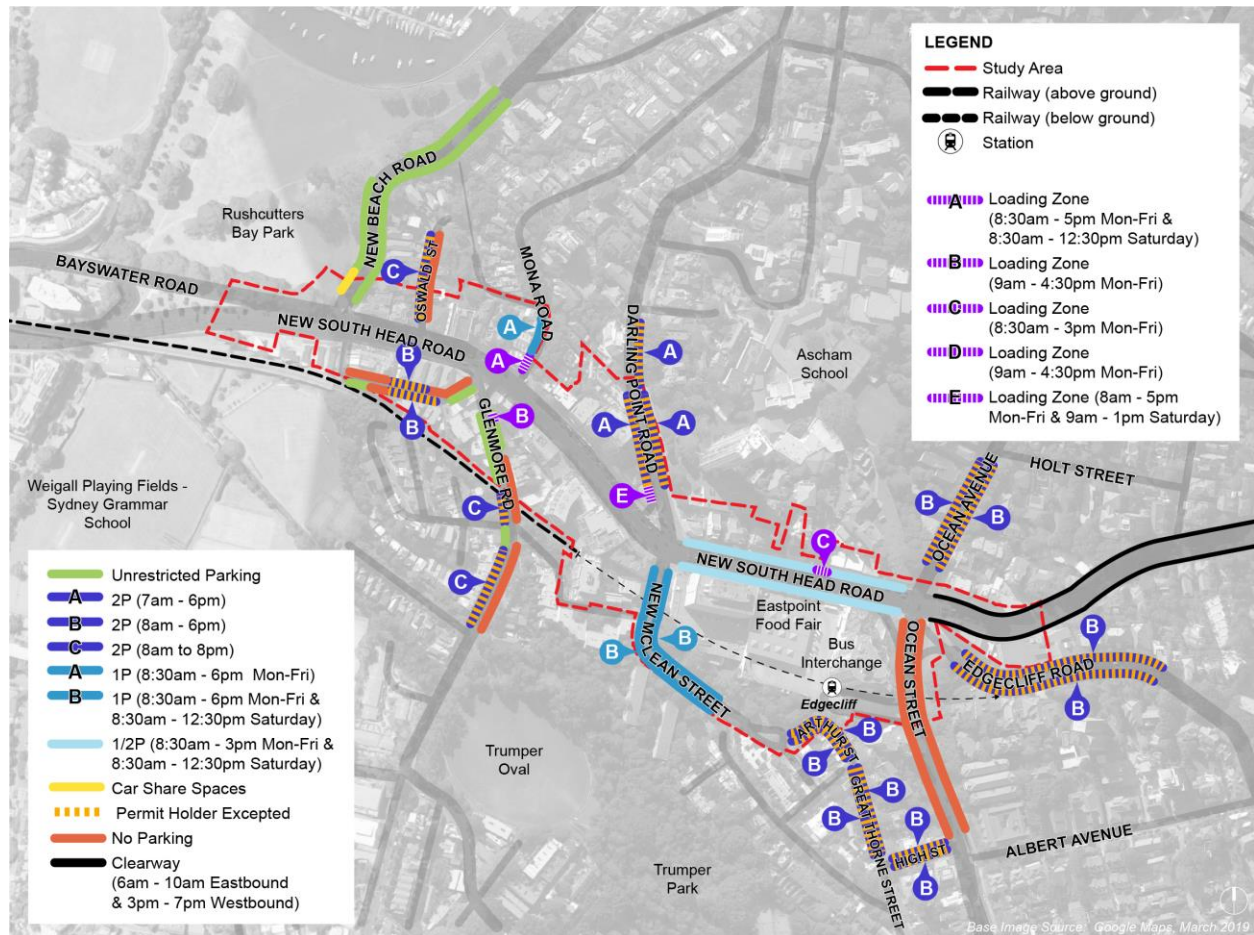
### 3.3.3 Access and car parking

Access to ECC can be made via the Ocean Street / New South Head Road intersection from the east and the New Beach Road / New South Head Road from the west. Access to the area is also gained via Mona Road, Darling Point Road and Ocean Avenue from the north and via New McLean Street and Glenmore Road from the south.

The Commercial Core developments can only be accessed by the public along the New McLean Street frontage, with a total of four car park accesses being present along this road. Car parking for tenants of the Commercial Core has separate or shared access from that for casual / shopping car parking and loading docks. A large portion of the properties along the ECC corridor can be accessed via New South Head Road only.

The *Edgecliff Commercial Centre Transport Assessment* (GTA Consultants, November 2017) presents the parking currently available within the ECC. This information, together with the updated parking as a result of the implementation of clearways in the area in 2018, has been summarised and presented in **Figure 3–8**.

Figure 3–8 Parking currently available within the Edgecliff Commercial Centre



Source: The Edgecliff Commercial Centre Transport Assessment (GTA Consultants, November 2017), modified by SCT Consulting; 2019

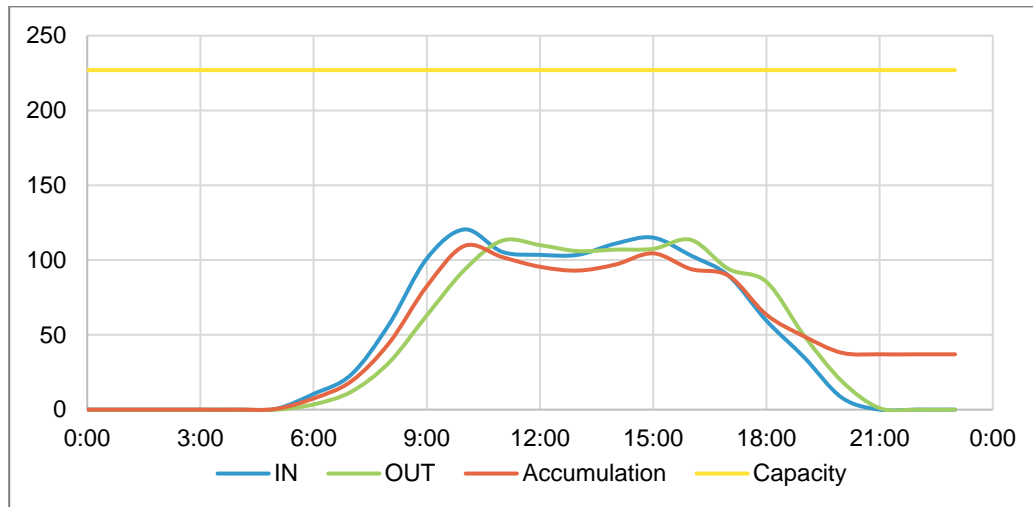
Car parking surveys undertaken for on-street parking during Thursdays and Saturdays within the ECC were presented in the *ECC Transport Assessment* report (GTA Consultants, November 2017). It should be noted that these surveys were undertaken prior to the Clearways being implemented in 2018.

From the surveys it was clear that with the exclusion of parking provisions within the ECC, car parking demand within publicly available on-street spaces remained consistent at 90 per cent for both the surveyed Thursday and Saturday, except for New South Head Road, where the on-street parking was observed to be fully occupied (which indicates that on-street parking has reached its practical capacity) during the Thursday. On the Saturday, New South Head Road experiences low to medium parking demand, which suggests a lower rate of parking generated by retail shopping along New South Head Road, as most of retail stores are closed during the weekend.

In addition, car park data was obtained from Edgecliff Centre, which is shown in **Figure 3–9**.



Figure 3–9 Edgecliff Centre car park data



Source: Edgecliff Commercial Centre, modified by SCT Consulting; 2019

Car park data indicates that the centre has spare capacity, and that the peak generation on a Thursday is 3pm, with a total generation of 223 vehicle trips. The Thursday AM peak has a generation of 89 vehicles and the PM peak has a generation of 184 vehicles. The centre currently comprises:

- 3,200 sqm retail;
- 700 sqm consultates;
- 710 sqm medical practises;
- 1,400 sqm co-working space; and
- 2,000 sqm accounting / financial services.

At an aggregate, this is consistent with a traffic generation rate of 2.29 trips / 100sqm GLFA (across both retail and commercial uses). Assuming the commercial generates 0.86 trips / 100sqm, this is equivalent to a retail trip generation of 4.4 trips / 100sqm GLFA. It is noted that this data was made available after agreement to traffic generation rates and therefore wasn't able to be taken into consideration in the agreed trip rates.

### 3.4 Road network performance

To assess the current operational performance of key intersections surrounding the ECC, traffic counts were undertaken by GTA Consultants during the weekday and Saturday AM and PM peak periods, on Thursday 13 October 2016 (between 6am and 9am and 3.30pm and 6.30pm) and Saturday 15 October 2016 (between 9am and 10am and 5pm and 6pm), respectively. The surveys and performance analysis were undertaken at the following signalised intersections:

- New South Head Road / New Beach Road;
- New South Head Road / Glenmore Road/ Mona Road;
- New South Head/ Darling Point Road / New McLean Street Road; and
- New South Head Road / Ocean Street / Ocean Avenue.

#### 3.4.1 Preparation of SIDRA models

A separate report (referred to as the 'SIDRA calibration and validation report, included as **Appendix A**) was prepared by SCT Consulting and contains the methodology and assumptions for the calibration of SIDRA models for the ECC. At the request of WMC and RMS, SCT Consulting prepared SIDRA models for the four intersections within the ECC, in accordance with the *Traffic Modelling Guidelines (2013)* Chapter 14 Single Intersection Modelling.

Operational performance is typically measured through an assessment of the throughput of vehicles across a traffic network, with average delay per vehicle used to assess the performance of an individual intersection. The average

delay per vehicle measure is linked to a Level of Service (LoS) index which characterises the intersection's operational performance. **Table 3-3** provides a summary of the LoS performance bands.

**Table 3-3 Level of Service Index**

Level of Service	Average Delay per Vehicles (sec/h)	Performance explanation
A	Less than 14.5	Good operation
B	14.5 to 28.4	Good with acceptable delays and spare capacity
C	28.5 to 42.4	Satisfactory
D	42.5 to 56.4	Operating near capacity
E	56.5 to 70.4	At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method.
F	70.5 or greater	At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method.

Source: Guide to Traffic Generating Developments; RMS; 2002

Analysis is also included on Degree of Saturation (DoS). This metric describes the volume on capacity ratio for the worst turning movement in the intersection. DoS is a helpful metric for planning because it shows the spare capacity of the intersection.

### 3.4.2 Existing Intersection performance summary

The weekday and Saturday AM and PM peak hour traffic volumes and the LoS at the four analysed key intersections are summarised in figures contained in **Table 3-4** and **Table 3-5**.

**Table 3-4 Weekday existing intersection performance**

Intersection	Weekday AM Peak Hour				Weekday PM Peak Hour			
	Volume	Delay	LoS	DoS	Volume	Delay	LoS	DoS
Ocean Street / Ocean Avenue / New South Head Road	6,135	33.9	C	0.96	5,631	38.6	C	0.96
New South Head Road / Darling Point Road / New McLean Street	5,064	15.0	B	0.88	5,171	20.5	B	0.97
New South Head / Glenmore Road / Mona Road	5,363	14.9	B	0.88	5,313	6.5	A	0.75
New South Head Road / New Beach Road	5,742	17.3	B	0.95	5,678	4.8	A	0.72

Source: SCT Consulting, 2019

Modelling for the weekday scenarios indicates that New South Head Road is operating close to capacity at all intersections, with long queue lengths observed at the entrance to the modelled network in the AM peak hour. The DoS measures are approaching capacity (1.00) for the intersections of New South Head Road / Ocean Street and New South Head Road / New McLean Street. This is consistent with site observations. It is likely that additional demands on the network would result in increases in delay and queuing during the AM peak hour.

Generally, the intersections operate with a higher degree of spare capacity during the PM peak hour, which is consistent with site observations since traffic in the PM peak hour is more spread out and therefore causes less of an issue with congestion.

Table 3-5 Weekend existing intersection performance

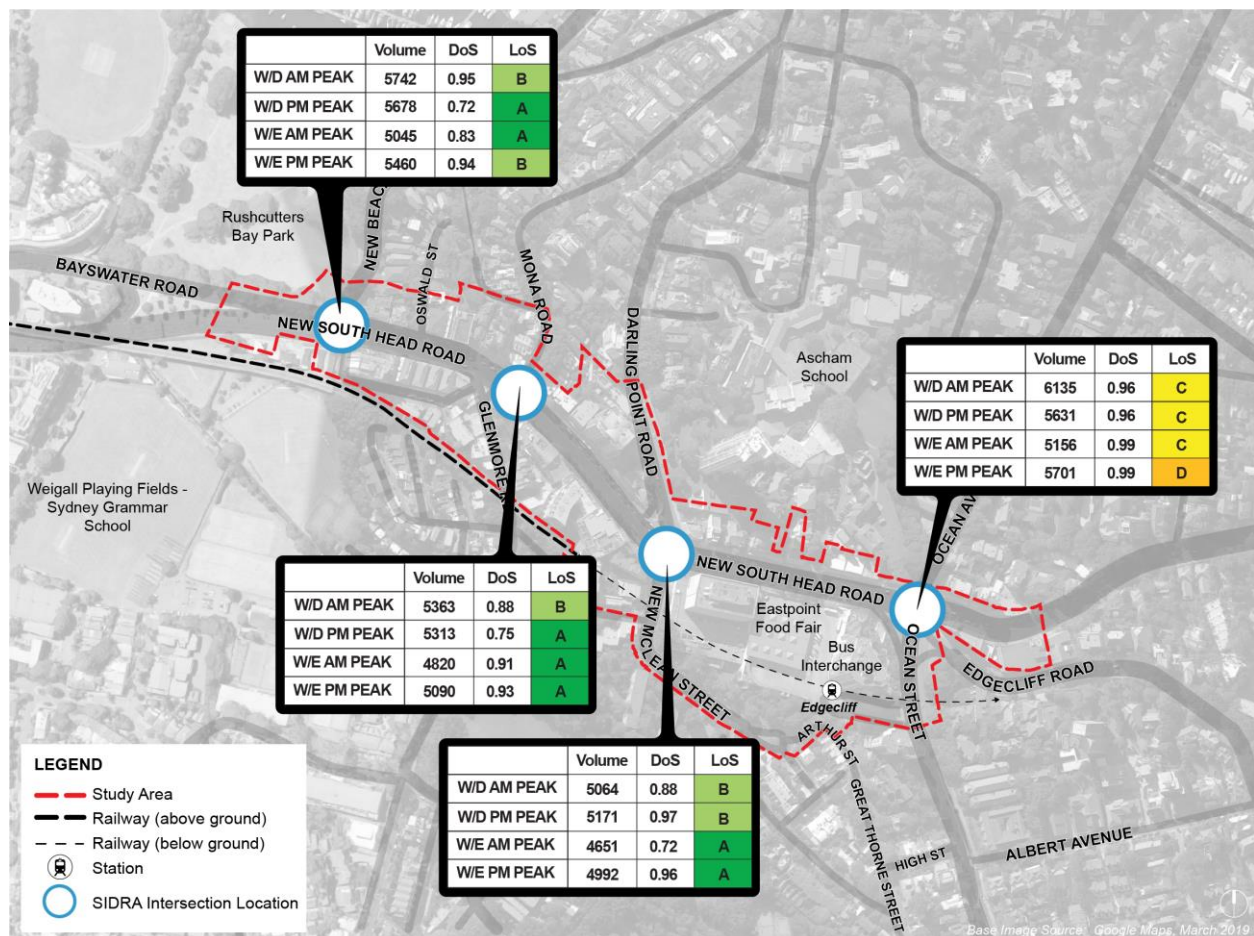
Intersection	Weekend AM Peak Hour				Weekend PM Peak Hour			
	Volume	Delay	LoS	DoS	Volume	Delay	LoS	DoS
Ocean Street / Ocean Avenue / New South Head Road	5,156	31.9	C	0.89	5,701	47.1	D	0.99
New South Head Road / Darling Point Road / New McLean Street	4,651	12.3	A	0.72	4,992	13.3	A	0.96
New South Head / Glenmore Road / Mona Road	4,820	13.8	A	0.91	5,090	12.8	A	0.93
New South Head Road / New Beach Road	5,045	8.2	A	0.83	5,460	23.0	B	0.94

Source: SCT Consulting, 2019

In the weekend peak hour AM peak hour modelling indicates that the New South Head Road corridor is operating close to capacity aside from the New South Head Road / Darling Point Road / New McLean Street intersection. However, the overall performance is better than during weekdays with all 95<sup>th</sup> percentile queue lengths being reduced below 150m.

For the PM peak hour, the modelling indicates that New South Head Road is operating close to capacity for all four intersections. Long queue lengths are seen at either end of the corridor, i.e. the east approach of Ocean St / New South Head Rd intersection and west approach of New South Head Rd / New Beach Rd intersection. It is likely that additional demands at the intersections could result in significant increases in delays and queues during both AM and PM peak hours. A summary of the performance of the existing network is provided in **Figure 3–10**.

Figure 3–10 Existing intersection volumes and performance



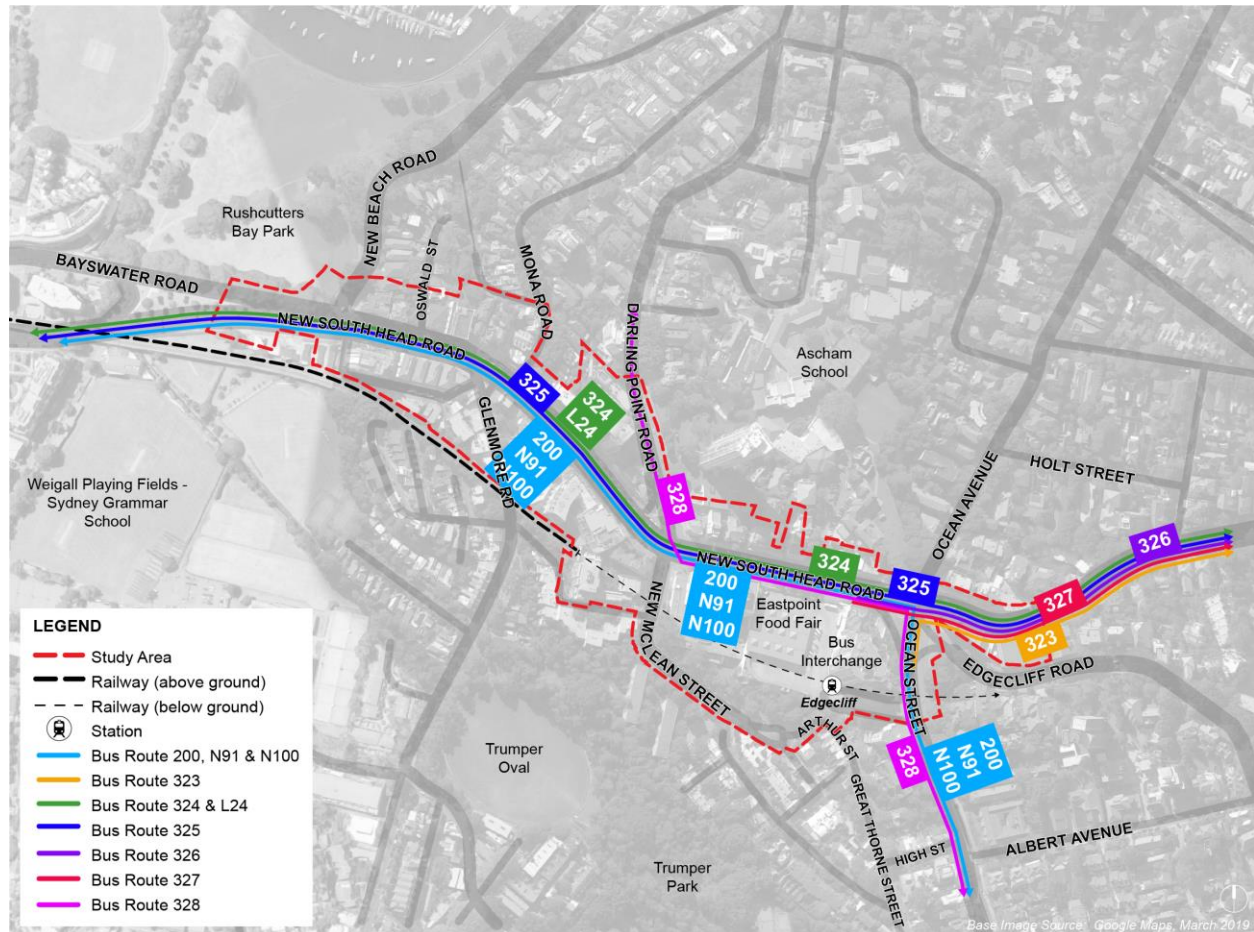
Source: SCT Consulting, March 2019

## 3.5 Public Transport

### 3.5.1 Bus

Eleven bus routes currently stop in proximity of the ECC, providing a high frequency of public transport links. There are direct bus links to key centres including Sydney CBD, Chatswood, Bondi Junction, Watsons Bay, Vaucluse and Macquarie Park. **Figure 3–11** shows the bus network map in the vicinity of the ECC.

**Figure 3–11 Surrounding Bus Network**



Source: Transport for NSW, 2019

**Table 3-6** shows the frequency of bus services in the vicinity of the ECC. The data shows that the ECC is well serviced by buses during the peak hours for both weekends and weekdays, with the majority of buses serving Bondi Junction and Watsons Bay. As shown, a number of bus routes serving the ECC terminates / commences at Edgecliff (routes 323, 327 and 327).



**Table 3-6 Bus Route Details for the ECC**

Route	Corridor	To	From	Average number of services (per hour, both directions)			
				Weekday		Weekend	
				AM (6-9am)	PM (3-7pm)	Sat (6-9pm)	Sun (6-9pm)
200	New South Head Road	Bondi Junction	Chatswood	5	6	-	-
323	New South Head Road	North Bondi	Edgecliff via New South Head Road	2	2	-	-
324	Old South Head Road	Watsons Bay	Walsh Bay via Old South Head Road	8	6	3	5
325	Vaucluse Road	Watsons Bay	Walsh Bay via Vaucluse Road	4	3	5	5
326	New South Head Road	Edgecliff	Bondi Junction via Bellevue Hill	4	4	2	2
327	Bellevue Rd / Manning Rd	Bondi Junction	Edgecliff via Bellevue Rd and Manning Rd	3	4	2	2
328	New South Head Road / Ocean Street	Bondi Junction	Darling Point via Edgecliff (loop)	-	1	1	1
L24	New South Head Road	Vaucluse	City (Wynyard)	1	-	-	-
N91	New South Head Road	Bondi Junction	Macquarie Park via City Town Hall	Night service Monday to Saturday			

Source: Transport for NSW, 2019

Opal Data bus capacity was provided by Transport for NSW for the 8 to 14 August 2016, the 21 to 27 November 2016, and 31 December 2016 to the 1 January 2017. This data records whether buses have “many seats available”, “few seats available” or is “standing room only”. No detail is provided on what differentiates few vs many seats being available. The average capacity of bus services throughout weekdays and weekends are summarised in **Table 3-7**.

**Table 3-7 Average bus capacity (yellow highlighting standing room only  $\geq 5\%$ )**

Time Period		Inbound (To Edgecliff)			Outbound (From Edgecliff)		
		Many seats available	Few seats available	Standing room only	Many seats available	Few seats available	Standing room only
Weekday	Before 7AM	86%	10%	3%	88%	8%	4%
	7AM - 9AM	76%	18%	6%	75%	20%	5%
	9AM - 5PM	75%	20%	5%	77%	20%	3%
	5PM - 7PM	80%	13%	7%	82%	16%	2%
	After 7PM	88%	8%	4%	89%	11%	0%
	Daily	79%	16%	5%	80%	17%	3%
Weekend	Before 7AM	100%	0%	0%	100%	0%	0%
	7AM - 9AM	93%	7%	0%	80%	13%	7%
	9AM - 3PM	76%	23%	2%	74%	23%	3%
	3PM - 7PM	69%	19%	12%	67%	27%	6%
	After 7PM	86%	11%	3%	89%	6%	6%
	Daily	82%	14%	4%	80%	16%	4%

Source: Transport for NSW, 2017

The data indicates that weekends are more constrained than weekdays for bus services, with services averaging 12 per cent standing room only in the weekend PM peak.

### 3.5.2 Train

Edgecliff Station is located on the T4 Eastern Suburbs and Illawarra Line and on the South Coast Line. These train lines provide direct access to Bondi Junction, the City, Sutherland and Wollongong, whilst also interconnecting to the wider Sydney Train network. It is an underground station which can be accessed via New South Head Road and New McLean Street. The majority of the ECC is located within an approximate distance of up to 500m catchment of the Edgecliff Station.

Trains travel to/from this station with a frequency of 18 services, in each direction of travel, during the AM peak hour period. During the PM peak hour period, 16 outbound (to Bondi Junction) trains and 17 inbound (to Central) trains service the station. There are approximately 7 train services per hour on Saturdays.

Capacity, assessed in the form of peak loading, has been obtained from Transport for NSW for the time period of 12 to 16 March 2018 on the T4 - Eastern Suburbs and Illawarra Line in the peak direction of travel and is summarised in **Table 3-8**. Capacity is assessed against the following two measures:

- 100 per cent load: A seat is available for each passenger
- 135 per cent load: The benchmark beyond which passengers experience crowding and waiting times that can impact on on-time running.

**Table 3-8 Maximum Train Loading Factors**

Period	Link	Direction	Maximum Load Factor	Measured At
Weekday 8-9am	T4 – Eastern Suburbs	Bondi Junction to Central	135%	Kings Cross
	T4 – Illawarra	Waterfall/Cronulla to Central	163%	Redfern
Weekday 5-6pm	T4 – Eastern Suburbs	Central to Bondi Junction	85%	Martin Place
	T4 – Illawarra	Central to Waterfall/Cronulla	128%	Redfern

Source: Transport for NSW, 2018

**Table 3-8** shows that the load factor is the highest during the AM peak hour for both the Eastern Suburbs Line and the Illawarra Line, with seating being at or above capacity respectively. During the PM peak hour the Eastern Suburbs Line is operating below capacity, while the Illawarra Line is nearing seating capacity. Additional data received from Transport for NSW from the Double Bay study indicates;

- During the AM peak the peak direction of travel is from Waterfall, Hurstville and Cronulla towards the Sydney CBD. Of the 30 trains that operate between 7-9AM, based on their arrive time at Central Station, only one train exceeds the 135 per cent threshold and five trains exceed the 100 per cent threshold as measured at Kings Cross Station. This indicates a large degree of spare capacity to operate future growth for individuals travelling to Edgecliff Station.
- In the PM peak, peak load measurements were undertaken at Martin Place Station for the T4 line. During the 4-6PM time period a total of 31 trains were recorded, based on the departure time from Central Station within this time period. Only one train was recorded as exceeding the 100 per cent threshold with no trains exceeding the 135 per cent threshold. As was noted in the AM peak this provides sufficient capacity to cater for potential growth in the ECC.

### 3.5.3 Interchange function

Edgecliff Station is served by a number of bus services throughout the day, with the majority of buses traveling to Bondi Junction and Watson Bay as final destinations. However, a number of bus services (traveling from North Bondi and Bondi Junction) also terminate at Edgecliff. Edgecliff Station is located on the T4 train line which provides frequent access to Bondi Junction, the City, Sutherland and Wollongong, whilst also interconnecting to the wider Sydney Train network.

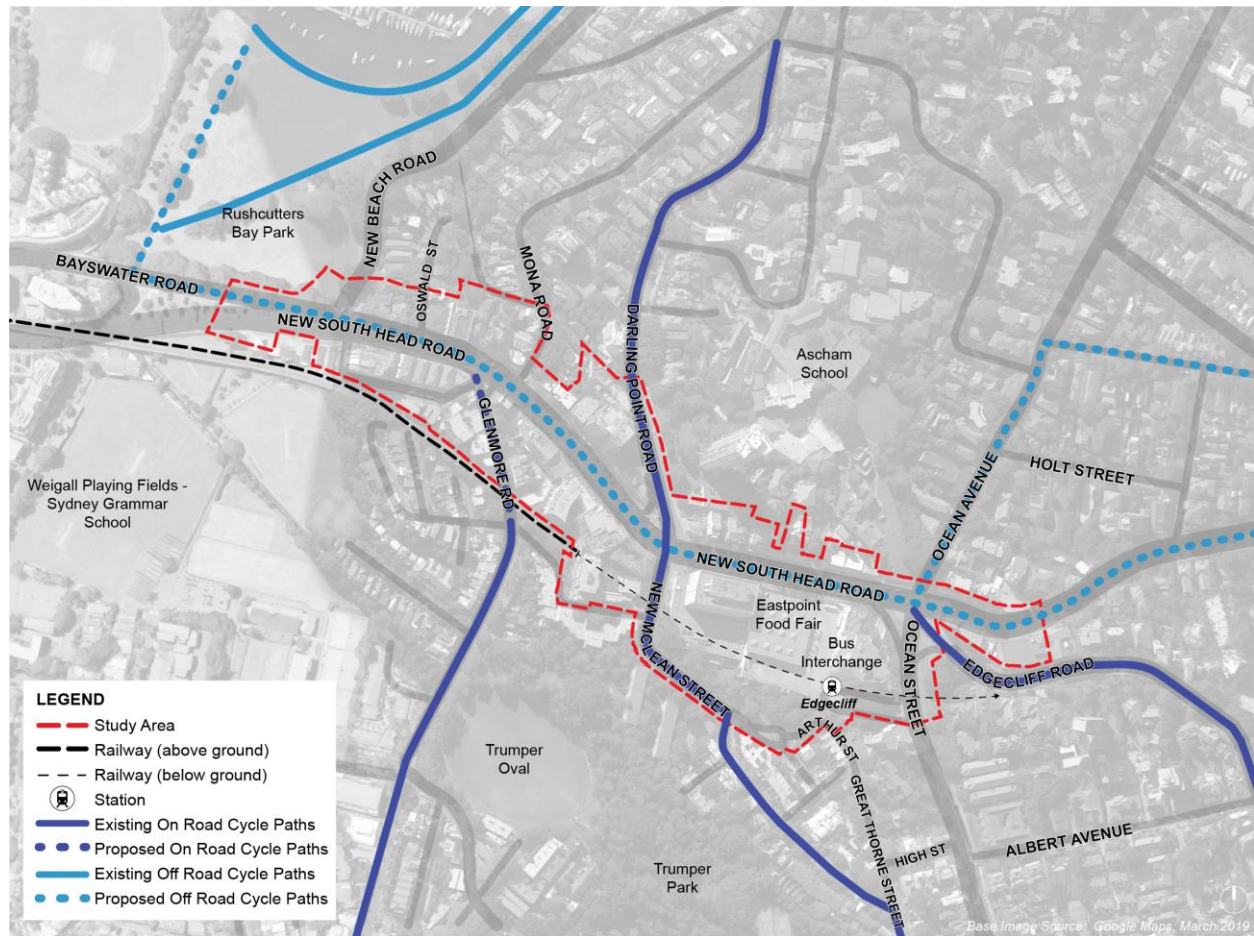
The combination of terminating bus services at the bus interchange and Edgecliff Train Station's good access to frequent train services suggests that Edgecliff, while being serviced by frequent bus and train services as separate transport modes, also holds an important role as an interchange between the two modes.

### 3.6 Active transport

#### 3.6.1 Cycling

The existing cycling routes serving the ECC are generally perpendicular to New South Head Road. The majority of these perpendicular routes are constrained by challenging grades of up to 10 per cent. There are no east-west road corridors except for New South Head Road, resulting in no alternative east-west cycle options. New South Head Road is a challenging road environment that precludes all but the most experienced riders. **Figure 3–12** shows the existing routes and those proposed in Woollahra's Bike Plan 2009 and subsequent planning by WMC.

**Figure 3–12 Existing and Proposed Bicycle Network**



Source: [www.woollahra.nsw.gov.au](http://www.woollahra.nsw.gov.au), modified by SCT Consulting, 2019

### 3.6.2 Walking

The ECC is generally well-served by pedestrian footpaths, with New South Head Road and surrounding local roads being provided with footpaths on both sides. However, some of the pedestrian footpaths have uneven pavers and do not provide ease of access for those with mobility issues, including parents with prams, the elderly or people with disabilities. Pedestrian access to the ECC is restricted by the railway line and the busy New South Head Road, which run along the southern boundary and middle of the ECC respectively.

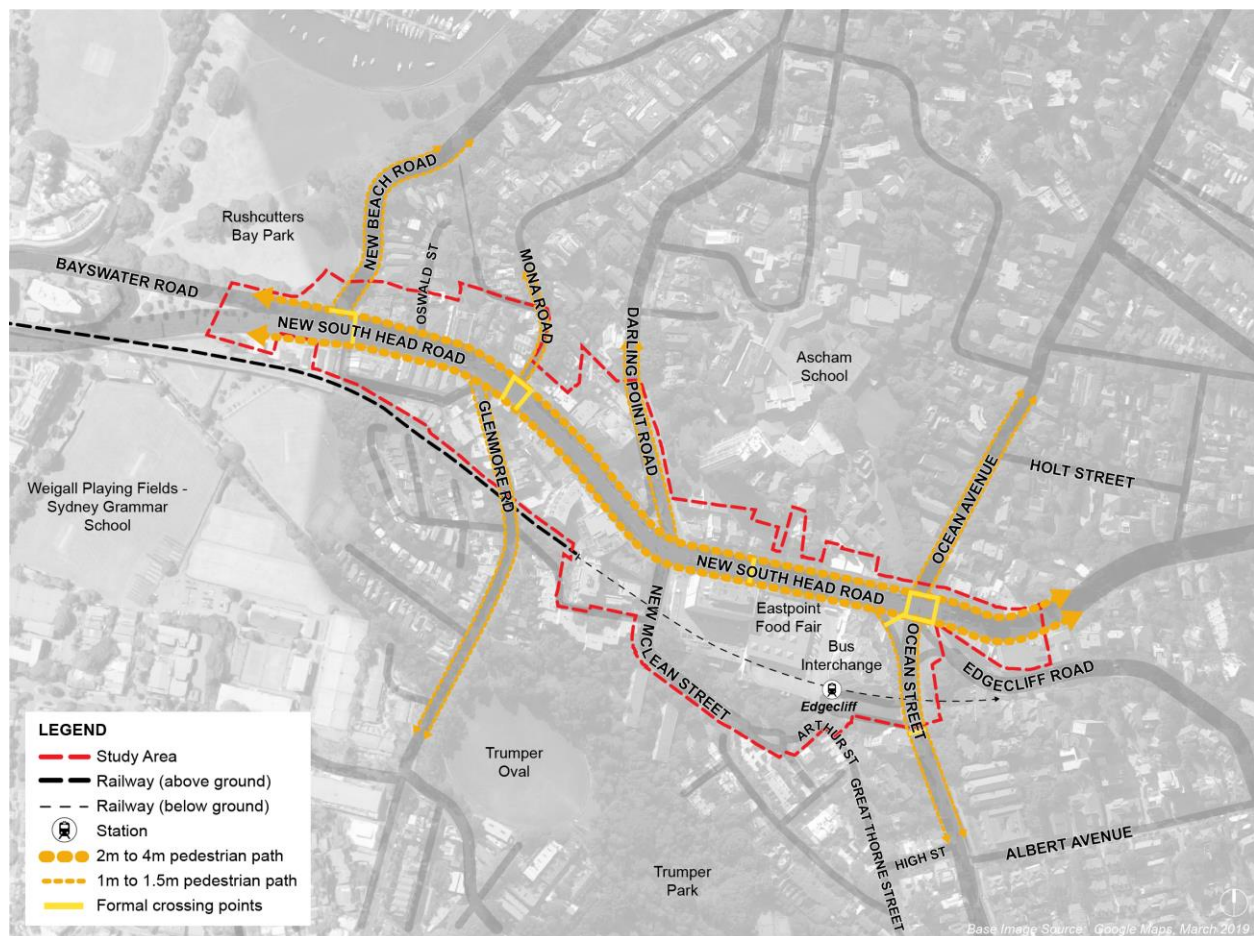
The ECC has limited pedestrian crossings in a north-south direction from both sides of intersections at New South Head Road / New Beach Road and New South Head Road / Darling Point Road / New McLean Street intersections. There is currently a zebra crossing on the slip lane at the north western corner of the New South Head Road / New Beach Road intersection, just west of the signalised pedestrian crossing across New Beach Road.

The lack of north-south crossing at New South Head Road / Darling Point Road / New McLean Street intersection results in additional 220 metre walking distance to get from the northwest corner to the southwest corner of the intersection. In addition, the north-west corner of this intersection is steep with a narrow footpath along Darling Point Road which again could contribute to an unsafe environment for pedestrians using the footpath, and especially for passengers getting in and out of their car. The pedestrian crossing on the southern approach of this intersection (New McLean Street) has a bend in it, which can be unsafe for visually impaired pedestrians crossing, since it directs individuals towards the middle of New South Head Road.

East of Ocean Avenue there is a signalised intersection for vehicles accessing the bus interchange (south of New South Head Road). However, there is currently no formalised crossing for pedestrians crossing this access way, which could cause conflicts between vehicles and pedestrians.

The existing footpaths and formal crossing opportunities are presented in **Figure 3–13**.

**Figure 3–13 Walking Catchment Map around the ECC**



Source: Transport for NSW, 2019, modified by SCT Consulting, 2019



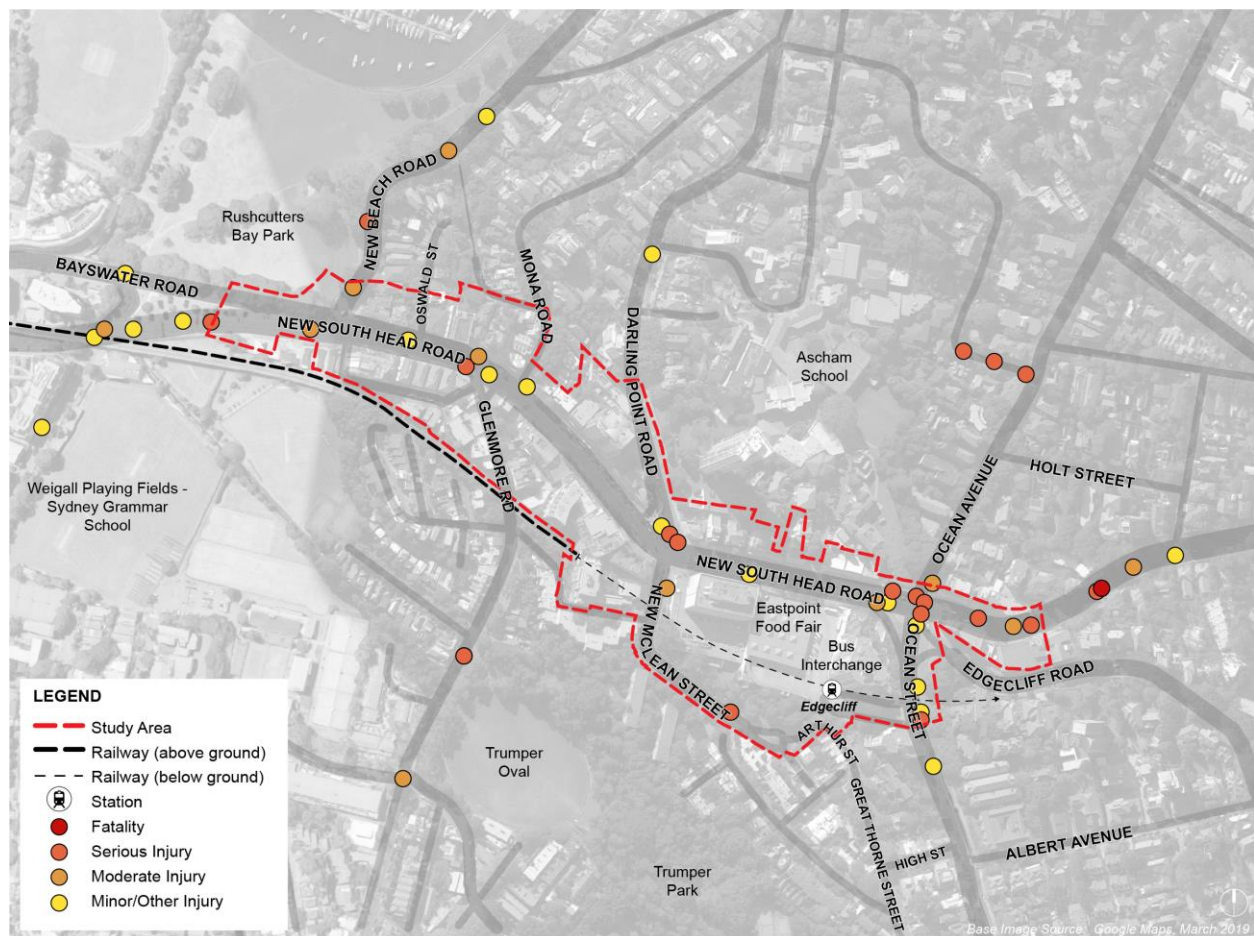
### 3.7 Crash Analysis

An analysis of the crash data for a five-year period (2013 to 2017) has been undertaken based on publicly available crash data sourced from Transport for NSW, for the ECC. The locations and severity of the crash data for the five-year period is shown in **Figure 3–15** and **Table 3-9**.

Over the analysed years, a total of 75 crashes occurred in the ECC and surrounding area, with the majority of crashes occurring during 2014 and 2015. Of the crashes occurring of the five-year period, there was one fatal crash and 22 serious injury crashes, with the fatal crash occurring just east of the ECC, on New South Head Road between Ocean Avenue and Henrietta Street.

The largest number of crashes occurred along New South Head Road, at or near the intersections with Ocean Avenue, Darling Point Road and Mona Road respectively.

**Figure 3–14 Crashes within the ECC (2013-2017)**



Source: <https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/nsw.html?tabnsw=3>, modified by SCT Consulting, 2019

**Table 3-9 Crashes by severity within the ECC (2013-2017)**

Crash severity	2013	2014	2015	2016	2017
Fatal	0	0	0	0	1
Serious injury	3	2	7	4	6
Moderate injury	4	5	3	4	2
Minor / Other injury	5	12	9	3	5

Source: <https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/nsw.html?tabnsw=3>, 2019

### 3.8 Car Share

Car share decreases the need for some people to own a car or a second car and can therefore reduce parking demand and traffic generation. It differs from traditional car hire companies in that cars can be hired by half hour increments and cars are located near to where people live or work. Car share is available from either companies that own a vehicle fleet or peer-to-peer services for individual owners to share their vehicles.

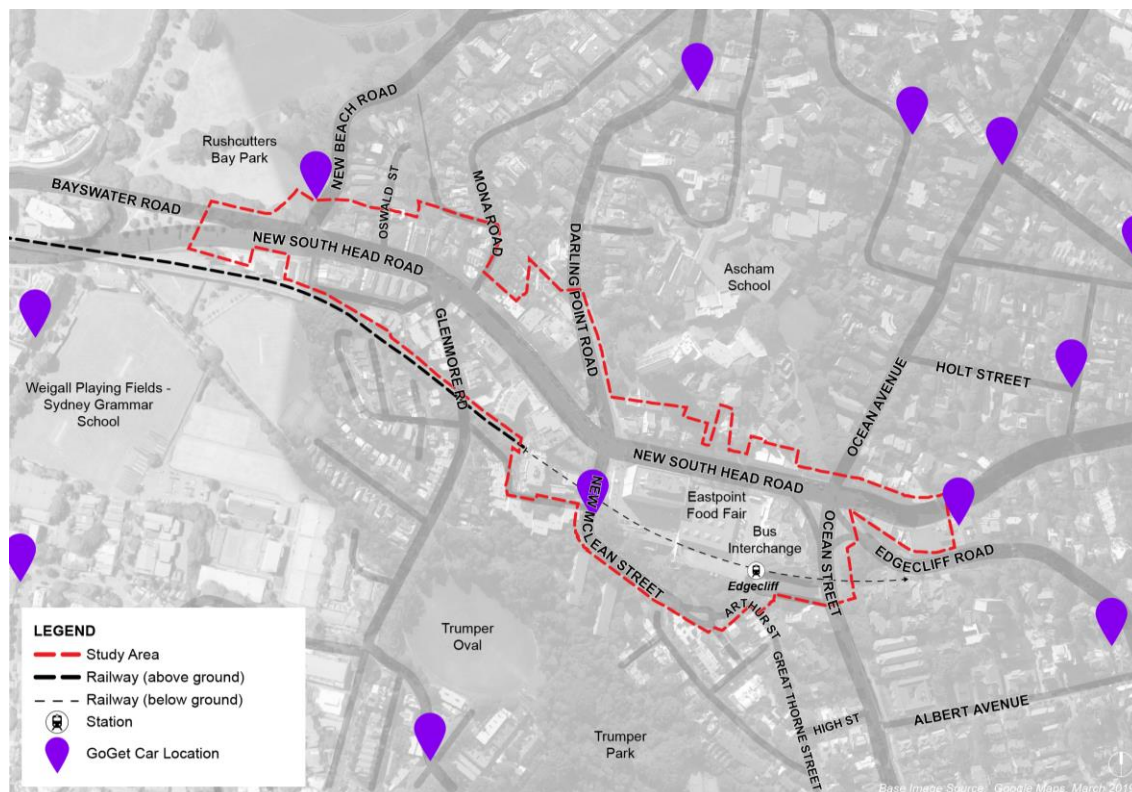
The benefits realisation of car share schemes, with respect to the City of Sydney Local Government Area, is documented within the Committee for Sydney document *'Carsharing: Sydney Snapshot'* as follows:

- Each car share vehicle replaces indicatively 10 private vehicles parking spaces, which could be considered in the application of ratios for car spaces within new dwellings;
- A reduction in vehicle kilometres travelled by approximately 2,000km per year for each user with corresponding increases in walking, riding a bicycle or using public transport. This has flow on impacts to the health of residents;
- Each car space in a multi-storey car park can cost between \$30,000 - \$70,000 to construct with apartment prices increasing in cost by \$50,000 - \$140,000 when a car space is provided. These cost savings are passed on to developers and unit owners; and
- The current benefit that each car share vehicle provides is estimated at \$59,673. This takes into consideration factors such as congestion, environmental factors such as emissions, opportunity cost of not owning a car space, management fees and community value of space.

These statistics support the notion of using car share schemes, such as Go Get, to achieve reductions in private vehicle ownership. They also allow for action to be taken regarding parking provision and a review of existing parking controls.

In the ECC, Go Get is currently the sole operator. A map of the GoGet parking locations is shown in **Figure 3–15**. There are two Go Get cars in the ECC, with approximately 10 Go Get cars outside, but in proximity to the ECC. Peer to peer car share services generally offer both cheaper and more expensive hire rates than Go Get depending on the value of the vehicle. Peer to peer car share services available in the ECC include 'Car next door' and 'Drive my car'.

**Figure 3–15 GoGet Car Share parking locations**



Source: GoGet, 2019, modified by SCT Consulting; 2019

## 4.0 Proposed Development

### 4.1 Description of preferred development option

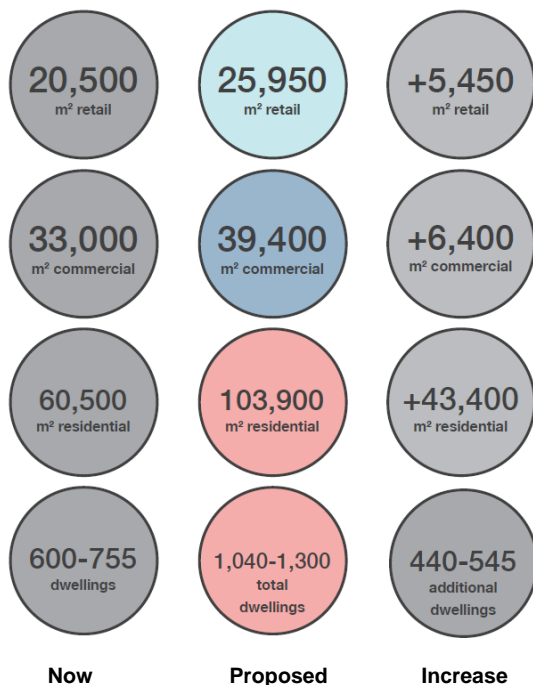
The ECC preferred development option proposes the following principles:

- Commercial uses are concentrated around the commercial core of the centre near the station, with a minimum non-residential FSR applied;
- Retail uses generally on the ground floor along the length of New South Head Road, but does not wrap around secondary streets (Glenmore Road, Mona Road etc);
- Residential uses are permissible, setback above other uses;
- The greatest height is focussed around the train station to emphasise topography (both from within the centre and surrounding areas);
- Building envelopes respond to view lines from existing residential buildings and significant views from public spaces and roads within the centre;
- Western Gateway is created through architectural features and a recognisable public domain;
- As a minimum maintain the current commercial GFA in any new development; and
- Include the WMC owned road reservation to New McLean Street to increase build-ability on the site at 203-233 New South Head Road and facilitate delivery of public plaza.

### 4.2 Development yield

The total potential yield for the preferred development option is outlined in **Figure 4–1**, which provides a summary of the current, future and additional floor space by land use.

**Figure 4–1 Potential yield under preferred development option**



Source: SJB, 2018

The preferred development option includes a reduction of the retail in the Commercial Core and provision of ground floor retail as part of shop top housing throughout the remainder of the precinct to increase the level of street activity.

## 5.0 Trip generation and distribution

### 5.1 Vehicle trip generation

A trip generation review has been undertaken based on the proposed different land uses and indicative yield to:

- Understand likely weekday / weekend peak hour vehicular and person trip generation.
- Understand likely impacts on surrounding road network.

Traffic generation rates were agreed to with RMS prior to completing the associated traffic impact assessment.

#### 5.1.1 High density residential

The location of the proposed increase in residential uses is within a short walk of the Edgecliff Train Station, which provides access to Sydney CBD within 5 minutes of train travel.

The average trip rate for high density residential flat dwellings that have good access to public transport services within Sydney urban areas, as published by the RMS, is identified as 0.19 and 0.15 trips per dwelling within the AM and PM peak hour periods respectively for weekdays. Saturday will see a higher trip rate of 0.25 per dwelling during a peak hour.

It is noted that the common practice is to propose a site within the *Technical Direction 2013/04a, Guide to Traffic Generating Developments* (TDT 2013/04a) that represents a similar level of access to the site. Of the sites in the technical direction, the closest in terms of access is St Leonards and Chatswood, with access to jobs within fifteen minutes of travel.

The trip generation rate is therefore proposed to be an average of the St Leonards and Chatswood sites, being:

- 0.14 trips / unit in the weekday AM peak;
- 0.095 trips / unit in the weekday PM peak; and
- 0.26 trips / unit on Saturday.

The proposed increase in residential yield of 440-545 apartments would expect to generate:

- 62 – 76 weekday AM peak hour trips;
- 42 – 52 weekday PM peak hour trips; and
- 114 – 141 Saturday peak hour trips.

#### 5.1.2 Retail

The proposed retail in the scheme is to form a total of 25,950 sqm GFA in the future. This includes a reduction in shopping centre floorspace from 11,058 sqm in the 'Edgecliff Centre' (203-233 New South Head Road) down to 10,137 sqm. Assuming that gross leasable floor area (GLFA) will account for 75 per cent of the gross floor area, this is a reduction of 690 sqm GLFA of shopping centre uses. The preferred development option then involves an increase of street retail from the current 9,400 sqm GFA of cafes and specialty retailers to 15,800 sqm GFA. This represents an increase of 6,371 sqm GFA or equivalent of 4,778 sqm GLFA.

The trip generation rates identified by TDT 2013/04a for shopping centres are shown in **Table 5-1**.

**Table 5-1 Retail trip generation rate for shopping centres**

Range in floor area (GLFA – sqm)	Peak hour generation rates (Vehicles per 100sqm GLFA)			
	Thursday	Friday	Saturday	Sunday
0-10,000	12.3	12.5	16.3	-
<b>10,000 – 20,000</b>	<b>7.6</b>	<b>6.2</b>	<b>7.5</b>	<b>6.6</b>
20,000 – 30,000	5.9	5.6	7.5	6.3
30,000 – 40,000	4.6	3.7	6.1	-

Source: Roads and Maritime; 2002 and 2013, modified by SCT Consulting; 2019



Based on the size of the shopping centre, the trip generation rates would fall into the 10,000 – 20,000 sqm category, with the rates identified in bold in **Table 5-1**. For the AM peak period, the generation rate is not included in the summary table but summarised for each of the surveyed sites in *TDT 2013/04a Appendix F3*. A traffic generation rate of 1.55 trips / 100sqm GLFA is proposed, which is based on the average of all of the urban shopping centres in *TDT 2013/04a Appendix F3*.

Cafes and specialty shops are ancillary in nature and often form part of the customer journey to a shopping centre rather than being the sole purpose. Trip generation is mostly associated with staff movements rather than customers.

Trip generation for the café and specialty shops is proposed to be 1.55 trips / 100 sqm GLFA, the average of the AM peak traffic generation of all urban shopping centres in *TDT 2013/04a Appendix F3*. The AM peak was selected, as it represents a time when there are few customers and staff are arriving for work. As such, it reflects that majority of visitors to the shops will be arriving for other purposes, so that the traffic generation is comprised mainly of staff arrivals. This rate was also adopted for the PM peak.

The land use assumptions were provided on a lot by lot basis, which assumed that 'Edgecliff Centre' experienced a reduction in retail with an increase in commercial and residential. On that basis, it was assumed that the shopping centre use decreased for that lot – resulting in a net reduction in shopping centre use for the site as a whole.

The implication is therefore that the total traffic generation for retail is:

- AM peak: -11 trips (shopping centre) + 72 trips (cafes) = 61 veh/h;
- PM peak (Thursday): -52 trips (shopping centre) + 72 trips (cafes) = 20 veh/h; and
- Saturday: -45 trips (shopping centre) + 72 trips (cafes) = 27 veh/h.

### 5.1.3 Commercial

The TDT 2013/04a describes vehicular trip rates for commercial developments where traffic surveys were undertaken for developments that are close to public transport (as shown in **Table 5-2**). Included in TDT 2013/04a were surveys at North Sydney, Chatswood, Macquarie Park and Parramatta, which are similar in terms of scale of development and proximity to the train stations.

**Table 5-2 Peak hour vehicle trip generation per 100sqm of similar office sites – weekday**

Surveyed location	North Sydney	Chatswood	Macquarie Park	Parramatta	Average
AM peak hour trips	52	105	119	185	115
PM peak hour trips	44	86	106	166	100
AM trip rate	0.17	1.03	2.07	0.69	0.99
PM trip rate	0.14	0.84	1.84	0.61	0.86

Source: RMS, Technical Direction 2013/14

The average peak hour trip rates per 100 sqm for the surveyed locations were estimated to be 0.99 and 0.86 trips during the AM and PM network peak hour respectively. Thus, the estimated vehicle trips for the additional commercial land use will be **63** and **55** for AM peak and PM peak, respectively.

The vehicle trip generation of office space is assumed to be zero on the weekends.

### 5.1.4 Total vehicle trips

Based on the adopted trip generation rates of the respective land uses, the proposed increase in development yield at ECC would generate about **200** additional vehicular trips during the AM peak hour and **120** vehicular trips during PM peak hour for a weekday in total. The estimated weekend vehicle trips will be about **160** in the peak hour in total.

A summary of the weekday and weekend peak hour trip generation rates used is shown in **Table 5-3**.

**Table 5-3: Weekday and weekend peak hour vehicle trip generation rate assumptions**

Proposed activity	Gross Floor Area	Yield	Vehicle trip generation rate		
			WD AM	WD PM	WE Peak
Residential	+43,400 sqm	440-545 units	0.14	0.095	0.26
Shopping centre	-920 sqm	-690 sqm GLFA	1.55	7.6	6.6
Shop top retail	+6,370 sqm	+4,778sqm GLFA	1.55	1.55	1.55
Commercial	+6,400sqm GFA		0.99	0.86	0
Total vehicle trips:			186 – 201 veh	117 – 127 veh	141 – 168 veh

Source: TDT 2013/04a and SJB, compiled by SCT Consulting, 2019. WD = Weekday, WE = Weekend

## 5.2 Person trip generation

Surveys at several locations were chosen from the TDT 2013/04a for person trip generation estimation. The average peak hour person trip rates were estimated to be 0.65 and 0.56 trips per 100sqm during the AM and PM network peak hour respectively for similar high-density residential areas. Saturday peak hour will see a trip rate up to 1.17 per 100sqm.

Referring to TDT 2013/04a for similar shopping centres, average peak hour trip rates were 3.11 and 7.6 person-trips per 100sqm during the AM and PM network peak hour respectively. Weekend PM person trips is estimated to be 12.23 person-trips per 100sqm during the peak hour.

Similar to vehicle trip rates, the sites outlined in **Table 5-4** have been used to obtain the possible person trip rate assumptions for office blocks. Based on these, it is estimated that the person trip rate will be 1.9 and 1.64 per 100sqm during the AM and PM peak hour respectively.

**Table 5-4 Peak hour person trip generation per 100sqm of similar office sites**

Item	North Sydney	Chatswood	Macquarie Park	Parramatta	Average
AM peak trips	394	249	142	387	293
PM peak trips	338	205	126	349	255
AM trip rate	1.3	2.44	2.47	1.43	1.90
PM trip rate	1.1	2.01	2.19	1.29	1.64

Source: Roads and Maritime, Technical Direction 2013/14

Person trip generation for the project was estimated as shown in **Table 5-5**, based on the peak hour trip generation rates estimated previously.

**Table 5-5 Peak hour person trip generation for the ECC**

Activity	Gross Floor Area	Yield	Person trip rates <sup>^</sup>		
			WD AM	WD PM	WE Peak
Residential	+43,400 sqm	440-545 units	0.66	0.56	1.17
Shopping centre	-920 sqm	-690 sqm GLFA	3.11	7.6	12.23
Shop top retail	+6,370 sqm	+4,778sqm GLFA	3.11	7.6	12.23
Commercial	+6,400sqm GFA		1.90	1.64	-
<b>Total</b>	<b>55,250 sqm</b>	<b>-</b>	<b>533-629 trips</b>	<b>688-769 trips</b>	<b>1,045-1,214 trips</b>
Less persons in cars			224-257 trips	271-297 trips	300-343 trips
<b>Total non-car trips</b>			<b>309-372 trips</b>	<b>417-472 trips</b>	<b>745-871 trips</b>

Source: SCT Consulting, 2019. WD = Weekday, WE = Weekend

<sup>^</sup>Assuming the car occupancy for the vehicle trip generation is 1.2 person / vehicles. Weekday AM Peak trip generation =  $(187-214) \times 1.2 = (224-257)$  persons and PM Peak trip generation =  $(226-247) \times 1.2 = (271-297)$  persons. Weekend peak trip generation =  $(250-286) \times 1.2 = (300-343)$  persons.

Given its location directly adjacent to the Edgecliff Train Station and peak hour travel purposes, most of these non-car trips will be using surrounding public transport services, some will be to other businesses and some would be walking or cycling from trip origins. Hence, it is estimated the preferred development option is forecast to generate approximately 340, 440 and 800 person-trips during the AM, PM and Saturday peak hours respectively, of which the majority will be associated with train and bus access. A further proportion would be walking / cycling to or from the origins of their trips.

### 5.3 Traffic distribution

With the limited data available from the census about the direction of travel during peak periods by mode, trip distribution is proposed to be estimated from prevailing road network volumes, which are assumed to be representative of the directions of travel of future residents. The likely traffic distribution as a result of existing road network volumes is presented in **Table 5-6**.

**Table 5-6 Traffic distribution**

Origin/destination	Weekday AM	Weekday PM	Weekend AM	Weekend PM
New South Head Rd Eastbound at New Beach Rd	17%	25%	22%	21%
New South Head Rd Westbound at New Beach Rd	30%	24%	27%	28%
New South Head Rd Eastbound at Ocean St	21%	21%	19%	21%
New South Head Rd Westbound at Ocean St	19%	15%	18%	18%
All Local Roads	14%	14%	15%	12%

Source: SCT Consulting based on 2016 count data, 2019

The key origins and destinations in the ECC for vehicle trips are assumed to be New South Head Road, which is forecast to supply 85 – 88 per cent of total trips to the ECC. The local road network represents the remaining supply. The inbound-outbound proportions that will be used based on these assumptions are presented in **Table 5-7**.

**Table 5-7 Inbound and outbound split to and from the ECC**

Origin/destination	Weekday AM	Weekday PM	Weekend AM	Weekend PM
Residential trips % in	20%	80%	50%	50%
Residential trips % out	80%	20%	50%	50%
Retail trips % in	80%	20%	50%	50%
Retail trips % out	20%	80%	50%	50%
Commercial trips % in	80%	20%	-	-
Commercial trips % out	20%	80%	-	-

Source: SCT Consulting, 2019

With commercial and retail uses largely expected to be generating staff trips by vehicle only, the balance is expected to be majority in in the weekday AM peak and majority out in the PM peak. The weekend peak is more balanced.



## 6.0 Transport and Traffic Impact Appraisal

This section evaluates the impacts of the preferred development option on the transport network and considers improvements required to mitigate the impacts.

### 6.1 Public transport impacts

As described in **Section 3.5**, the potential residents and employees resulting from the preferred development option will be located within a 500m walking distance to the Edgecliff Train Station, which will continue to provide direct access to Bondi Junction, Sydney CBD, Sutherland and Wollongong, as well as connecting to the wider Sydney Trains network.

The excellent access to train services and also bus services (which provide frequent access to Sydney CBD, Chatswood, Bondi Junction, Watsons Bay, Vaucluse and Macquarie Park) will facilitate public transport as the primary means of travel. As per the Method of Travel to Work data, public transport is the dominant mode of transport, with a mode share of 44 per cent compared with 26 per cent by private vehicle. With further densification of the centre and an appropriate suite of infrastructure, services and policy, the preference for public transport will continue to grow.

As described in **Section 5.2**, the peak hour person trip generation of the potential development is expected to generate approximately 340, 440 and 800 person-trips during the AM, PM and Saturday peak hours respectively. Given its location directly adjacent to the Edgecliff Station, the majority of these trips will be associated with train and bus customers, while a smaller proportion would be walking / cycling to or from the origins of their trips.

The rail network has a number of constrained services, however the majority of services to the city from Edgecliff have spare capacity for this growth in demand.

Management of the rail network falls within the responsibility of Transport for NSW.

**Recommendation:** Lobby Transport for NSW to continue reviewing rail service demand, providing additional capacity as demands increase on the T4 Bondi Junction to Waterfall or Cronulla Line.

### 6.2 Parking impacts

The majority of the on-street parking facilities were at or near capacity during site visits, and it is not likely that significant on-street parking could be made available. The off-street parking facilities at the 'Edgecliff Centre' has significant additional capacity, indicatively 140 spaces, which is most constrained during midday on a typical Thursday.

Additional parking demands will arise from the different types of uses, with different types of spaces demanded:

- Residential: residential and visitor spaces to be satisfied off-street, within the apartment block strata title;
- Shopping centre and commercial: spaces to be satisfied by remaining capacity in the 'Edgecliff Centre' car park;
- Shop top retail: spaces to be satisfied by the 'Edgecliff Centre' car park and any off-street parking available within building.

Based on the dominance of public transport as the preferred mode of transport, parking demands are largely able to be satisfied by virtue of alternative options for transport. Rather than driving to the centre, visitors will likely walk, cycle or use public transport. Much of the retail will also be serviced by linked trips.

As the centre's car park is priced, this will also assist in management of demand to be consistent with the available capacity.

**Recommendation:** No additional parking spaces be provided within the ECC despite an increase in floor space based on the spare capacity and ability to use price to manage demands.

There is also the opportunity to use residential parking as a policy to manage traffic generation of the preferred development option, which will be explored in later sections of this report.

## 6.3 Active transport impacts

Based on the non-car generation of the preferred development option, up to 870 additional pedestrians would be generated in the busiest peak period (weekday AM). This population comprises walk and cycle only modes as well as customers walking to access public transport. This large demand of additional pedestrians makes the importance of the currently wide footpaths at the centre high importance to maintain into the future so far as is practicable. Within a peak hour, this number of pedestrians would result in up to an additional 20 pedestrians per cycle crossing New South Head Road.

**Recommendation:** Footpath impacts be kept to a minimum in addressing road network capacity issues.

### 6.3.1 Proposed walking infrastructure modifications

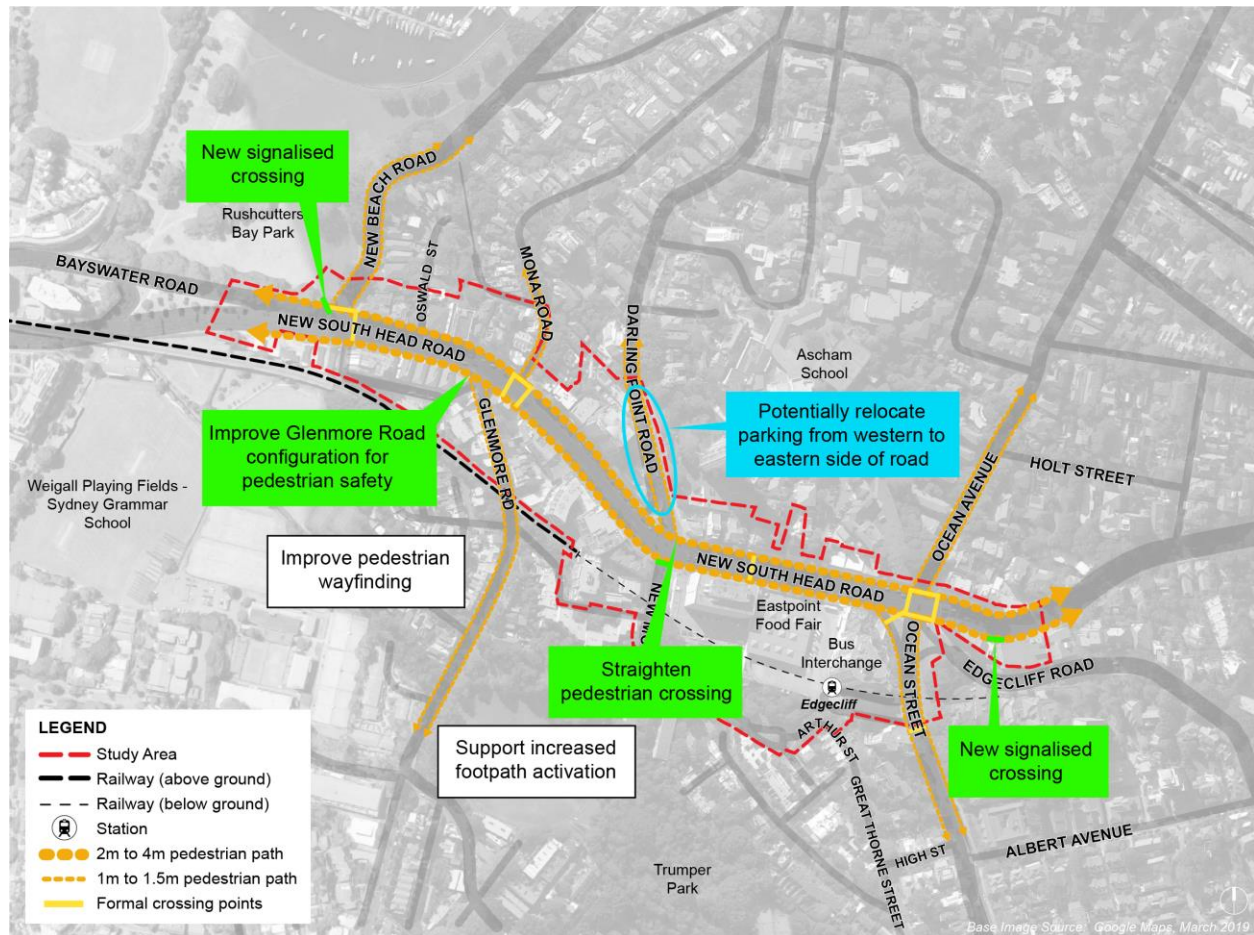
To improve the active transport network for the increased pedestrian activity in the ECC, enhancements to the deficiencies noted in Section 3.6 could be considered. These are shown in **Figure 6–1** and are subject to further, detailed design.

**Recommendation:** Consider the following pedestrian infrastructure improvements:

- A new signalised intersection at the slip lane at the north western corner of the New South Head Road / New Beach Road intersection, to continue the existing signalised crossing across New Beach Road and further improve safety for pedestrians crossing the slip lane;
- Potential relocation of parking from the western to the eastern side of Darling Point Road where the footpath is wider, to improve access and safety for people leaving and accessing their cars;
- Straightening of the pedestrian crossing on the southern side of the New South Head Road / Darling Point Road / New McLean Street intersection (across New McLean Street) to improve safety for visually impaired pedestrians crossing the road;
- Introduction of a signalised crossing on the south side of New South Head Road east of Ocean Street to ensure pedestrians crossing the bus interchange access road can do so safely;
- Improve Glenmore Road configuration for pedestrian safety to address the unclear delineation between the kerb, car park and footpath on the western side of Glenmore Road; and
- Improving wayfinding for pedestrians by introducing a pedestrian wayfinding strategy, to encourage people to walk with comfort and confidence around the ECC.

In addition, it is also recommended that the built form encourages pedestrian activation in the area, particularly in areas that have wide footpaths or are separated from New South Head Road, as many of the roads are unpleasant to walk on.

Figure 6–1 Proposed active transport network enhancements in the ECC



Source: SCT Consulting, 2019

### 6.3.2 Cycling infrastructure options

WMC's previous planning indicated a desire to facilitate an off-street cycleway along New South Head Road to deliver east-west connectivity. This proposal represents a challenge as there is not sufficient width to deliver a dedicated off-street facility without reducing the carriageway width of New South Head Road. Such a proposal is challenging as it is unlikely to be supported by road users. The alternative is an off-road shared path facility. With the number of pedestrians generated by ECC, the train station and bus interchange, coupled with gradient issues, a shared path could create safety hazards for pedestrians. There are also no alternative east-west corridors due to the dense land uses in surrounding areas and lack of east-west roads.

**Recommendation:** An engineering review be conducted to compare the safety and desirability of a shared cycle path compared with the current provision of on road cycling infrastructure.

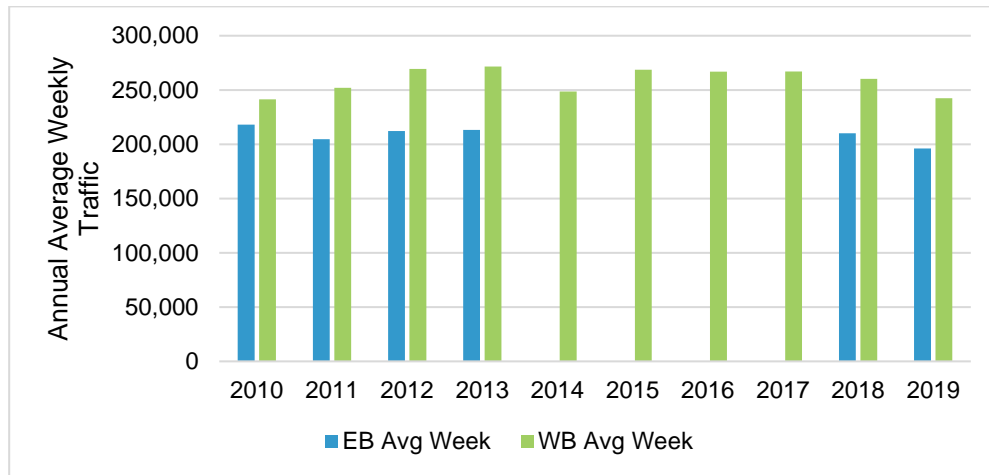
## 6.4 Road network impacts

Intersection modelling was undertaken to assess the operational performance of the four key intersections analysed for the existing scenario, to determine the impact of the potential development on the surrounding road network.

### 6.4.1 Background growth

With the extent of peak hour traffic constraints and the limited expectation of growth in the New South Head Road catchment, historical data is a good predictor of the future growth on the corridor. Historical data in terms of RMS annual average daily traffic count for New South Head Road count station 10011 was used to determine any background growth of the corridor. The data indicates that the weekly traffic has varied considerably between 2010 and 2019, with periods of growth and decline in traffic volumes on the corridor. This is typical of a corridor experiencing congestion, in that growth has plateaued. This is shown in **Figure 4–1**.

**Figure 6-2 Annual average weekly traffic for New South Head Road (10011)**



Source: SCT Consulting based on RMS AADT Data for station New South Head Road (10011), 2019

Based on the slightly negative growth on the corridor from 2010 to 2019 of 0.5 per cent per annum, zero background growth is assumed for the corridor, for the modelling scenario with the additional trips generated by the potential development.

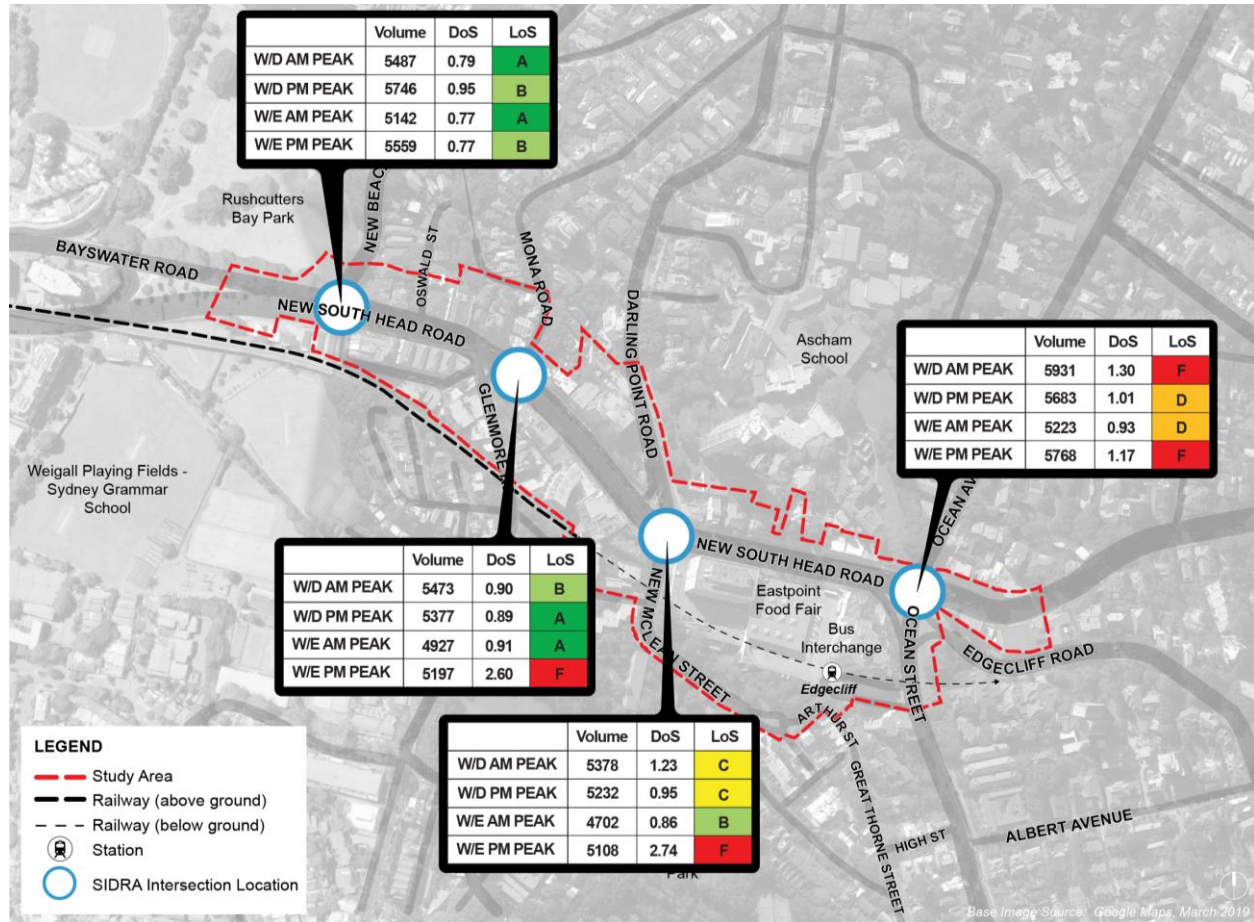
#### **6.4.2 Network performance with potential development and no infrastructure improvements**

To assess the impact of the potential development from the preferred development option, the operational performance of key intersections in the ECC were modelled in SIDRA. The modelling is included as a separate report as **Appendix A**.

The results of the intersection performance analysis undertaken with SIDRA is shown in **Figure 6-3**, **Table 6-1** and **Table 6-2**. SIDRA movement summaries are also included in **Appendix B**. The results show the modelled impact of the potential development without the introduction of any road infrastructure improvements designed to address the potential increase in traffic congestion.



Figure 6–3 Intersection performance with potential development and no infrastructure improvements



Source: SCT Consulting, 2019

Table 6-1 Weekday Intersection performance, with potential development and no infrastructure improvements

Intersection	Weekday AM peak				Weekday PM Peak			
	Volume	Delay	LoS	DoS	Volume	Delay	LoS	DoS
Ocean Street / Ocean Avenue / New South Head Road	5,931	164	F	1.304	5,683	51.8	D	1.010
New South Head Road / Darling Point Road / New McLean Street	5,378	41.0	C	1.230	5,232	30.1	C	0.949
New South Head / Glenmore Road / Mona Road	5,473	15.9	B	0.898	5,377	8.5	A	0.891
New South Head Road / New Beach Road	5,487	13.1	A	0.789	5,746	16.0	B	0.949

Source: SCT Consulting, 2019

During weekdays analysis indicates that with development trips, the New South Head Road / Ocean Street / Ocean Avenue intersection will perform at unsatisfactory levels, particularly during the AM peak hour. Significant delays and a DoS of above 1.0 were recorded.

The New South Head Road / Darling Point Road / New McLean Street intersection approaches capacity in the PM peak hour. This is due to the increase in demands associated with the development from the east.

**Table 6-2 Weekend Intersection performance, with potential development and no infrastructure improvements**

Intersection	Weekend AM Peak				Weekend PM Peak			
	Volume	Delay	LoS	DoS	Volume	Delay	LoS	DoS
Ocean Street / Ocean Avenue / New South Head Road	5,223	49.3	D	0.928	5,768	115	F	1.173
New South Head Road / Darling Point Road / New McLean Street	4,702	25.2	B	0.861	5,108	75.0	F	2.742
New South Head / Glenmore Road / Mona Road	4,927	12.6	A	0.911	5,197	92.6	F	2.600
New South Head Road / New Beach Road	5,142	9.9	A	0.769	5,559	20.0	B	0.772

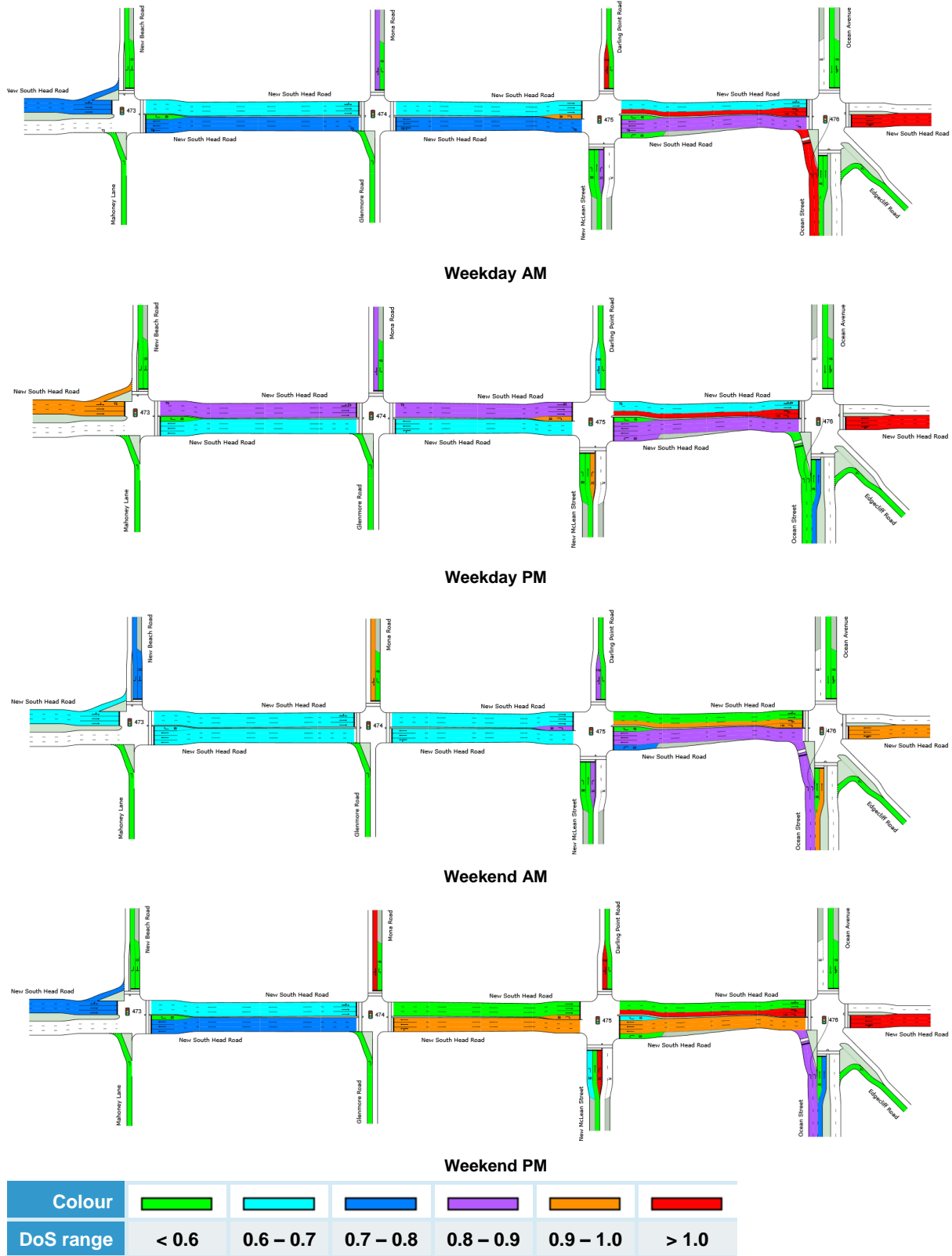
Source: SCT Consulting, 2019

During weekends, the majority of intersections perform poorly during the PM peak hour with the exception of the New South Head Road / New Beach Road intersection. All other intersections operate with delays at Level of Service F and DoS of greater than 1 are observed.

Compared to the existing situation, the performance of the road network is forecast to deteriorate due to the additional vehicle trips generated by the potential development.

The DoS for the analysed intersections during weekdays and weekends is graphically illustrated in **Figure 6-4**.

Figure 6–4 Weekday and weekend DoS with potential development and no infrastructure improvements



Source: SCT Consulting, 2019

### 6.4.3 Proposed road infrastructure improvements

The analysis of the road network with the additional trips generated by the potential development showed the network will operate at a level that will cause significant delays to road users. As a result, a number of infrastructure improvements to the road network are recommended to address traffic delay issues, being:

1. **Ban right turns from Darling Point Road to New South Head Road, diverting traffic to Mona Street (time-limited / permanent):** demand at the intersection of Darling Point Road / New South Head Road exceeds the capacity. The removal of this right turn reduces the demand and reduces the number of phases so that each remaining movement gets more green time. This would affect a total of 150 vehicles per hour in the busiest peak period;
2. **Make Mona Road a dual right turn and remove the western pedestrian crossing on New South Head Road:** this provides additional capacity for vehicles travelling from the north of New South Head Road heading towards the city. This improvement is required to accommodate the additional traffic diverted from Darling Point Road due to the right turn ban above;
3. **Widen the southern side of the New South Head Road to allow 50m right turn bay from New South Head Road into New McLean Street via repurposing underutilised open space / modified urban design:** this allows for greater queue storage for this right run, reducing the number of times that queuing spills out of the turn bay and blocks traffic on New South Head Road headed eastbound.

Other options were tested such as changed lane designation or phasing. Significant widening was precluded based on the need to maintain a significant footpath width and the number of heritage and strata titles.

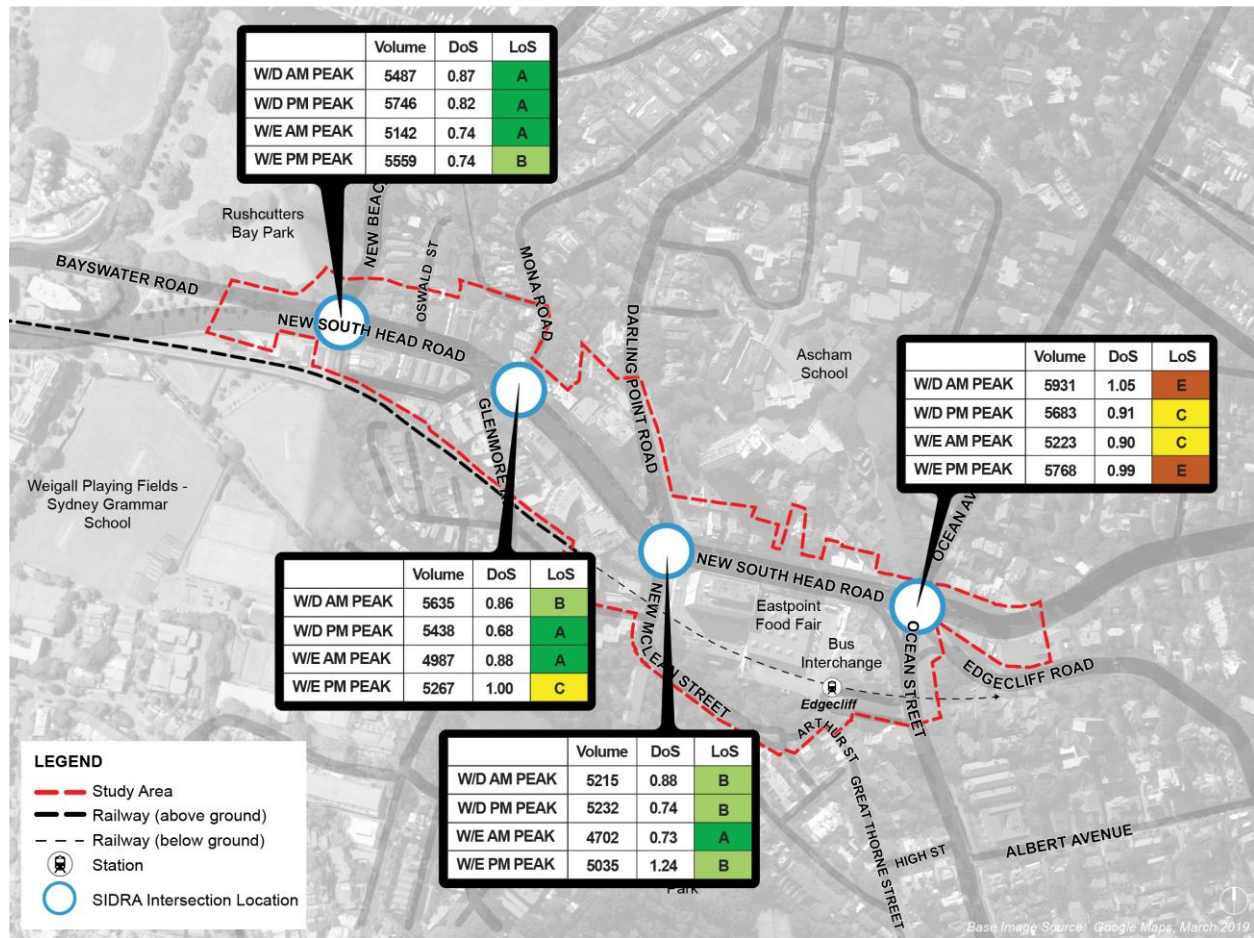
Although the banning of the right turn from Darling Point Road to New South Head Road, diverts traffic to Mona Street, it is necessary to reach the outlined level of performance of the network. WMC should consider community engagement and a further study to confirm the impacts on the performance of Darling Point Road / Mona Road / Darling Point Road, which is understood to operate with significant delays during peak periods.

#### Road network performance with infrastructure improvements

SIDRA modelling was undertaken with the infrastructure improvements, to assess the performance of the road network with the trips generated by the potential development included. The results of this analysis is shown in **Figure 6-5**, **Figure 6-6** and **Table 6-4** respectively.



Figure 6–5 Intersection performance with development and improvements



Source: SCT Consulting, 2019

Table 6-3 Weekday Intersection performance, with potential development and infrastructure improvements

Intersection	Weekday AM peak				Weekday PM peak			
	Volume	Delay	LoS	DoS	Volume	Delay	LoS	DoS
Ocean Street / Ocean Avenue / New South Head Road	5,931	65.3	E	1.050	5,683	38.6	C	0.914
New South Head Road / Darling Point Road / New McLean Street	5,215	17.1	B	0.879	5,232	17.1	B	0.735
New South Head / Glenmore Road / Monna Road	5,635	14.6	B	0.858	5,438	5.3	A	0.677
New South Head Road / New Beach Road	5,487	13.6	A	0.874	5,746	7.2	A	0.823

Source: SCT Consulting, 2019

**Table 6-4 Weekend Intersection performance, with potential development and infrastructure improvements**

Intersection	Weekday AM peak				Weekday PM peak			
	Volume	Delay	LoS	DoS	Volume	Delay	LoS	DoS
Ocean Street / Ocean Avenue / New South Head Road	5,223	38.4	C	0.898	5,768	58.9	E	0.991
New South Head Road / Darling Point Road / New McLean Street	4,702	14.4	A	0.730	5,035	28.0	B	1.236
New South Head / Glenmore Road / Mona Road	4,987	10.1	A	0.882	5,267	40.8	C	1.000
New South Head Road / New Beach Road	5,142	10.8	A	0.739	5,559	15.8	B	0.735

Source: SCT Consulting, 2019

The analysis shows that with the proposed infrastructure improvements, there is a significant improvement in intersection performance compared to the 'without improvements' scenario presented in **Section 6.3**, for all time periods analysed during both weekdays and weekends, and especially during the weekday PM and weekend AM peak hours.

The proposed infrastructure improvements provides net travel time savings during the peak periods, which is shown in **Table 6-5**.

**Table 6-5 Travel time savings from infrastructure improvement proposals**

Intersection	Travel time saving (second / vehicle / hr)			
	Weekday AM	Weekday PM	Weekend AM	Weekend PM
Ocean Street / Ocean Avenue / New South Head Road	98.7	13.2	10.9	56.1
New South Head Road / Darling Point Road / New McLean Street	23.9	13.0	10.8	47.0
New South Head / Glenmore Road / Mona Road	1.3	3.2	2.5	51.8
New South Head Road / New Beach Road	-0.5	8.8	-0.9	4.2

Source: SCT Consulting, 2019

Minor increases in delays at some intersections are due to traffic released from queues slightly delaying other drivers. On the whole, this level of travel time savings would result in a strong economic case for investment.

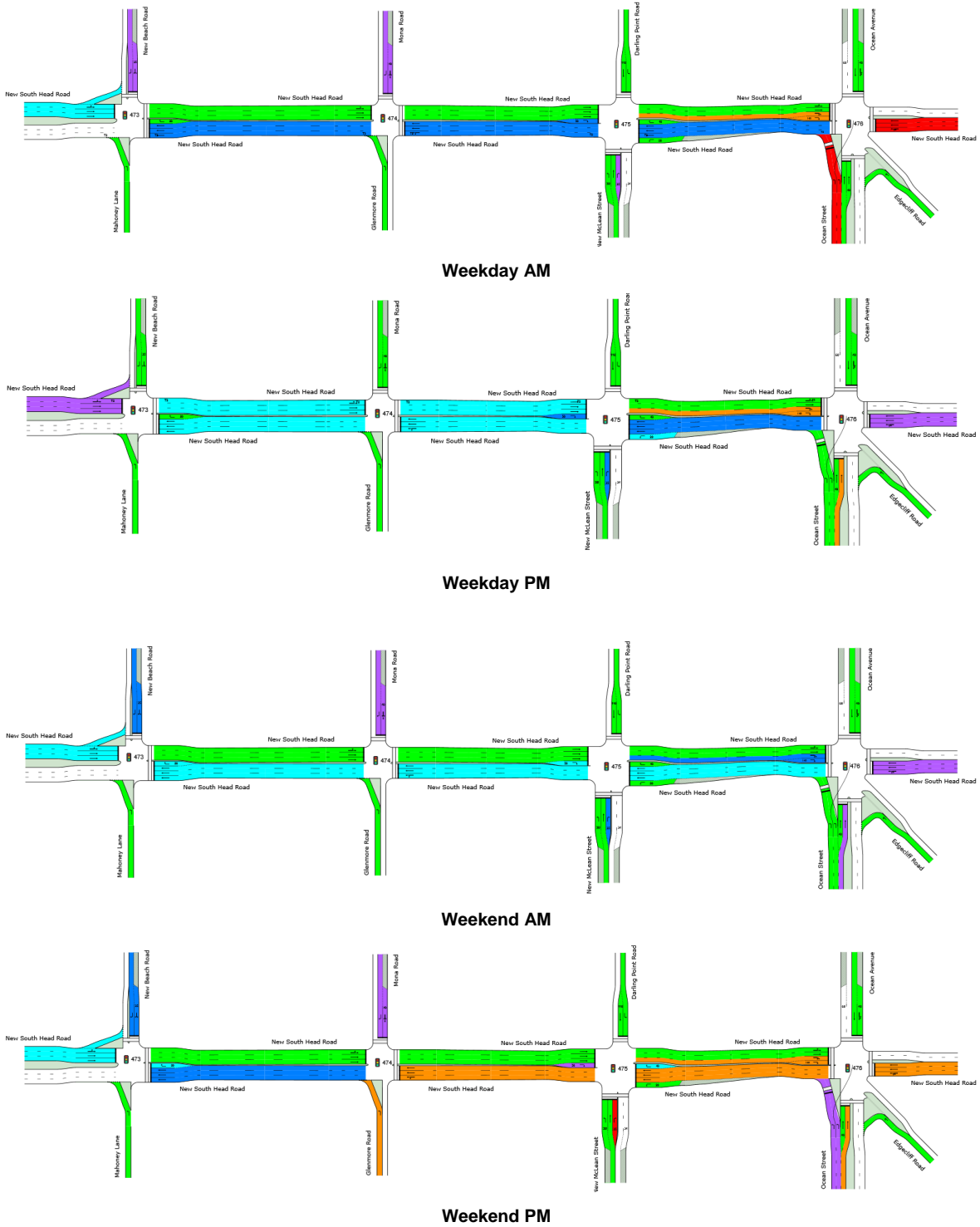
Delays and a DoS above 1.0 are, however, still experienced at







- *Intersection of Ocean Street (weekday AM peak): New South Head Road (west approach) right turn / New South Head Road (east approach) through.* Due to the large pedestrian crossing time required for the north-south crossings, there is no way to allocate more green time to the main movements without removing a pedestrian crossing. With the importance of these crossings it is not recommended that they be removed. Strategic policy directions should be pursued by WMC to ensure that performance remains acceptable, and balanced, across all road users; and
- *Intersection of New McLean Street (weekend PM peak): New McLean Street right turn into New South Head Road.* This movement experiences a DoS of 1.2, while all other movements perform at DoS less than 1.0. Due to the small number of vehicles undertaking this turn, this performance is considered acceptable.

Opportunities to improve the performance of Ocean Street / Ocean Avenue / New South Head Road were investigated, such as a triple left turn. There were no options that addressed the performance without costly acquisition, significant pedestrian impacts or significant route diversions for drivers. As such, policy intervention is recommended as the best approach to address the demand exceeding capacity.

The results are also shown in **Figure 6-6**, which graphically illustrates the road network performance (based on DoS).

Figure 6–6 Weekday and weekend DoS with development and improvements



Colour						
DoS range	< 0.6	0.6 – 0.7	0.7 – 0.8	0.8 – 0.9	0.9 – 1.0	> 1.0

Source: SCT Consulting, 2019

## 7.0 Proposed Traffic and Transport Solutions

### 7.1 Strategic policy

From the traffic and transport impact assessment undertaken, it is clear that the impact of potential development from the preferred option on the road network will be an increased number of trips across all modes of transport. Catering for the additional trips generated is an important consideration in the place and precinct outcomes for the ECC. Proposed infrastructure improvements to cater for the increase have been recommended in **Section 6.4.3** of this report. However, measures related to policy changes also need to be considered, to encourage a mode shift from private vehicle use towards more sustainable modes of transport.

The traffic modelling indicates that a number of vehicles that are above the intersection capacity in each scenario:

- 133 vehicles per hour in the weekday AM peak;
- 0 vehicles per hour in the weekday PM peak;
- 0 vehicles per hour in the weekend AM peak; and
- 24 vehicles per hour in the weekend PM peak.

These figures are derived from the SIDRA outputs by calculating the difference between the demand and the capacity for locations with a DoS over 1.

The network performance with these vehicles in the network is not dissimilar to many locations in Sydney. However, as a guide for strategic policies, this number of trips needs to be absorbed by policy interventions to equate to no change in the existing operating capacity of the impacted road network. This represents a maximum of 70 per cent of the preferred development option's potential traffic generation.

Sustainable transport and Travel Demand Management (TDM) strategies involve the application of policies, objectives, measures and targets to influence travel behaviour, to encourage uptake of sustainable forms of transport, i.e. non-car modes, wherever possible and to reduce the need to travel and hence reduce overall transport and travel demand and the impacts of new development.

Based on the analysis undertaken to develop the Edgecliff Commercial Centre Transport Study, strategic policy directions and proposed solutions are recommended for WMC to drive a successful outcome for the potential development. These directions (as described below) would help control the level of private vehicle traffic generation of the proposed (and other future developments) in the area.

#### 7.1.1 Support mixed use development

Mixed use development is correlated with lower car dependency as residents can walk to activities rather than needing to drive<sup>1</sup>. This research indicates a coefficient of 0.39 for jobs against the probability of internal capture, whereby changing from no job opportunities to an optimal ratio results in an increase of trip containment by 39 per cent. With the preferred development option including significant job opportunities as well as residential, the balance of jobs to residents will become more optimal.

**Recommendation:** Ensure that job-generating land uses are paired with residential land uses to reduce the need for car and public transport journeys.

#### 7.1.2 Reduce existing parking controls

Current maximum parking provision rates and parking multipliers within Part E 'General Controls for all Development' of the Woollahra DCP 2015 should be evaluated in view of considering a reduction in parking requirements, particularly for residential uses. Given the proximity of the ECC. to excellent public transport options, there is room to further reduce the maximum rates set out in the DCP, in particular for studios and one to two-bedroom units.

An update of the controls in Edgecliff to set out a maximum number of parking spaces for studios / 1-bedroom units from 0.5 spaces per unit to 0.3 spaces is estimated to lead to a reduction in car trips by 30 vehicle trips in the peak period (assuming no additional residential parking schemes were permitted for residents).

<sup>1</sup> Traffic Generated by Mixed-Use Developments—Six-Region Study Using Consistent Built Environmental Measures, Ewing, Reid et. Al, Journal Of Urban Planning And Development © Asce / September 2011



**Recommendation:** Decrease the maximum parking rate for units to 0.3 spaces for studios and 1 bedroom units, while exempting new residential flat buildings from the residential parking scheme.

Consider the inclusion of mandatory car share space(s) within developments above a determined threshold. The inclusion of car share spaces under this threshold could be promoted through a reduction in overall parking spaces required for the development.

Use of priced on-street parking could support local businesses by increasing the level of vacancy of on-street spaces by encouraging higher turnover and allowing customers to find a parking space without driving around the area.

It is critical that the development in the Commercial Core not be provided with any additional parking. The largest traffic generators in the area are the shopping centres, commercial and retail, all of which rely on the Commercial Centre's car parks. Capping of additional parking of this facility will deliver an additional reduction in trips of 100 vehicles per hour.

A comparison, for example of North Sydney with other centre traffic generation rates shows that some centres have significantly lower trip generation. These centres also have lower parking rates. Capping the parking to existing levels is therefore expected to have a significant difference to the trip generation and absorb trips that are beyond the network capacity.

**Recommendation:** Cap parking for the Commercial Core to be no more than currently provided.

### **7.1.3 Introduce travel plan program**

As shown in Section 3.2, three quarters of trips from the ECC are made to either Sydney city (which has excellent public transport links and restricted parking options) or to within Woollahra. This suggests that the majority of employees living in the ECC could use either public transport or active transport options to travel to work. Although the data also shows that the majority of employees already use public transport to travel to work, a Travel Plan program has the potential to further educate the individuals who currently drive to work (from a nearby location) on alternate modes of travel to their destination. It could also encourage greater flexibility in working hours to spread the demand placed on the arterial and local road network.

This would be achieved by ensuring that travel plans are completed as part of the development application process and have follow-up evaluation post-occupancy.

**Recommendation:** Ensure travel plans are effectively delivered by development proponents.

### **7.1.4 Support additional car share**

The provision of additional car share (Go Get) spaces on street within WMC, as well as dedicated parking provision within new developments and WMC car parks, will reduce car ownership and on-street parking demand.

GoGet currently has 464 drivers in post code 2027 sharing 8 vehicles, which is 58 members per car. GoGet tries to target 30 drivers per car, so drivers currently have difficulty accessing vehicles. An additional 8 spaces would address this issue.

When coupled with new developments car share reduces the need for individuals to purchase a vehicle and, as highlighted in Section 3.5, provides significant benefits to the area in which they operate. City of Sydney Council statistics indicate that one car share vehicle can remove up to 10 local vehicles that would compete for on street parking.

**Recommendation:** Amend the Woollahra DCP 2015 to require the allocation of one on-site car space for shared vehicles to offset 10 on-site parking spaces in new developments.

Investigate the use of car share schemes in conjunction with certain residences not being eligible for access to residential parking permit schemes.

### **7.1.5 Pedestrian wayfinding strategy**

The development of a consistent pedestrian wayfinding system for pedestrians would aid the delivery of a more legible public domain that encourages people to walk with comfort and confidence around the ECC. The strategy would be used as a guiding document to inform future design development for WMC's pedestrian wayfinding system.

**Recommendation:** Prepare a pedestrian wayfinding strategy for the ECC.

### 7.1.6 Pedestrian safety issues

It was also noticed that within the ECC, there are several instances of potentially unsafe signalised pedestrian crossing facilities. At several locations, there is a “green on green” – i.e. a location where both cars and pedestrians receive a green light, despite being in conflict. The alternative is to provide a red turn arrow, to provide drivers with an additional visual cue to pay attention. NRMA’s *Look Up: Keeping Pedestrians Safe* road safety series recommends removal of all green on green signals in Australia to improve pedestrian safety<sup>2</sup>. This is considered an existing safety issue with the state road network at the following locations:

- Ocean Avenue / Ocean Street / New South Head Road, north, south and east crossings;
- New McLean Street / Darling Point Road / New South Head Road, south crossing; and
- Mona Road / New South Head Road, east crossing.

**Recommendation:** As this is an existing issue with the state road network, it is recommended that WMC lobby Transport for NSW (Roads and Maritime) for upgrades at these locations.

## 7.2 Infrastructure improvements

In addition to the above strategic policy directions, various infrastructure improvements are recommended to benefit the road network operation within the ECC for all modes of transport (as described in **Section 6**). The following improvements (for further consideration and assessment by WMC) are recommended for the road network, to improve capacity with the introduction of the additional vehicle trips (as shown in **ID 8**: Improve Glenmore Road configuration for pedestrian safety.

Figure 7–1):

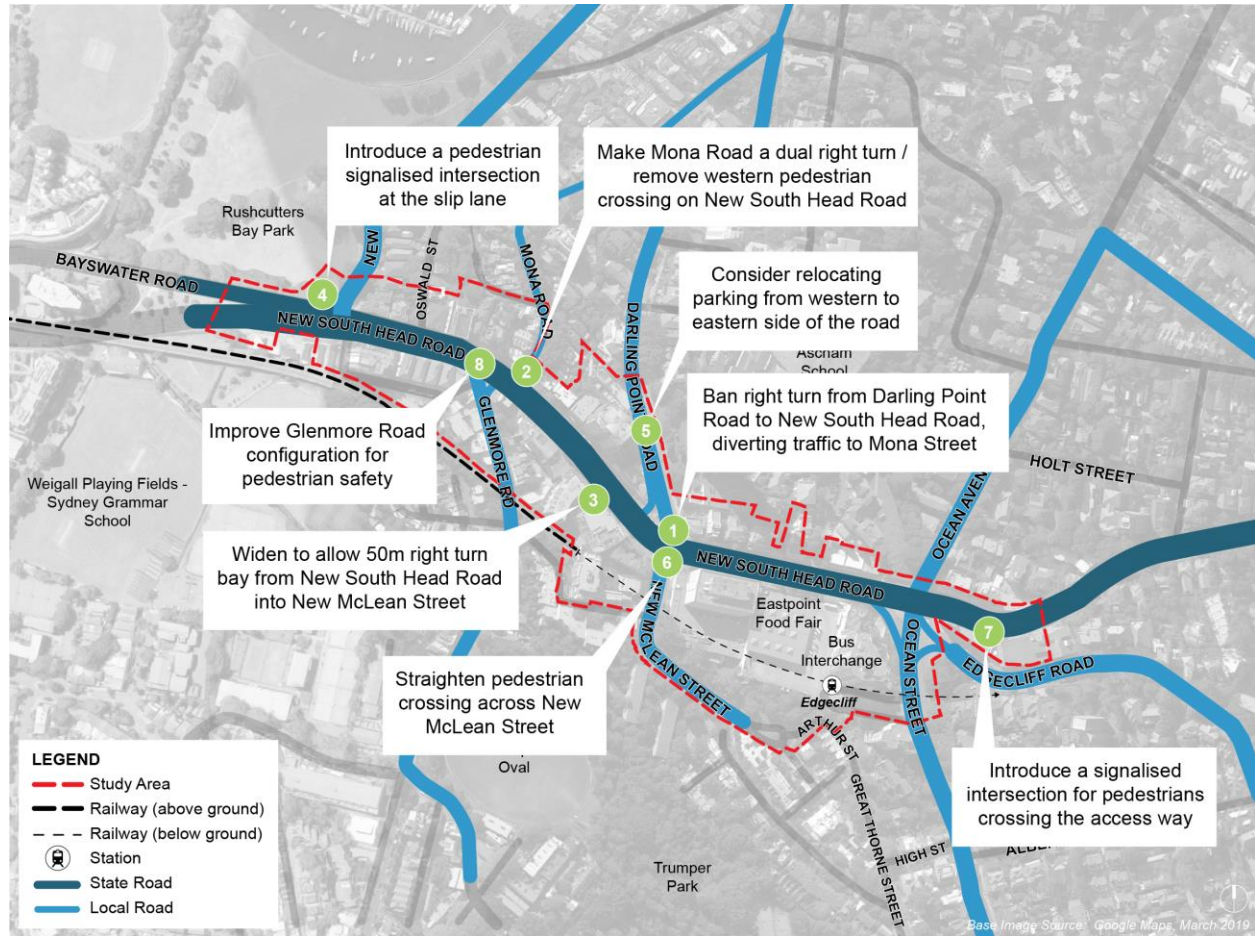
- ID1: Ban right turns from Darling Point Road to New South Head Road, diverting traffic to Mona Street (time-limited / permanent).
- ID 2: Make Mona Road a dual right turn and remove the western pedestrian crossing on New South Head Road.
- ID 3: Widen the southern side of the New South Head Road to allow 50m right turn bay from New South Head Road into New McLean Street via repurposing underutilised open space / modified urban design.

The following improvements are recommended to the pedestrian network, to enhance the pedestrian environment in the ECC, improve safety for pedestrians and cater for the increase in pedestrian trips generated by the potential development:

- ID 4: Introduce a new signalised intersection at the slip lane at the north western corner of the New South Head Road / New Beach Road intersection, to continue the existing signalised crossing across New Beach Road and further improve safety for pedestrians crossing the slip lane.
- ID 5: Potentially relocate parking from the western to the eastern side of Darling Point Road where the footpath is wider, to improve access and safety for people leaving and accessing their cars.
- ID 6: Straighten the pedestrian crossing on the southern side of the New South Head Road / Darling Point Road / New McLean Street intersection (across New McLean Street) to improve safety for pedestrians crossing the road, in particular visually impaired pedestrians.
- ID 7: Introduce a new signalised intersection for pedestrians crossing the bus access way east of Ocean Street, to improve safety for pedestrians crossing the access way on the southern side of New South Head Road.
- ID 8: Improve Glenmore Road configuration for pedestrian safety.

<sup>2</sup> <https://www.mynrma.com.au/-/media/documents/advocacy/look-up-keeping-pedestrians-safe.pdf?la=en&hash=83AF22A582EF35C901E303FE7B6A2BFD>

Figure 7-1 Proposed infrastructure improvements



Source: SCT Consulting, 2019

## 8.0 Summary and Next Steps

### 8.1 Summary

ECC is currently characterised by a highly public-transport oriented population, who use public transport as their preferred mode of travel. The centre has a diversity of existing uses and good transport access, enabling trips to Sydney CBD within 15 minutes.

With spare capacity in the bus and rail network, the centre is ideally located for intensification. Increase in mixed use development within walking distance from the station could support activation of the centre while delivering to the GSC dwelling targets in an area that will have minimal impact on the transport network.

Traffic modelling indicates the network performs with significant delays after introduction of the additional vehicle trips. Several junctions perform at demands significantly over capacity, resulting in significant queues. Several modifications are proposed to mitigate these impacts:

- ID1: Ban right turns from Darling Point Road to New South Head Road, diverting traffic to Mona Street (time-limited / permanent).
- ID 2: Make Mona Road a dual right turn and remove the western pedestrian crossing on New South Head Road.
- ID 3: Widen the southern side of the New South Head Road to allow 50m right turn bay from New South Head Road into New McLean Street via repurposing underutilised open space / modified urban design.

The following improvements are recommended to the pedestrian network, to enhance the pedestrian environment in the ECC, improve safety for pedestrians and cater for the increase in pedestrian trips generated by the potential development:

- ID 4: Introduce a new signalised intersection at the slip lane at the north western corner of the New South Head Road / New Beach Road intersection, to continue the existing signalised crossing across New Beach Road and further improve safety for pedestrians crossing the slip lane.
- ID 5: Potentially relocate parking from the western to the eastern side of Darling Point Road where the footpath is wider, to improve access and safety for people leaving and accessing their cars.
- ID 6: Straighten the pedestrian crossing on the southern side of the New South Head Road / Darling Point Road / New McLean Street intersection (across New McLean Street) to improve safety for pedestrians crossing the road, in particular visually impaired pedestrians.
- ID 7: Introduce a new signalised intersection for pedestrians crossing the bus access way east of Ocean Street, to improve safety for pedestrians crossing the access way on the southern side of New South Head Road.
- ID 8: Improve Glenmore Road configuration for pedestrian safety.

Despite these changes, the road network is still forecast to be over capacity with the potential development. Several policy recommendations were developed to absorb this impact:

- Ensure that job-generating land uses are paired with residential land uses to reduce the need for car and public transport journeys;
- Decrease the maximum parking rate for units to 0.3 spaces for studios and 1 bedroom units, while excepting new residential flat buildings from the residential parking scheme;
- Cap parking for the Commercial Core to be no more than currently provided;
- Ensure travel plans are effectively delivered by development proponents;
- Amend the Woollahra DCP 2015 to require the allocation of one on-site car space for shared vehicles to offset 10 on-site parking spaces in new developments;
- Investigate the use of car share schemes in conjunction with certain residences not being eligible for access to residential parking permit schemes; and
- Prepare a pedestrian wayfinding strategy for the ECC.

With these interventions, the proposed development supports the strategic policy objectives of WMC and the NSW Government transport agencies.



## 8.2 Next Steps

Following review of the Edgecliff Commercial Centre Transport Study documentation the following next steps are recommended for action by WMC:

- Progress and implement the various strategic policies / solutions identified within **Section 6** and **Section 7** to foster reduced private vehicle trip generation within the ECC; and
- Evaluate, through the strategic design stage of the project development (where applicable), the installation of physical infrastructure / turn restrictions as outlined in **Section 7**.

APPENDIX A

# SIDRA Calibration and Validation report

## Appendix A – SIDRA Calibration and Validation report

## APPENDIX B

# SIDRA Results



## Appendix B – SIDRA Results

### Base year 2018 results

## **Future Year With Development No Improvements**

## **Future Year With Development and Improvements**

