Transport for NSW

Central Precinct Renewal

Transport Strategy and Transport Impact Assessment

September 2023

NSW GOVERNMENT

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Acknowledgement of Country

We respectfully acknowledge the Traditional Custodians of the Central Precinct, the Gadigal and recognise the importance of place to Aboriginal people and their continuing connection to Country and culture. We pay our respect to Elders past, present and emerging.

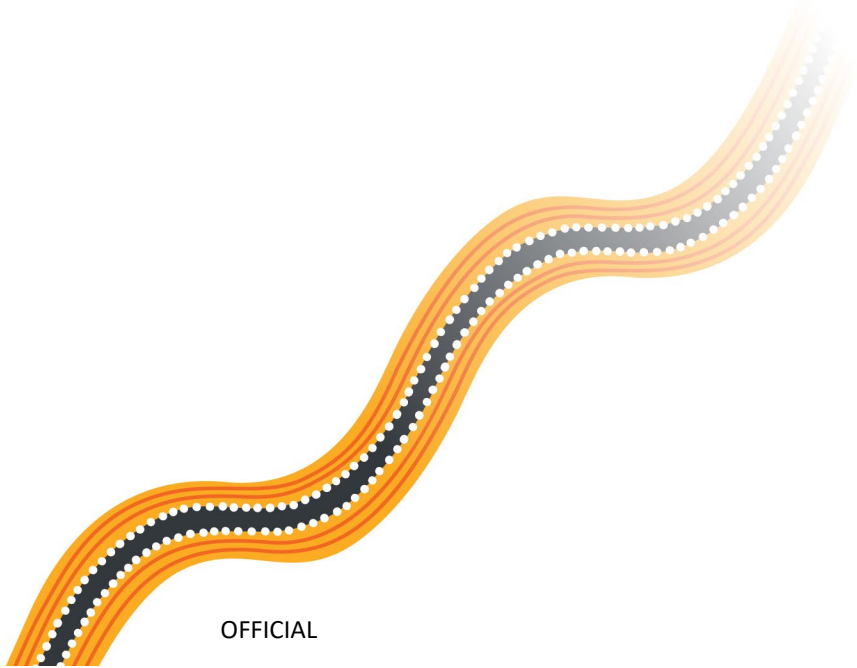

Table of Contents

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Authors	Arcadis Australia Pacific Pty Limited
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Versions

Version	Amendment notes
1.0	Final for CPRP Public Exhibition 2022
2.0	Final for DPE Submission
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4.0	Final version.

Abbreviations

Abbreviation	Definition
ABS	Australian Bureau of Statistics
BAU	Business as Usual
CBD	Central Business District
CFP	Car-Free Precinct
CoS	City of Sydney
CPRP	Central Precinct Renewal Project
CSELR	CBD and South East Light Rail
DA	Development application
DCP	Development control plan
DPE	NSW Department of Planning and Environment
GFA	Gross floor area
GIS	Geographic Information System
GSC	Greater City Commission
HTS	Household Travel Survey
IWLR	Inner West Light Rail
LGA	Local Government Area
MTMS	More Trains More Services
MVKT	Million Vehicle Kilometres Travelled
OGA	Office of Government Architect
OSD	Over Station Development
RMS	Roads and Maritime Services
SA	Statistical Area
SEPP	State Environmental Planning Policy
SSDA	State significant development application
SSP	State Significant Precinct
STFM	Strategic Traffic Forecasting Model
STP	Sustainable Transport Preferred
TfNSW	Transport for NSW
UTS	University of Technology Sydney

Definitions

Term	Definition
Amenity	The extent to which a place, experience or service is pleasant, attractive or comfortable. Improved features, facilities or services may contribute to increase amenity.
Catchment	Area from which a location or service attracts people
Central Precinct	Central Precinct State Significant Precinct
Central Sydney	Land identified as Central Sydney under the Sydney Local Environmental Plan 2012 and represents the Metropolitan Centre of Sydney. Central Sydney includes Sydney's Central Business District
Character	The combination of the attributes, characteristics and qualities of a place (GANSW, 2021, Draft Urban Design Guide)
Community	Particular types of stakeholder and refers to groups of people in particular places who are both affected by our work and experience the outcomes and benefits of our activities
Control	A numerical standard that is applied in a prescriptive manner
Corridor	A broad, linear geographical area between places
Council	The City of Sydney Council
Customers	Those who use transport networks and services. They include car drivers, heavy vehicle operators, public transport and point to point passengers, pedestrians, cyclists and freight and goods providers
Department	The Department of Planning and Environment
Determination	The approval made in accordance with the *Environmental Planning and Assessment (EP&A) Act 1979*. In relation to Central Precinct SSP, a determination will be made by the Minister for Planning and Public Spaces
District Plan	means the Eastern City District Plan
Gateway	Cities that provide state level services and facilities to support a broad population catchment while also having international connections through their cities airport and/or port.
Goods Line	The official name for the partly elevated walkway from Central Station to Darling Harbour following the route of a disused railway line
Grand Concourse	Part of Central Station
Greater Sydney's Green Grid	The link between parks, open spaces, bushland and walking and cycling paths
Interchange	A facility to transfer from one mode of transport or one transport service to another. For example, a station with an adjoining light rail stop
Mobility	The ability to move or be moved easily and without constraints
Mortuary Station	The building formerly used as a railway station on the Rookwood Cemetery railway line, now disused
NABERS	A national rating system that measures the environmental performance of Australian buildings and tenancies

Term	Definition
Objective	A statement of a desired future outcome, generally expressed in a qualitative manner that enables merit based assessment
Place	An intersection of transport infrastructure with social infrastructure and commercial activity. These are the areas within and around transit stops where people live and commute. Places can be created as an outcome of Placemaking
Planning instrument	Means any of the following: • strategic plan (comprising regional strategic plans and district strategic plans) and local strategic planning statements • environmental planning instrument (comprising State environmental planning policies and local environmental plans) • development control plan
Planning Secretary	The Secretary of the Department of Planning
Precinct	Geographical area with boundaries determined by land use and other unique characteristics. For example, an area where there is an agglomeration of warehouses may be termed a freight precinct
Principal development standards	Matters addressed in Part 4 of the Standard Instrument
Proponent	Transport for NSW
Proposal	Proposed amendments to the planning framework
Provisions	means a broad term covering objectives and controls
Public spaces	means areas that are publicly accessible where people can interact with each other and make social connections
Rail network	means the rail infrastructure in NSW
Railway corridor	The land within Central Precinct on which a railway is built; comprising all property between property fences, or if no fences, everywhere within 15m from the outermost rails. Under planning legislation rail corridor is defined as land: a) that is owned, leased, managed or controlled by a public authority for the purpose of a railway or rail infrastructure facilities: or b) that is zoned under an environmental planning instrument predominately or solely for development of the purpose of a railway or rail infrastructure facilities
Reference Master Plan	A non-statutory document that shows one way in which Central Precinct (Precinct) may develop in the future in accordance with the proposed amendments to the planning framework Note: Refer to the GANSW Advisory Note v2, dated 12/09/2018 for further guidance
Region Plan	The Greater Sydney Region Plan - A Metropolis of Three Cities
Rezoning	Amendments to environmental planning instruments, in particular for land use zones and principal development standards such as height of buildings and floor space ratio
Shocks and stresses	The acute short-term damaging events or long term trends causing inequity impacting a city's resilience
Siding	A short stretch of rail track used to store rolling stock or enable trains on the same line to pass
Social procurement	Purchasing decisions based on good social outcomes

Term	Definition
Standard Instrument	The Standard Instrument — Principal Local Environmental Plan
State	The state of New South Wales
State-led rezonings	A focus on precincts where there is a strategic imperative for the Department of Planning to lead the process, including places that benefit from current or future city-shaping infrastructure or investment, and where we can create great public spaces in collaboration with councils and communities. These rezonings generally occur under a SEPP
State Significant Precinct	The areas with state or regional planning significance because of their social, economic or environmental characteristics
Strategic Framework	The document prepared by Transport for NSW for Central Precinct in 2021 that addresses key matters including vision, priorities, public space, strategic connections, design excellence, identify sub-precincts for future detailed planning and also outlines the next steps in the State Significant Precinct process for Central Precinct
Strategic plan	The regional strategic plan, district strategic plan or a local strategic planning statement
Sub-precinct	The definable areas within Central Precinct SSP due to its unique local character, opportunities and constraints, either current or future. The Western Gateway is a sub-precinct
Sydney Metro	A fully-automated, high frequency rail network connecting Sydney
Tech Central	The State government initiative as set out in The Sydney Innovation and Technology Precinct Panel Report 2018. Previously known as the Sydney Innovation and Technology Precinct. Tech Central is located south of the Sydney central business district, surrounded by the suburbs of Redfern, Ultimo, Haymarket, Camperdown, Chippendale, Darlington, Surry Hills and Eveleigh
Transport for NSW	The statutory authority of the New South Wales Government responsible for managing transport services in New South Wales.
Transport interchange	A facility designed for transitioning between different modes, such as a major bus stop or train station
Transport modes	The five public transport modes are metro, trains, buses, ferries and light rail. The two active transport modes are walking and cycling
Urban renewal	A planned approach to the improvement and rehabilitation of city areas with new infrastructure, new commercial/mixed uses, improved services and renovation or reconstruction of housing and public works
Vibrant streets / places	Places that have a high demand for movement as well as place with a need to balance different demands within available road space

Executive summary

Located within the heart of Eastern Harbour City, Central Precinct (Precinct) is Australia's busiest transport interchange. The Precinct currently has significant potential in revitalising Central Sydney, with its proximity to the Sydney CBD and the extensive transport connections across Greater Sydney and regional NSW. The Central Precinct Renewal Project (CPRP) will provide a world-class transport interchange experience, effective space for jobs of the future, improved connections with surrounding areas, new and improved public spaces and social infrastructure to support the community.

In July 2019, Central Precinct was declared a nominated State Significant Precinct (SSP) in recognition of its potential to improve public outcomes, boost investment and deliver new jobs. The SSP planning process for Central Precinct will identify a new statutory planning framework for Central Precinct.

Arcadis has been engaged by Transport for NSW to prepare this Transport Strategy and Transport Impact Assessment Report as part of the Central SSP Study for the CPRP. This assessment addresses the study requirements issued by the NSW Department of Planning and Environment to guide preparation of the SSP Study, specifically the requirement to prepare a Transport Strategy and Transport Impact Assessment Report.

Central Precinct has been an important site for transport operations for over 150 years. Today, Central Station is Australia's busiest transport interchanges and is the anchor of the NSW rail network. The broader transport interchange also caters for light rail, bus, coach and point to point (such as taxis) services. The transport interchange will also form part of the Sydney Metro network, which will begin in 2024.

A Place Strategy, Urban Design Framework and a Public Domain Strategy have been prepared as part of the CPRP, which establishes the Reference Master Plan for Central Precinct. The Urban Design Framework and Public Domain Strategy provides a comprehensive urban design vision and strategy to guide future development of Central Precinct and has informed the proposed planning framework of the SSP Study. The Reference Master Plan comprises about:

- 28,100 square metres of publicly accessible open space
- 263,000 square metres of office gross floor area (GFA)
- 24,450 square metres of retail GFA
- 53,000 square metres of hotel GFA
- Approximately 82,350 square metres of residential accommodation GFA, providing for approximately 820 dwellings (assuming 1 dwelling per 100sqm GFA). The Central Precinct SSP Study will include the commitment to deliver 30 per cent of any new residential floor space as affordable housing.
- 46,000 square metres of education/ tech space GFA
- 20,700 square metres of student accommodation GFA
- 14,800 square metres of community/ cultural space GFA.

The key features of the Reference Master Plan, include:

- a network of new and enhanced open spaces linked by green connections
- a new network of circulation that will establish a clear layer of legibility and public use of the place
- an active recreation system that supports health and well-being through its running and cycling loops, fitness stations, distributed play elements, informal sports provision, and additional formal recreation courts.

Figure ES-1 provides a summary of the key transport initiatives proposed as part of the Central Precinct Reference Master Plan.

Figure ES-1: Summary of proposed Central Precinct transport initiatives

The travel demand assessment determined the proposed development of Central Precinct is expected to generate 10,530 trips in the AM peak hour and 8,550 trips

in the PM peak hour across all transport modes. This excludes trips generated by the Western Gateway development.

COVID-19 has substantially impacted existing and future demands on the transport network and the travel patterns of people across the Sydney CBD. Transport for NSW has developed revised forecasts to account for these substantial changes in the way people now travel, and are likely to travel in the future, given changing customer needs. Revised forecasts prepared by Transport for NSW in 2022 have informed this assessment and are representative of the changes in the future of travel on the transport system.

Detailed analysis has been completed to assess the impact of the CPRP to support the SSP. This includes dynamic modelling of the pedestrian environment within Central Station, across the surrounding precinct and on the new deck above the station against revised patronage and movement forecasts provided by Transport for NSW. This supplements the broader assessment on the existing operation of the transport system, in-depth appreciation of the current opportunities and constraints and the analysis of the quantum of travel that is likely to be generated by the proposed SSP.

To effectively allocate space on the transport system within and surrounding Central Precinct, as well as accommodate transfers between different transport modes, priority will be given to the more sustainable and efficient modes of transport, such as walking, cycling, and road-based public transport. The following modal hierarchy priority has been adopted for this Transport Strategy and Transport Impact Assessment:

1. Walking
2. Cycling
3. Public transport
4. Drop-off/ pick up (goods and people)
5. Parking.

Prioritising these modes above others supports mode shift from private cars, facilitates the reduction of congestion on the surrounding road network, and improves safety around Central Precinct. The hierarchy is intended to guide the location and accessibility of facilities for different modes of transport in terms of their proximity to the station or stop entrance, while ensuring that the station and broader precinct can operate efficiently and safely. For freight and servicing of the Precinct, trucks and other vehicles will be directed to off-street integrated loading and distribution facilities, allowing the transfer of large quantities of goods and waste to occur away from the public realm.

A suite of initiatives has been proposed to support the development of Central Precinct and mitigate the impacts on the transport network. These include:

- mitigation measures and actions that can be addressed through changes to the Planning Framework
- updates to the Central Precinct master plan
- supporting infrastructure projects that could be delivered as part of the renewal of Central Precinct (but outside the scope/ boundary of the SSP)
- infrastructure projects that fall outside the scope of Central Precinct.

Critical to the success of all the identified initiatives, and the corresponding success of Central Precinct, will be the ongoing engagement with stakeholders and transport authorities as the project progresses.

1. Introduction

Located within the heart of Eastern Harbour City, Central Precinct is Australia's busiest transport interchange. The Precinct currently holds latent potential with all its inherent advantages of location and transport connections to revitalise Central Sydney. Capitalising on Central Precinct's prime location within Tech Central, a New South Wales (NSW) Government commitment to create the biggest technology hub of its kind in Australia, Central Precinct presents the ultimate transformative opportunity to deliver a connected destination for living, creativity and jobs. The Central Precinct Renewal Project (CPRP) will provide a world-class transport interchange experience, effective space for jobs of the future, improved connections with surrounding areas, new and improved public spaces and social infrastructure to support the community.

1.1 Tech Central

1.1.1 Overview

The NSW Government is committed to working with the local community to develop the biggest innovation district of its kind in Australia. Bringing together six neighbourhoods near the Sydney CBD (Haymarket, Ultimo, Surry Hills, Camperdown, Darlington North Eveleigh and South Eveleigh), Tech Central is a thriving innovation ecosystem that includes world-class universities, a world-leading research hospital, 100 + research institutions, investors and a wide range of tech and innovation companies. The vision for Tech Central is for it to be a place where universities, startups, scaleups, high-tech giants and the community collaborate to solve problems, socialise and spark ideas that change our world. It is also for it to be place where centring First Nations voices, low carbon living, green spaces, places for all people and easy transport and digital connections support resilience, amenity, inclusivity, vitality and growth.

Tech Central is an essential component of the Greater Sydney Region Plan's Eastern Harbour City Innovation Corridor. It aims to leverage the existing rich heritage, culture, activity, innovation and technology, education and health institutions within the Precinct as well as the excellent transport links provided by the Central and Redfern Station transport interchanges.

The Central Precinct is located within the Haymarket neighbourhood of Tech Central. Planned to become the CBD for Sydney's 21st century, this neighbourhood is already home to The Quantum Terminal (affordable coworking space in the iconic Central Station Sydney Terminal Building) the Scaleup Hub (affordable and flexible workspace for high-growth technology scaleups) and is soon to be the home of Atlassian's headquarters. It is also in close proximity to a number of important education and research institutions.

The planned urban renewal of the Central Precinct has been identified as a key project to achieving the vision for Tech Central.

1.1.2 Background & Context

In August 2018, the NSW Government established the Sydney Innovation and Technology Precinct Panel (the Panel) comprising representatives from various industry, health, education, government agencies and key community members. In December 2018 'The Sydney Innovation and Technology Precinct Panel Report'

was produced, setting out the Panel's recommendations for a pathway to delivering a successful innovation and technology district at Tech Central.

In February 2019, the NSW Government adopted the Panel's report and committed to delivering the following:

- 25,000 additional innovation jobs
- 25,000 new STEM and life sciences students
- 200,000 m^2 for technology companies, and
- 50,000 m^2 of affordable space for startups and scaleups

In February 2019, the Greater Sydney Commission released a Place Strategy for the area that is now known as Tech Central (Camperdown-Ultimo Collaboration Area Place Strategy, GSC). The Place Strategy, developed collaboratively by a range of stakeholders involved in planning for Tech Central's future, was prepared to inform public and private policy and investment decisions by identifying and recognising the complex, place-specific issues inhibiting growth and change. The strategy identifies shared objectives for the place and sets out priorities and actions to realise the vision for the area under the key themes of Connectivity, Liveability, Productivity, Sustainability and Governance.

Both the Panel Report and Place Strategy recognise the importance of the Central Precinct to Tech Central's future.

In July 2019, Central Precinct was declared a nominated State Significant Precinct (SSP) in recognition of its potential to boost investment and deliver new jobs. The SSP planning process for Central Precinct will identify a new statutory planning framework for Central Precinct. This involves two key stages:

- Stage 1: Development of a draft Strategic Vision which has since evolved into the Central Precinct Strategic Framework
- Stage 2: Preparation of an SSP study with associated technical analysis and community and stakeholder consultation.

In March 2021, the Central Precinct Strategic Framework was adopted, representing the completion of Stage 1 of the planning process to develop a new planning framework for Central Precinct. The Strategic Framework outlines the vision, planning priorities, design principles, and the proposed future character of sub-precincts within Central Precinct.

This is intended to inform and guide further detailed planning and design investigations as part of this SSP Study (Stage 2 of the SSP planning process). This SSP Study intends to amend the planning controls applicable to Central Precinct under the SSP SEPP 2005 to reflect the vision and planning priorities set for the Precinct under the Strategic Framework. Study Requirements were issued in December 2020 to guide the investigations and the proposed new planning controls.

1.2 Central Precinct vision

Central Precinct will be a vibrant and exciting place that unites a world-class transport interchange with innovative and diverse businesses and high-quality public spaces. It will embrace design, sustainability and connectivity, celebrate its unique built form and social and cultural heritage and become a centre for the jobs of the future and economic growth.

1.3 Case for change

In its current state, Central Station is underperforming as Australia's major transport interchange – it is currently a gap in the heart of Sydney's CBD, lacking connectivity, activation and quality public spaces.

Over the coming years, Central Station will come under increasing pressure as technological innovations progress, investment in transport infrastructure increases and daily passenger movements increase.

Sydney Metro, currently Australia's biggest public transport project, will result in the delivery of a new generation of world-class, fast, safe, and reliable trains enabling faster services across Sydney's rail network. In 2024, Sydney Metro's Central Station will open with daily passenger movements during the week forecast to increase from 270,000 persons to 450,000 persons over the next 30 years.

The renewal of Central Precinct will expand and revitalise Central Station and transform this underutilised part of Sydney from a place that people simply move through to one where they want to visit, work, relax, connect and socialise. Its renewal also presents the potential to deliver on the strategic intent and key policies of regional, district and local strategic plans, providing for a city-shaping opportunity that can deliver economic, social and environmental benefit. Specifically, it will:

- make a substantial direct and indirect contribution to achieving the Premier's Priorities by facilitating upgrades to Sydney's largest and most significant public transport interchange, improving the level of service for users and visitors, and supporting the creation of new jobs and housing
- implement the recommendations of the NSW State Infrastructure Strategy 2018-2038, in particular the upgrading of the major transport interchange at Central to meet future customer growth

- contribute to key 'Directions' of the Greater Sydney Region Plan, to deliver 'a city supported by infrastructure', help create 'a city of great places', support 'a well-connected city', deliver new 'jobs and skills for the city' and create 'an efficient city'
- implement the outcomes envisaged within the Eastern City District Plan including reinforcing the Harbour CBD's role as the economic powerhouse of Australia and supporting its continued growth as a Global International City
- deliver on the shared objectives and priorities for Tech Central, the future focal point of Sydney's innovation and technology community, which aims to boost innovation, economic development and knowledge intensive jobs while creating an environment that foster collaboration and the exchanging of ideas
- deliver an outcome that responds to the overarching vision and objectives of the Central Sydney Planning Strategy. In particular, it will assist with implementing a number of 'key moves' outlined in the strategy, including to 'ensure development responds to its context', 'ensure infrastructure keeps pace with growth', 'move people more easily', 'protect, enhance and expand Central Sydney's heritage, public places and spaces', and to 'reaffirm commitment to design excellence.'

1.4 About this report

The purpose of this assessment is to address the study requirements issued by the NSW Department of Planning and Environment (the Department) to guide preparation of the Central State Significant Precinct Study.

This report provides a transport strategy and impact assessment of the CPRP within Central Precinct itself and adjoining areas.

This report has the following structure:

- **Section 1:** Introduction – Provides an overview of the development of Central Precinct as a state significant precinct
- **Section 2:** Strategic Planning Context – Provides an outline of the NSW Government and City of Sydney transport and land use initiatives that have guided the assessment outlined in this report
- **Section 3:** Existing Transport Conditions – Outlines existing travel patterns and mode shares for the area, as well as the Central Station SSP transport context
- **Section 4:** Transport Planning – Provides details of proposed amendments to the planning framework, including proposed planning provisions and relevant transport initiatives
- **Section 5:** Transport Assessment – Outlines the transport assessment of the Central Station SSP, including applicable mitigation measures
- **Section 6:** Preliminary Construction Staging Approach – Outlines the preliminary construction approach and staging for the proposal
- **Section 7:** Implementation Plan and Strategy – Presents an implementation plan and strategy for the proposal
- **Section 8:** Consultation – Documents the consultation process and how each stakeholder was involved as required by the study requirements
- **Section 9:** Conclusion and Recommendations – Provides a summary of the study outcomes and recommended planning controls to be included for the rezoning (to be included in a broader precinct design guidelines).

1.4.1 SSP study requirements

This report addresses 7.1 Transport study requirement issued by the NSW Department of Planning and Environment in October 2020. The relevant study requirements, considerations and consultation requirements, and location of where these have been responded to are outlined in Table 1-1.

Table 1-1: Study requirements, considerations, and consultation requirements

Ref	Requirement or consideration	Summary response	Where addressed
Study requirement			
10.1	Prepare a comprehensive transport strategy and transport impact assessment for the Precinct that:	This report identifies existing transport conditions, strategic context and future changes to accommodate the growth of movement within the study area. This report aims to support and inform the proposed planning framework	-
	• Identifies the existing situation, including constraints opportunities and key issues;	-	Section 3
	• Reviews the trip generating potential for all proposed modes and purposes, develops mode share targets and measures to achieve these targets;	-	Section 5.2 Section 5.3
	• Provides an understanding of the travel behaviours and patterns (all modes) of future workers, visitors and residents of the proposal through benchmarking, forecast modelling tools and other sources of evidence;	-	Section 3.2
	• Identifies and assesses the impacts resulting from the proposal with an appropriate level of pedestrian and traffic analysis;	-	Section 5
	• Provides details of the proposed transport strategy including, any necessary transport infrastructure and servicing improvements; the proposed approach to pedestrian and bicycle facilities, car parking; and access and egress requirements; and	-	Section 7
	• Informs and supports the preparation of the proposed planning framework including any recommended planning controls or DCP/Design Guideline provisions that would deliver an appropriate planning outcome.	-	Section 9.2

Ref	Requirement or consideration	Summary response	Where addressed
Study considerations			
10.1	The Study is to demonstrate consideration of:	-	-
	• A "vision and validate" approach to the Precinct and adjacent street network to develop a street user hierarchy, including movement and place considerations, for the Precinct	-	Section 5.2 Section 5.10
	• Inclusion of pedestrian analysis at development and station access/egress points, at intersections with the road network along key desire lines	-	Section 5.4
	• Measures to safeguard future transport infrastructure and traffic changes (for example any planned/future road closures, pedestrianised street sections, one way/two-way traffic operation etc. to the adjacent transport network)	-	Section 7.2
	• The overall interchange function of the Precinct, with priority to pedestrian access, safety, connectivity, wayfinding, and signage	-	Section 4.1
	• Limitation of parking and overall reduction in vehicular traffic	-	Section 5.7 Section 5.8.1
	• Access to key destinations and infrastructure in the local area, in particular schools, community facilities and other local services	-	Section 3.1
	• The safety of all road users, in particular pedestrians and cyclists	-	Section 5.9.1
	• The performance of the existing and future cycling, public transport and road network surrounding the Precinct, including potential improvements	-	Section 5.5 Section 5.6 Section 5.7
	• Cumulative growth of the surrounding area based on committed and planned developments (such as development of Tech Central and the potential renewal of the area subject to the Pyrmont planning review) and proposed infrastructure (such as WestConnex, Sydney Metro, and associated projects)	-	Section 5.11
	• The role of shared vehicles in managing travel demand and implementation of shared vehicle solutions	-	Section 5.8

Ref	Requirement or consideration	Summary response	Where addressed
	• Potential impacts of construction traffic including a strategic construction approach and potential staging	Staging and potential traffic impacts have been considered at a high level due to the early phases of the CPRP development,	Section 6
	• Access for people with disability, older people, pram users and people travelling with luggage	-	Section 5.4
	• Allowance for potential future infrastructure including rail service upgrades, very fast train, future light rail, relocation of coach services, and changes to bus services	-	Section 5.6
	• Light rail stops, bus stops, bicycle parking areas, kerbside areas for 'kiss and ride' and day and late-night taxis (including secure taxi rank/ Point to Point)	-	Section 5.6 Section 5.8.3
	• Integration with the cycle network, including consideration of direct and safe cycle ways along the eastern and western side of Central Station and provision of end of trip facilities	-	Section 5.5
Consultation			
10.1	Consultation with the City of Sydney and NSW Treasury should be undertaken. In particular, the City of Sydney should be consulted with, and agreement sought from City of Sydney and DPIE, on the methodology for the study. Specific consultation should be undertaken with the City of Sydney in relation to its forthcoming Sydney 2050 reference document and on key matters such as mode share targets and study methodology.	-	Section 10 and Appendix B
Author			
	The study is to be prepared by a suitably qualified transport professional(s) with the necessary experience and expertise to undertake the required works.	This report was authored by: • Bailey Byrnes – Principal Transport Planner Bachelor of Engineering (Civil) • Anthony Fransos – Principal Transport Planner Bachelor of Science (Engineering)	-

Ref	Requirement or consideration	Summary response	Where addressed
		• Wendy Hu - Transport Planner Bachelor of Engineering (Civil)	
Guidance documents			
	The following documents provide guidance for this Study: • Future Transport Strategy • City of Sydney Cycling Strategy and Action Plan 2018-2030 • Sydney's Cycling Future 2013 • City of Sydney Walking Strategy and Action Plan 2015-2030 • Sydney City Centre Access Strategy 2013 • NSW Road Planning Framework • The Movement and Place Practitioner's Guide, March 2020 • Legible Sydney- Wayfinding Strategy • A City for All Inclusion (Disability) Action Plan 2017-2021 (CoS) • Tech Central Place-based Transport Strategy, 2021 • Walking Space Guide, 2020		

1.5 Study area

Central Precinct is located at the south-east edge of Central Sydney (refer to Figure 1-1). Central Precinct is surrounded by several suburbs including, Haymarket to the north, Chippendale to the south and Surry Hills to the south-east. It is located within the City of Sydney local government area (LGA) with an approximate gross site area of 24 hectares of Government owned land. The Precinct comprises land bounded by Pitt Street and Regent Street to the west, Cleveland Street to the south, Eddy Avenue, Hay Street and Goulburn Street to the north and Elizabeth Street and Chalmer Street to the east.

Central Precinct has been an important site for transport operations for over 150 years. Today, Central Station is Australia's busiest transport interchanges and is the anchor of the NSW rail network. It provides 24 platforms for suburban and Intercity and Regional train connections as well as a direct link to Sydney Airport. The broader transport interchange also caters for light rail, bus, coach and point to point (such as taxis) services. The transport interchange will also form part of the Sydney Metro network, with new underground platforms to be provided for Sydney Metro services under Platform 13, 15 and 16 at Central Station. Sydney Metro services will begin in 2024. The Precinct also comprises several significant heritage items including the state-heritage listed Sydney Terminal Building and the clocktower.

Figure 1-1: Location plan of Central Precinct

As part of the Strategic Framework, eight sub-precincts have been defined that reflect and positively respond to the varying character of the surrounding areas. These sub-precincts are:

- Central Station
- Northern Over Station Development
- Western Gateway
- Regent Street Sidings
- Southern Over Station Development
- Prince Alfred Sidings
- Eastern Gateway
- Goulburn Street.

The location of these sub-precincts and relevant boundaries is illustrated in Figure 1-2.

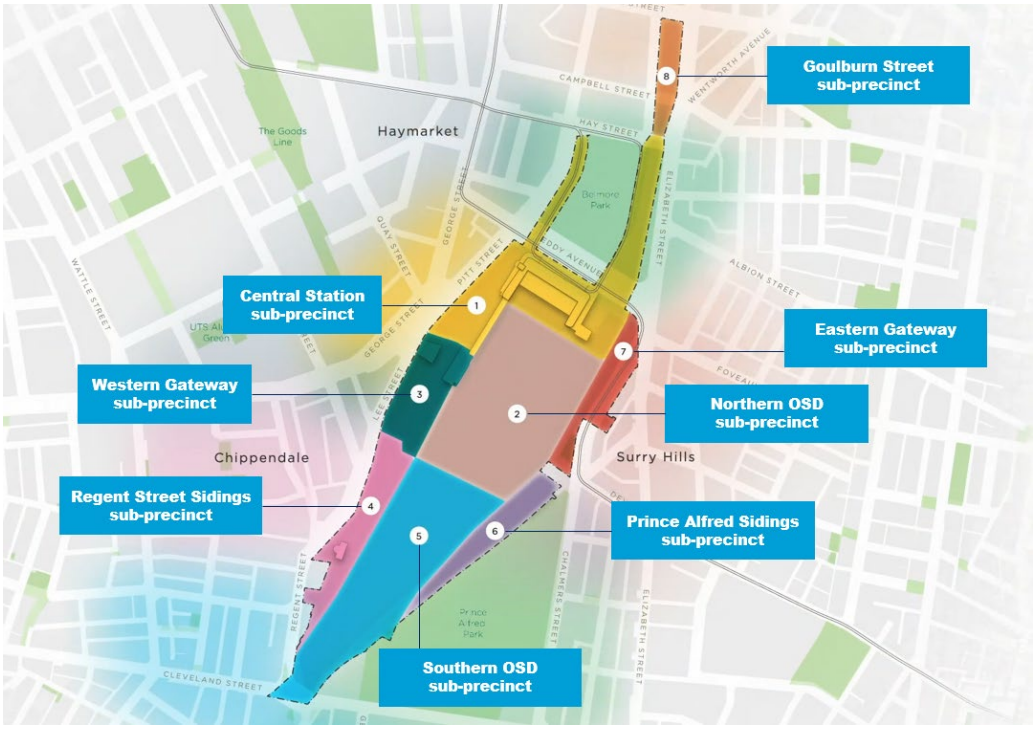


Figure 1-2: Central Precinct and sub-precincts

Source: Ethos Urban

1.5.1 Planning priorities

To help realise the vision of Central Precinct and the desired local character of the sub-precincts, the following planning priorities have been developed and are grouped into four key themes as outlined in Table 1-2.

Table 1-2: Central Precinct planning priorities

Theme	Planning priorities
Place and destination	• Unite the city by reconnecting with the surrounding suburbs • Shape a great place that is vibrant, diverse, active, inclusive and has a high level of amenity • Deliver a precinct which responds to its urban context and embeds design excellence Improve existing and providing additional connected public space in the Precinct of high environmental amenity and comfort • Protect and celebrate the Precinct's heritage values • Create a people focussed precinct through a focus on public transport, cycling and walkability • Facilitate the Precinct's focus on transport and economic diversity in tourism and across commercial sectors including office, business and retail.
People and community	• Design public spaces that promote health, equality and well-being • Promote social cohesion by providing spaces for gathering, connection, exchange, opportunity and cultural expression • Honour and celebrate the cultural heritage and identity of the Precinct's past and present Aboriginal community • Create a safe and intuitive precinct that promotes social access and inclusion • Support programs and initiatives that benefit communities and people • Create a precinct that responds to the current and future needs of transport customers, workers, residents and visitors, including those of the broader local community.
Mobility and access	• Provide a world class, integrated and seamless transport interchange • Maintain the Precinct's role as NSW's main transport interchange • Improve the transport customer experience, including wayfinding, pedestrian flows and interchange between different transport modes • Facilitate and enhancing connections within and towards key locations in southern Central Sydney • Deliver a people focussed precinct that is walkable, well connected, safe and puts people first • Design infrastructure that will adapt to future changes in transport and mobility.
Economy and innovation	• Advance Sydney's status as a global city • Support the creation of jobs and economic growth including new and emerging industries such as innovation and technology and explore the provision of space for cultural and creative uses and start-ups • Provide an active and diverse commercial hub with a rich network of complementary uses that nurture and support business • Support both the day and night economies of the Precinct through diverse complementary uses, promoting liveability and productivity • Foster collaboration between major institutions in the Precinct including transport, education, health and business • Create a smart precinct that incorporates digital infrastructure to support research and innovation.

1.5.2 Reference Master Plan

Architectus and Tyrrell Studio have prepared a Place Strategy, Urban Design Framework and a Public Domain Strategy which establishes the Reference Master Plan for Central Precinct. The Urban Design Framework and Public Domain Strategy provides a comprehensive urban design vision and strategy to guide future development of Central Precinct and has informed the proposed planning framework of the SSP Study.

The Reference Master Plan includes:

Table 1-3 Detailed breakdown of allocation of land within Central Precinct

Land allocation	Proposed
Publicly accessible open space comprising:	**22,000 m²**
Central Green - a publicly accessible park located in immediately south of the Sydney Terminal building	6,000 m²
Central Square - a publicly accessible square located at the George Street and Pitt Street junction	7,000 m²
Mortuary Station Gardens - a publicly accessible park (excluding Mortuary Station building) located at Mortuary Station	4,470 m²
Henry Deane Plaza - a publicly accessible plaza located in the Western Gateway sub-precinct	1,879 m²
Eddy Avenue Plaza - a publicly accessible plaza located in the north-eastern portion of the Sydney Terminal building	1,680 m²
Western Terminal Extension Building Rooftop - a publicly accessible space above the Western Terminal Extension Building Rooftop.	970 m²
Office	**269,500 m²**
Retail	**22,850 m²**
Hotel	**53,600 m²**
Residential accommodation Provides for approximately 850 dwellings (assuming one dwelling per 100 square metres GFA). The Central Precinct SSP Study will include the commitment to deliver 15 per cent of any new residential floor space as affordable housing.	**84,900 m²**
Education / tech space	**47,250 m²**
Student accommodation	**22,500 m²**
Community / cultural space	**14,300 m²**

The key features of the Indicative Reference Master Plan, include:

- A network of new and enhanced open spaces linked by green connections. This will include:
    - A Central Green (Dune Gardens) at the north of Central Precinct that will create a new civic public realm extension of the Sydney Terminal building and a new vantage point for Central Sydney
    - A new Central Square which will deliver on the vision for a new public square at Central Station, as one of three major public spaces within Central Sydney connected by a people-friendly spine along George Street
    - Mortuary Station Park at Mortuary Station that will be a key public domain interface between Chippendale and the over-station development. that will draw on the story of Rookwood Cemetery and the Victorian Garden context with the established rail heritage of the Goods Line and the rail lines
    - Henry Deane Plaza which will prioritise the pedestrian experience, improving connectivity and pedestrian legibility within the Western Gateway sub-precinct and provide clear direct links to and from the State heritage listed Central Station and its surrounds
    - Eddy Avenue Plaza – will transform into a high-amenity environment with significant greening and an enhanced interface with the Sydney Terminal building.
- A new network of circulation that will establish a clear layer of legibility and public use of the place. This will include:
    - A 15 - 24 metre wide Central Avenue that is laid out in the spirit of other street layouts within Central Sydney and which responds to the position of the Central clocktower, providing new key landmark views to the clocktower. Central Avenue will be a place for people to dwell and to move through quickly. It brings together the threads of character from the wider city and wraps them
    - Three over-rail connections to enhance access and circulation through Central Precinct, as well as provide pedestrian and bicycle cross connections through the Precinct
    - The extension of public access along the Goods Line from Mortuary Station Gardens, offering a new connection to Darling Harbour
    - New vertical transportation locations throughout the Precinct allowing for seamless vertical connections.
    - An active recreation system supports health and well-being through its running and cycling loops, fitness stations, distributed play elements, informal sports provision, and additional formal recreation courts.
    - a network of fine grain laneways that are open to the sky

A summary of the proposed land allocation for Central Precinct is described in Table 1-4 below.

Table 1-4 Breakdown of allocation of land within Central Precinct

Land allocation	Proposed
Open-air rail corridor	101,755 m^2
Developable area	119,619 m^2
Public open space	19,185 m^2/ 16% of developable area
Other publicly accessible open space (Including movement zones, streets and links)	41,773 m^2/ 35% of developable area
Building area	58,661 m^2/ 49% of developable area
Central SSP total area	**23.8 ha**

The exhibited Urban Design Framework for Central Precinct is illustrated in Figure 1-3 below.

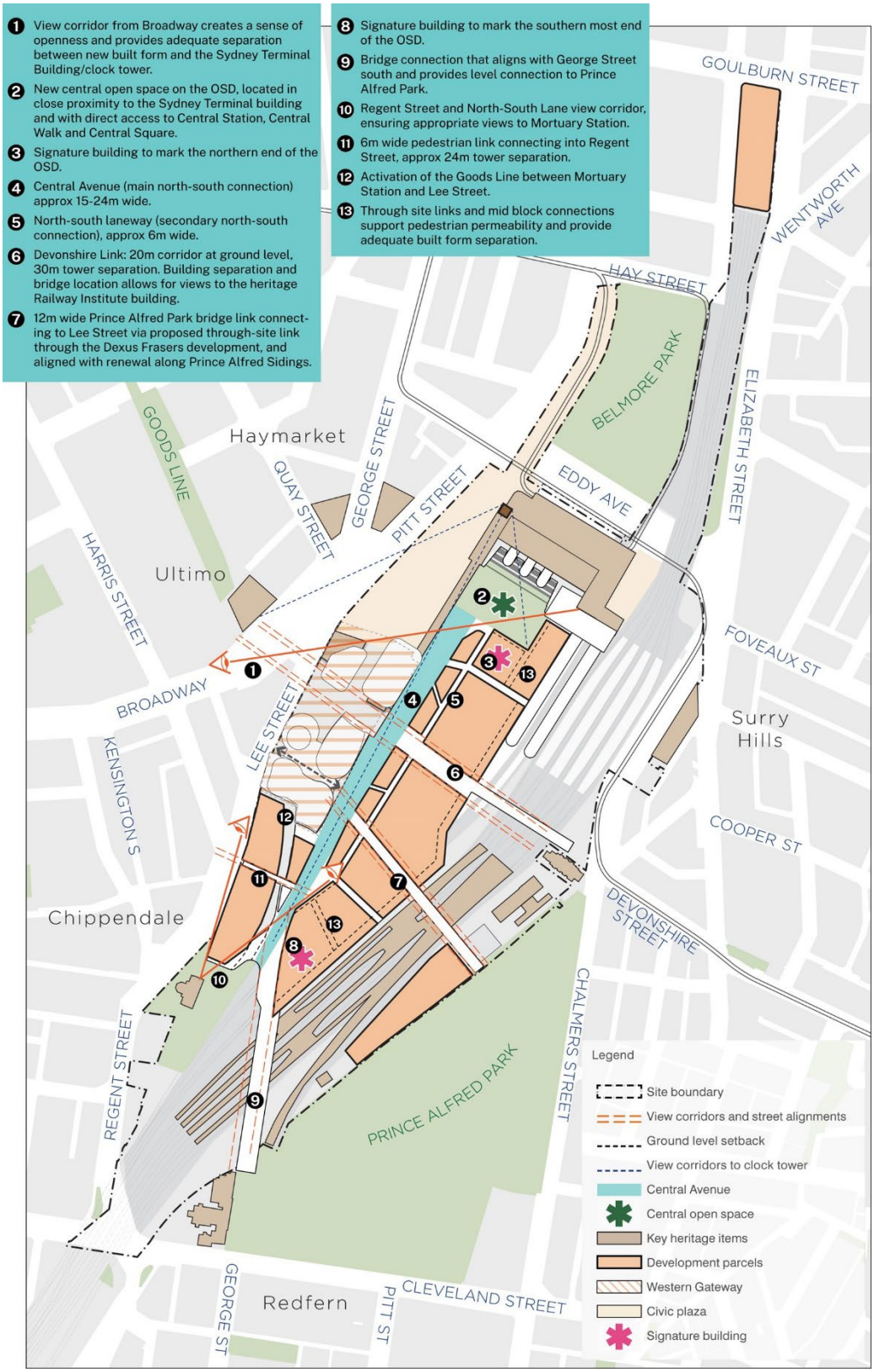


Figure 1-3: Exhibited Urban Design Framework

1.6 Demand assessment yields

Preliminary demand calculations were undertaken during the initial design stages of the CPRP for the purpose of early stakeholder consultation. Revised development yields have been developed due to subsequent master plan updates *Central Precinct Draft SSP Metrics* and architect GFA updates. The latest master plan GFA schedule is summarised in Table 1-5 and the estimated phases of construction provided in Table 1-6.

Individual project areas have been based on the average number of dwellings and proposed GFA for retail and commercial development outlined in Table 1-5 and Table 1-6.

Table 1-5: Revised Master plan gross floor area schedule

Block	Building label	Gross floor area totals (m^2)
Station	Grand Terminal Building	16,495
A	A1	68,245
	A2	48,860
	A3	40,105
	A4	4,098
	A5	2,621
	A6	3,164
B	B1	42,459
	B2	37,112
	B3	4,036
	B4	4,962
C	C1	32,664
	C2	28,505
	C3	42,790
	C4	3,411
	C5	2,352
D	D1	35,425
	D2	31,899
E	E1	20,921
F	F1	49,167
Total (m^2)		**519,291**

Table 1-6: Estimated phases and construction dates

Stage	Building label	Estimated start date	Estimated completion
Stage 0	Terminal Building	2023	2026
	D1		
	D1		
	E1		
	F1		
Stage 1	A1	2031	2033-34
	A2		
	A3		
	A4		
	A5		
	A6		
Stage 2	B1	2031	2034-35
	B2		
	B3		
	B4		
	C1		
	C4		
	C5		
Stage 3	C2	2033	2035-36
	C3		

These figures provide information on the estimated quantity of dwellings for residential units and GFA for retail and commercial developments.

1.7 Public Exhibition and response to submissions

The Central SSP Study and supporting documents were made available for public comment from 22 August to 4 October 2022. During the exhibition period, community members and stakeholders were invited to provide their comments and feedback on the rezoning proposal.

1.7.1 Feedback relating to traffic and transport received during exhibition

A total of 368 submissions were received from individuals, local council, government agencies, industry bodies, non-government organisations, and interest groups. Table 1-7 below provides an overview of the feedback relating to traffic and transport identified as part of the review of submissions.

Table 1-7 Summary of feedback from public exhibition relating to traffic and transport

Theme	Summary of feedback
Assumptions, inputs and transport modelling	Concerns about the input data used to inform the assessment, including the use of pedestrian and traffic survey data both pre- and post-covid, and use of alternative trip generation rates to the RMS/TfNSW adopted rates.
	Concerns about the traffic and pedestrian modelling completed for the assessment, including the absence of a 'no development' scenario for comparison, and details on pedestrian volumes at intersections.
Pedestrian assessment	Concerns about the use of the Fruin Level of Service to assess pedestrian impact in preference to the TfNSW Walking Space Guide.
Cycling network	Concerns on the absence of cross-precinct cycling links, including the absence of ramps on all approaches.
Public transport	Further clarification was sought on how the future Coach terminal would operate within the new Western Forecourt area
Traffic and safety	Concerns about adverse impacts caused by traffic generated by the development, the lack of benchmarking of crash statistics,
Parking, freight and servicing	Concerns about the proposed car parking and loading bay rates were raised, including the absence of provisions to support electric vehicles.
	Further clarification was sort on how autonomous vehicles would operate and interface with pedestrians and other vehicles around the precinct.

1.7.2 Responses to key issues raised

A summary of the key themes and feedback received consultation and public exhibition process and the associated response are outlined in the following section.

Assumptions, inputs and transport modelling

Various submissions outlined concerns on the absence of detail in the development of the demand and distribution of trips across the study area, and how changes in demand due to COVID-19 were accounted for. Further information was also sought on the use of alternative trip generation rates to the RMS/TfNSW adopted rates.

The submissions noted the staged completion of the transport modelling completed for this assessment, and the impact of COVID-19 on travel demands and how this was considered in the broader assessment. Some submissions queried elements of the transport modelling and assessment, including:

- The use of alternative trip generation rates as opposed to the RMS/TfNSW adopted rates.
- The lack of a 'no development' scenario, limiting the ability to assess the impact on pedestrians and the broader transport network caused by CPRP
- Lack of information on how the base models were calibrated and validated
- The modelling doesn't consider the cumulative impact of CPRP alongside other significant transport projects across Sydney
- How demands were identified and distributed across the study area

With regards to the adopted trip generation rates, the calculation of the number of trips generated by CPRP required data on 'people trips' for a broad range of land uses. The rates provided in the RMS/ TfNSW Guide to Traffic Generating Developments document do not include all land uses proposed as part of CPRP;

for land uses that are specified, vehicle trips are the predominate dataset captured, with people trip data not available for all land uses.

Analysis of databases from other countries showed that the weekday peak TRICS vehicle trip rates where similar to the current RMS/TfNSW rate for comparable developments, and as such was considered to be a more holistic approach to determining overall trip generation. This approach was agreed to by TfNSW in 2019.

This assessment used a variety of data sources to understand movement patterns and future demands, including 2016 Census data for Journey To Work trips, people movement data from GPS datasets, forecast demand from the Sydney Transport Model, pedestrian survey counts and video capture from the precent. The use of the Sydney Transport Model in the development of the future year forecasts ensured the resulting pedestrian and transport demands incorporates any broader influences from other city-shaping projects.

Further information on the data sources and how they were used to inform the assessment, including the approach in calculating background demand, development trip generation and the distribution of these movements to the study area, is outlined in Section 5.3.

Further modelling has been completed that includes assessment of a 'no development' scenario, with the results included in this report.

Pedestrian network and assessment

A number of submissions raised concerns on the approach used to assess capacity of the pedestrian network, with a strong preference in the use of the TfNSW Walking Space Guide for areas outside the gateline. Concerns were also noted in the ability to assess the impacts of the development on people walking in the broader precinct in the absence of a 'no development' scenario.

Further clarity was sought on the closure of Lee Street and the resulting impact on pedestrian movement, as well as the role of Devonshire Tunnel in the longer term given the extension of Central Walk to the west and the creation of new links over the corridor.

The Walking Space Guide was used in the original assessment to understand overall pedestrian comfort in key footpath locations around the precinct. In response to the concerns raised, the updated assessment now adopts the Walking Space Guide approach as the trigger for consideration of further intervention, rather than the previously adopted Fruin 'footpath' Level of Service criteria.

As noted previously, a 'no development' scenario has also been modelled to so that a detailed assessment of impacts on the pedestrian network caused by CPRP. These findings have been included in this report, along with further information on the impact of Lee Street being closed.

Assessment of the future pedestrian network across Central Precinct suggests maintaining Devonshire Tunnel as an unpaid connection across the rail corridor will assist in providing resilience to the pedestrian network in the longer term. However, the role of Devonshire Tunnel will be further evaluated as part of a future DA stage.

Cycling network

A number of submissions identified cycling as an issue, with further consideration needed on improving connections across the precinct and to surrounding areas. Many submissions highlighted a need for continuous cycling connections across the precinct, with missed opportunities in designating the extended Goods Line and the Devonshire Tunnel as cycling routes. The Railway Colonade was also identified as a missing link connecting the precinct to the north, with recommendations to provide cycling access along the bridge connection.

Recommendations were also provided on where hubs for bicycle parking and end-of-trip facilities could be provided.

The cycling and active transport network across Central Precinct have been planned to provide a mix of through-routes around the precinct, and local connections to the station and the OSD. While through-site cycling connection would be ideal in linking across the rail corridor, the technical complexity of building over the tracks, traversing significant level change and integrating with existing heritage poses challenges to providing cycle access across the site at deck level.

The use of the Goods Line extension and Devonshire Tunnel were contemplated as commuter-level cycling links, however it was found that the interface with the plazas and spaces at the end of these connections impacted on the suitability of the use of these links as a high-speed cycling corridor.

The Goods Line extension, with its potential for a bicycle parking hub to be located along its length, has been identified as a local access route, that will provide cycling connections to development and local activity within the precinct. The Railway Colonade has also been identified as a local access cycling route in response to the concerns raised.

Further details on provisions for bicycle hubs and end-of-trip facilities, including provisions for cargo-bikes and other micro-mobility devices, will be made at the detailed design stage.

Public transport

Some submissions raised concern with the suitability of the Regent Street Sidings site for use as a bus layover site in the longer term due to adverse impacts on the road network. There was also a request for further clarity on how the coach terminal would operate within the revitalised Western Forecourt area.

The bus layover is an existing facility within the Central Precinct Study area, and is required in the longer term to cater for growing bus patronage across the Sydney CBD. Further work will be completed during the detailed design phases to look at approaches in improving site access efficiency, including providing a combined entry and exit point that is integrated with a signalised intersection.

With regards to coach movements, the masterplan design allows for coaches to operate in a similar manner to existing conditions, with coach access via the Railway Colonnade. Interchanging passengers would have improved access to Central Station, as well as improved access to bus and light rail connections through more direct links through the terminal building.

Traffic and safety

There were a number of comments made in relation to road network impact and street design. This includes:

- Providing a quantitative assessment of road network impacts to understand potential safety risks and identify the reliability impacts to road based public transport and freight and logistics to and from the precinct
- Exclusion of the Harris Street / Broadway / George Street / Regent Street intersection from the study area
- Requests for further detail on the impacts at the intersections of Pitt Street / Eddy Avenue / Rawson Place, Elizabeth Street / Foveaux Street, and Devonshire Street / Chalmers Street
- Further detail on the number of vehicle movements generated by CPRP for each access each day
- Further information on the service and emergency vehicle network
- A request for benchmarking to be completed as part of the safety analysis

As identified in Section 3.6, the existing road network around Central Precinct is generally at capacity. This assessment recognises the limitations of the road network, and through the adoption of the "Vision and validate" approach, is minimising impacts on the existing road network by reducing parking availability onsite through the adoption of reduced maximum parking rates, and targeting a high mode share supported by a range of initiatives, including potential upgrades to intersections surrounding the precinct.

Resolving the preferred solution for these locations will require further analysis and stakeholder engagement, with detailed modelling to understand these impacts to be completed at a later stage. For the purposes of this assessment, the completed traffic modelling has been used to understand the local impacts of vehicle access to and from the development, as well as the broader impacts of pedestrian movement on the broader precinct.

With regards to the intersection of Harris Street / Broadway / George Street / Regent Street, this location is outside the boundaries of the detailed pedestrian assessment. As such, the pedestrian movement at the intersection has not been calibrated and validated to the same level as intersections adjacent to the site. However, as it is included in the wider traffic model boundary, the report has been updated to provide commentary on general performance with regards to pedestrian and traffic flow.

The report has been updated to include further detail on intersection performance, details on the number of movements generated by CPRP for each access each day, and to include details of the service and emergency vehicle network. The safety analysis has also been updated to include benchmarking of similar areas.

Parking and servicing

There were a number of comments made in relation to parking and servicing associated with the development:

- While reduced parking rates were generally supported, there were queries on why the parking provisions identified in the masterplan did not match the rates
- Recommendation to adopt the DCP rates for loading and servicing, and ensure the loading strategy consider all servicing needs and not just day-to-day requirements
- Recommendation to include rates for the provision of electric vehicles
- Recommendation to increase in car share provisions

- Clarification on how autonomous vehicles would operate and interface with pedestrians and other vehicles around the precinct.

With regards to the onsite parking provisions, the rates proposed are for new development across Central Precinct. The surplus parking was provided to accommodate activities associated with the operation of Central Station. The quantum of parking allocated for operational use will be reviewed at a future DA stage.

As outlined in Section 5.8, the identified loading bay provisions are based on a detailed assessment using servicing trip rates from similar developments. A future Integrated Loading Strategy and Management Plan for Central Precinct will be completed at the DA stage, which will outline how non-typical freight and servicing activities will be managed alongside day-to-day operations.

The assessment and Design Guide will be updated to include provisions for electric vehicle parking and car share provisions. Further information on how autonomous vehicles have been integrated into the proposal are provided in this report.

1.7.3 The revised proposal

Based on the feedback received during the public exhibition of the Central Precinct rezoning proposal, a revised proposal has been prepared for DPIE's consideration as part of its assessment. The revised proposal includes an updated Urban Design Framework and Public Domain Strategy, which establishes the updated Reference Masterplan and has informed updates to the proposed planning framework for Central Precinct. The updated Reference Masterplan comprises:

- approximately 263,000 square metres of commercial gross floor area (GFA).
- approximately 24,450 square metres of retail GFA
- approximately 46,000 square metres of education/ tech GFA
- approximately 14,800square metres of community/ cultural GFA
- approximately 82,350 square metres of residential GFA
- approximately 53,000 square metres of hotel GFA.
- approximately 20,700 square metres of student accommodation GFA.
- 30% of new dwellings to be provided as affordable housing
- over two hectares of new and improved publicly accessible spaces, including:
  - Central Square, a new approximately 7,000 square metre publicly accessible open space located at the junction of George Street and Pitt Streets at street level
  - Central Green, a new approximately 6,200 square metre publicly accessible open space located immediately south of the Sydney Terminal building at deck level, including the Sydney Terminal building western rooftop
  - Devonshire Square, an approximately 3,700 square metre publicly accessible plaza at the junction of Central Avenue and the Devonshire link
  - Southern Plaza, an approximately 4700 square metre publicly accessible plaza at the junction of Central Avenue and the George Street Bridge
  - Mortuary Station Gardens, an approximately 6,500 square metre (excluding the Mortuary Station building) publicly accessible plaza located at street level at the junction of the Mortuary Station and the Goods Line

- upgrades to Eddy Avenue Plaza and Ibero-American Plaza.

- an integrated network of streets, laneways and other movement corridors, including:
  - Central Avenue, as Central Precinct's new main street
  - Devonshire Link, as Central Precinct's main east-west sequence
  - a north-south link as an intimately scaled, active laneway
  - a supporting network of other open-to-the-sky laneways generally running east-west through the Precinct
  - through-block links to provide further permeability for pedestrians
  - three active transport over-rail bridges
  - a revitalised Goods Line as an active transport corridor.

The key features of the updated Reference Masterplan, include:

- A network of new and enhanced public spaces linked together by green connections. This will include:
  - A new Central Square that will deliver on the vision for a new public square at Central Station, as one of three major public spaces within the Sydney CBD connected by a people-friendly spine along George Street
  - A Central Green (Dune Gardens) at the north of Central Precinct will create a new civic park extension of the Sydney Terminal building and a new vantage point for Central Sydney
  - A new civic space (Devonshire Square) at the proposed entry/exit point to Central Walk from the OSD, giving access to all platforms within Central Station.
  - Mortuary Station Gardens at Mortuary Station will be a key public domain interface between Chippendale and the over-station development and a public link to the Goods Line
  - A reconfigured Southern Plaza at the southern end of the OSD deck will provide a new arrival and meeting space when coming from Redfern and a key connection to Redfern when coming from the city
  - Henry Deane Plaza which will prioritise the pedestrian experience, improving connectivity and pedestrian legibility within the Western Gateway sub-precinct and provide clear, direct links to and from Central Station and its surrounds
  - Eddy Avenue Plaza will transform into a more civic environment with improved amenity and an enhanced interface with the Sydney Terminal building.

- A new network of circulation spaces that are legible and provide for public access and use of the place. This will include:
  - Central Avenue, with a consistent minimum width of 18 metres located to provide long views of the Sydney Terminal Building clocktower. Central Avenue will be a place for people to dwell and move through while linking together a sequence of publicly accessible spaces on the OSD deck, including the Central Green, Devonshire Square and the Southern pPlaza
  - A minimum 6-metre wide north-south laneway providing an additional intimate and active link between the sequence of publicly accessible spaces on the OSD deck, and opportunities for smaller courtyard experiences
  - Three new over-rail connections to enhance pedestrian and bicycle access to and from Surry Hills, Prince Alfred Park, Redfern and Chippendale and circulation to and through the Central Precinct

- The extension of public access along the Goods Line offering a new connection to Darling Harbour from Mortuary Station Gardens
- New vertical transportation locations throughout the precinct provide accessible vertical connections to the OSD.

The revised proposed land allocation for Central Precinct is described in **Table 1-8** below.

Table 1-8 Breakdown of allocation of land within Central Precinct

Land allocation	Proposed
Open-air rail corridor (Infrastructure)	89,781 sqm
Western Gateway	16,638 sqm
Developable area (Total)	131,593 sqm
Public Space (Including open space, squares, plazas, movement zones, streets and links)	71,603 sqm /54.4 % of Developable area
Building area	59,990 sqm / 45.6 % of Developable area
Central SSP total area	**238,012 sqm (23.8 ha)**

The revised Indicative Reference Master Plan for Central Precinct is illustrated in Figure 1-4.

1.7.4 Key changes from the exhibited proposal

The feedback on the exhibited rezoning proposal has informed subsequent amendments to the Reference Masterplan. A summary of the key changes adopted as part of the revised Reference Masterplan are described below:

- **Improved interface between Terminal and OSD**: The interface relationship between the OSD deck and the Terminal Building has been further rationalised to improve the function of the station as a major interchange and better respect the heritage of Central Railway Station. The following changes have been made:
  - a reduced spatial extent of the stairs between the OSD deck and the Terminal to now be a consolidated vertical connection (stairs, lift and escalators) to the north-eastern edge of Central Green
  - an expanded concourse level with greater access to daylight and new opportunities for landscaping that will improve the passenger experience on the platforms and in the concourse, compared to the exhibited proposal
  - incorporating an interpretation of the platform canopies to deliver a heritage-responsive and weather-protected connection.
- **Consistent 18-metre-wide Central Avenue**: A consistent width of 18 metres has been provided for Central Avenue. The future role and function of this link has been revised from an avenue between the north and south of the OSD deck to now becoming a connector of a sequence of public spaces on the OSD deck.
- **Additional mid-block through-site links**: The introduction of additional mid-block connections to reinforce breaking up the podiums on the OSD deck level into interconnected smaller building forms.

- **Removal of the Eastern Colonnade**: The eastern colonnade has been removed from the revised Reference Masterplan.
- **Reconfiguration of Central Green**: The layout of Central Green has been adjusted to be a squarer geometry compared to the exhibited proposal. The primary movement path through Central Green is now focused toward the southern and eastern edges of this open space. The indicative design of Central Green has also been adjusted to improve its relationship with the Terminal Building through the incorporation of seating and greater landscaping at the northern edge of the park.

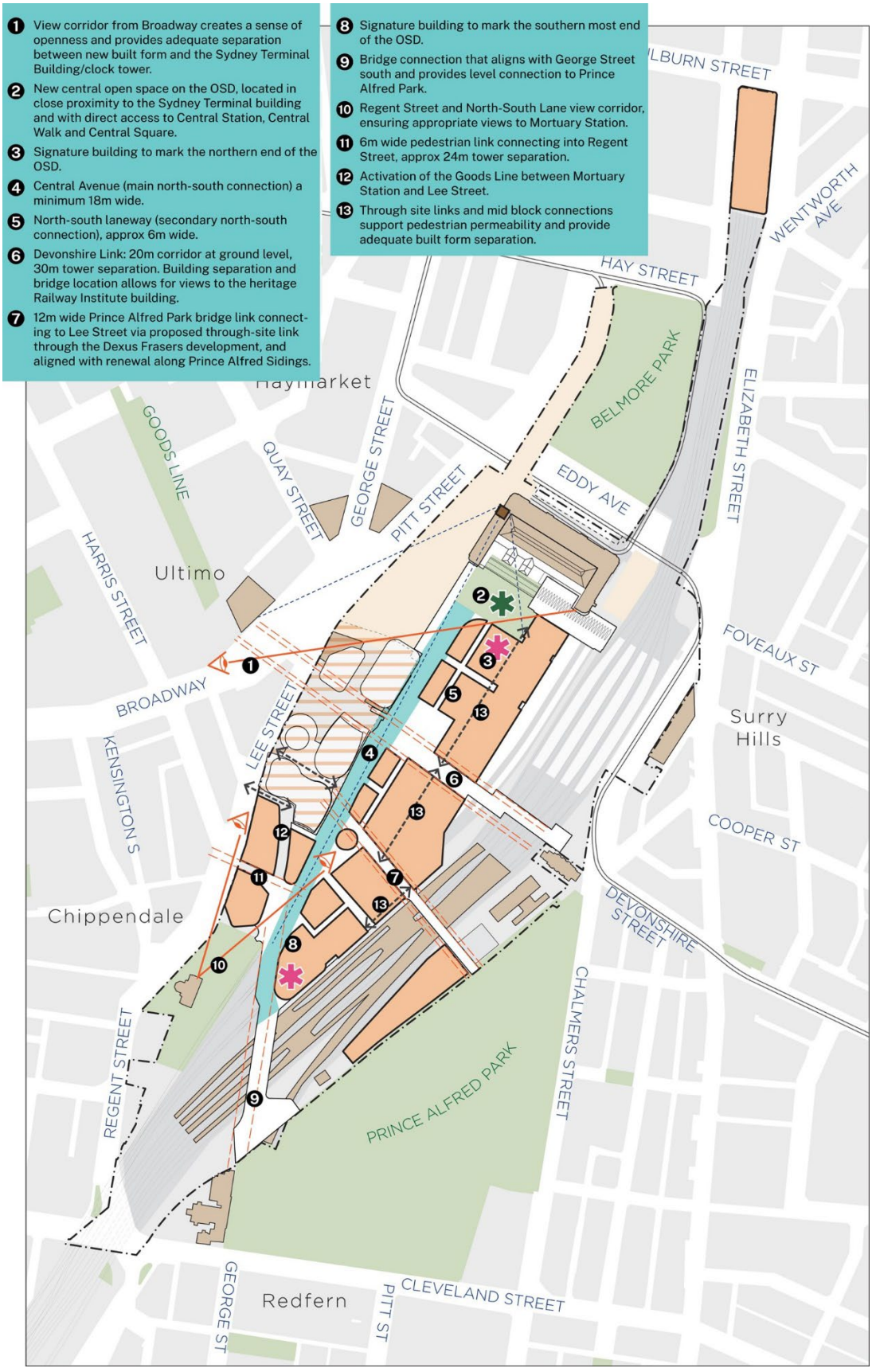


Figure 1-4: Revised Urban Design Framework
Source: Architectus, 2023

- **An enlarged Mortuary Station Gardens**: The reduction of the podium building envelope of the Regent Street Sidings building brought about through changes to the bus layover and basement entry /exit pathways provide for an enlarged public space at Mortuary Station Gardens by 2,030 square metres to a total area of 6,500 square metres. The increase in the size of this public space also presents the opportunity to retain the existing fig tree at Mortuary Station and provide a new playground that is accessible to the broader community.
- **Devonshire Square**: A new square of approximately 2,700 square metres has been included into the revised Reference masterplan at the junction of Central Avenue and the Devonshire link, which will provide a new civic space at the entry point to the proposed extended Central Walk. (Central Walk will provide access to all of the rail platforms in Central).
- **Southern Plaza**: A new reconfigured civic space of approximately 4,700 square metres at the southern end of Central Avenue, providing a new arrival and meeting space when coming from the south. Within the Southern Plaza, there is the potential for a marker building that is designed with a Connecting with Country focus.
- **Regent Street Sidings**: The podium envelope at Regent Street Sidings has been further rationalised to improve the integration between the OSD deck level and Regent Street Sidings, the Goods Line and Mortuary Station Gardens. This has been through the following changes:
  - undergrounding the bus layover into the basement to enable the reduction of the podium footprint
  - consolidating basement entry/exit into a single location for loading, residential parking and bus layover
  - locating basement entry/exit at a signalised intersection
  - increase the opportunity to activate the Goods Line and Mortuary Station Gardens
  - extending the OSD deck level to integrate with the podium rooftop of Regent Street Sidings.
- **Increased green cover**: An increase to the overall green cover in the precinct has been adopted as part of the revised Reference Masterplan.
- **Enhanced east-west view lines**: The indicative building envelopes on the OSD deck have been refined in location and shape to increase the separation of tower forms and enhance east-west view lines.
- **Reduction in overall GFA**: Based on refinements to the Reference Masterplan, the overall proposed GFA of Central Precinct has reduced by approximately 10,600 square metres.

1.7.5 Updates to this report

This report has been updated in response to the submissions received during the consultation process. A summary of all the changes made to this report in response to the submissions received are outlined in Table 1-9.

Table 1-9 Summary of updates to this report in response to feedback from public exhibition relating to traffic and transport

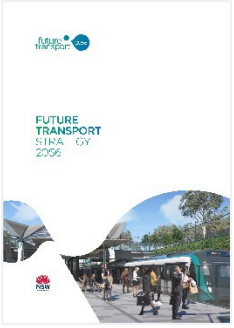
Feedback theme	Summary of updates made to this report	Report section
Assumptions and inputs Modelling results	• Inclusion of further scenarios modelled, including the 'no development scenario' • Further explanation on the adoption of TRICS traffic generation rates • additional information on the assumptions and inputs used in developing the pedestrian, public transport, vehicle and development demands used in this assessment	5.1 Assessment overview 5.3 Demand and trip generation assessment
Pedestrian assessment	• Inclusion of Walking Space Guide assessment • Impact of the closure of Lee Street • Pedestrian volumes at intersections and at key footpath locations	5.4 Pedestrian assessment
Cycling network	Further information on the cycling network, Addition of the Railway Colonnade to the local cycling network	5.5 Cyclist assessment
Traffic and safety	• Additional commentary on road network impacts • Further details on site access and integration with the surrounding network • Benchmarking of safety crash statistics	5.7 Road network assessment 5.7.2 Site access Safety assessment
Parking, freight and servicing	• Recommendations on Electric Vehicle requirements • Further details on parking provisions and the allocation of parking • Further details on the integration of autonomous vehicles with Central Precinct.	5.8.1 Car parking 5.8.2 Service vehicle requirements 5.9 Safety assessment

Amendments to the findings of the assessment resulting from the revised Masterplan have been called out in this report in this format.

2. Strategic planning context

2.1 State and regional transport plans

Several State and regional strategic documents and plans provide guidance and direction on the planning and management of transport networks and services around Central Precinct. These plans and their relationship to the CPRP are detailed in the following subsections.



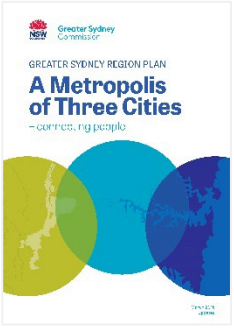
Future Transport Strategy

Transport for NSW, 2022

Future Transport Strategy is the State's overarching transport strategy that outlines how to manage growth and change across Greater Sydney and NSW over a 40-year timeframe. It sets out a vision, strategic directions and customer outcomes with a focus on technology and innovation across the transport system to transform the customer experience, improve communities and boost economic performance.

The CPRP contributes to achieving several key objectives and outcomes including:

- Encouraging active travel (walking and cycling) and using public transport
- Connecting people to jobs, goods and services in our cities and regions
- A fully accessible network that enables barrier-free travel for all
- Supporting more environmentally sustainable travel.



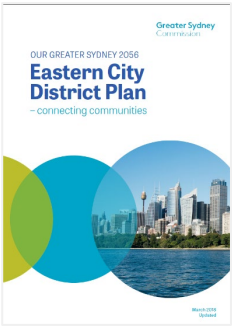
Greater Sydney Region Plan – A Metropolis of Three Cities

Greater Sydney Commission, 2018

The *Greater Sydney Region Plan* establishes a 40-year strategic land use plan for Sydney. Developed in conjunction with *Future Transport 2056* and the State Infrastructure Strategy, it looks to redistribute growth across the greater Sydney area and develop three connected cities (Eastern Harbour City, Central River City and Western Parkland City).

Central Precinct lies in the Eastern Harbour City, where urban renewal is driven by significant rail and transport projects. Potential indicators to deliver the plan that would be relevant to the CPRP include:

- Increased 30-minute access to metropolitan centres and clusters
- Increased use of public resources such as open space and community facilities
- Increased walkable access to local centres
- Increased jobs in metropolitan and strategic centres.



Eastern City District Plan

Greater Sydney Commission, 2018

The *Eastern City District Plan* is a supporting document to the *Greater Sydney Region Plan* that outlines the planning priorities and actions for managing growth and improving quality of life across the Eastern City over the next 20-years.

Central Precinct, through the CPRP, delivers on key actions of the Plan by providing new centres, better places and employment opportunities that are integrated with significant city shaping transport projects.

South East Sydney Transport Strategy

Transport for NSW, 2020

The *South East Sydney Transport Strategy* provides a blueprint for transforming the way people travel to, within and through South East Sydney to 2056. It looks to support future growth and activity through targeted transport investment that enables the redevelopment of government land and the growth of strategic centres through improved and reliable access.

Central Precinct sits on the north of the Southeast Sydney boundary and is a key transport link connecting the area to the Sydney CBD and the broader metropolitan area. As the Southeast grows, Central Precinct will have an ongoing role as a key movement and mobility hub servicing new bus, light rail and potential metro services in future years.

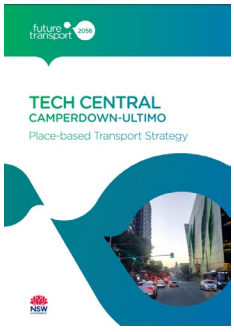
Central to Eveleigh Urban Transformation Strategy

NSW Government, 2016

The *Central to Everleigh Urban Transformation Strategy* sets the foundation for renewing precincts of government-owned land in the Central to Eveleigh area. It focuses on how the area can contribute to a growing Sydney and deliver a broader range of homes, new and higher quality public open space, better connections, and community facilities.

The transformation of Central Precinct supports several key moves identified by the strategy, including:

- create connections across the railway corridor for walking and cycling
- connect the city with surrounding places
- create centres of activity around stations
- integrate new high-density mixed-use buildings with existing neighbourhoods and places.



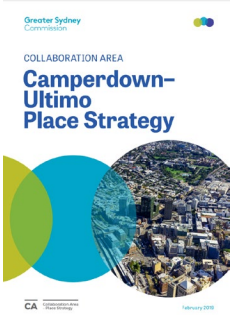
Tech Central Place-based Transport Strategy

NSW Government, 2021

The *Tech Central Place-based Transport Strategy* outlines a 20-year vision for transport in Tech Central, which is earmarked to be the biggest technology hub of its kind in Australia. Adopting a place-based approach, the strategy provides recommendations and priorities on how Tech Central to continue to thrive and grow as a place of innovation, employment and recreation regardless of travel choice.

The transformation of Central Precinct supports several key initiatives by the strategy, including:

- providing a transformed Central Precinct
- Encourage sustainable travel patterns and reduced demand for travel



Camperdown-Ultimo Place Strategy

Greater Cities Commission, 2019

The *Camperdown-Ultimo Place Strategy* sets out the broader vision for an innovation and technology precinct across the Camperdown-Ultimo area. The area is already distinguished by its scale and concentration of people, jobs and institutions, with the strategy outlining 11 priorities and 39 actions to progress the future vision.

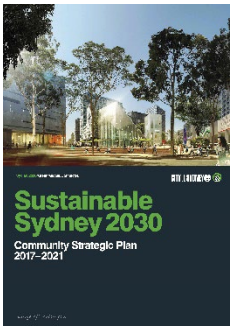
The transformation of Central Precinct supports several key initiatives identified by the strategy, including:

- Facilitating the renewal of Central Station and surrounding lands to improve pedestrian and cycling
- Supporting the reallocation of roadspace to prioritise space for pedestrians

2.2 City plans and strategies

The CPRP has also been influenced by a range of local planning and transport strategies that guide transport planning within the Sydney Central Business District (CBD) and around the Precinct.

These plans and their relationship to the CPRP are detailed in the following subsections.



Sustainable Sydney 2030

City of Sydney, 2017

Sustainable Sydney 2030 identifies the communities' main priorities and aspirations for the future and outlines how these targets and goals will be achieved.

The CPRP supports and enables the following strategic directions from the community strategic plan:

- investment in public transport and walking and cycling infrastructure encourages more people to use these forms of transport to travel to, from and within the city
- public transport, walking and cycling are the first-choice transport modes within the city
- transport services and infrastructure are accessible
- the city and neighbouring areas have a network of accessible, safe, connected pedestrian and cycling paths integrated with green spaces

Cycling Strategy and Action Plan 2018-2030

City of Sydney, 2017

The *Cycling Strategy and Action Plan* outlines actions and directions to increase bicycle trips and mode share across the Sydney LGA towards the targets identified in *Sustainable Sydney 2030*.

The CPRP supports the strategy and action plan through:

- providing bicycle parking in the public domain where it is needed
- considering and supporting all bike network users, including those on cargo bikes, ebikes, trishaws and mobility scooters, in the design of infrastructure
- deliver public end-of-trip facilities in the city centre, connected to the bicycle network.

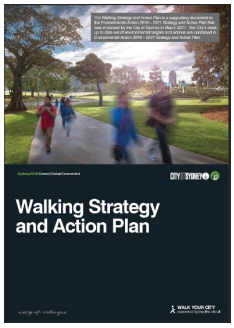
Sydney's Cycling Future

Transport for NSW, 2013

Sydney's Cycling Future outlines how the NSW Government will improve the bicycle network and ensure that the needs of cyclists are integrated into the planning of new transport and infrastructure projects. The plan also outlines priority cycleways, and projects to address missing links near major centres across Greater Sydney.

Around Central Precinct, these links include stronger cycling connections:

- east to Bondi Junction
- southeast to the Randwick Education and Health precinct
- south to Green Square and Sydney Airport.



Walking Strategy and Action Plan 2015-2030

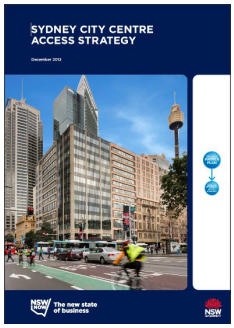
City of Sydney, 2017

The *Walking Strategy and Action Plan* outlines the City of Sydney's vision to create a city village network that is an attractive, safe, and interesting place to walk. This document brings together existing actions and targets to a more walkable and effective transport network.

Key points to emerge from the Action Plan that are relevant to Central Precinct include:

- giving priority to people walking
- completing networks and providing new connections through urban renewal areas
- creating an inviting and interesting walking environment through placemaking and activation.

The renewal of Central Precinct has the potential to significantly enhance walkability in the local area.



Sydney City Centre Access Strategy

Transport for NSW, 2013

Sydney's City Centre Access Strategy outlines how the NSW Government will manage how people enter, exit, and move within the Sydney CBD over the next 20 years by providing clear direction on how all transport modes will work together to:

- reduce congestion
- provide for future growth
- improve the customer experience.

Around Central Precinct, key outcomes include improving pedestrian and cycling links, increasing public transport access to and capacity in the city centre, and making it easier to transfer between different public transport services.

2.3 Relevant policies and guidelines

The following documents have been considered in the assessment and preparation of this transport strategy and transport impact assessment for the CPRP:

- NSW Road Planning Framework
- The Movement and Place Practitioner's Guide
- NSW Planning Guidelines for Walking and Cycling
- NSW Road Safety Plan 2021
- Legible Sydney Wayfinding Strategy (2019)
- Walking Space Guide (TfNSW, 2020)

2.4 Planned infrastructure, service improvements and development

Central Precinct and the surrounding area are subject to several significant infrastructure and large-scale renewal projects that will change how people move within and interact with destinations across Greater Sydney.

This section details the proposed transport network upgrades and significant development proposals that may impact the CPRP. Figure 2-1 shows the planned infrastructure upgrades and their relationship to Central Precinct.

Figure 2-1: Planned infrastructure upgrades around Central Precinct

2.4.1 Planned transport infrastructure and service improvements

Sydney Metro and Metro West

Sydney Metro is Australia's biggest public transport project and will result in the delivery of a new generation of world-class, fast, safe and reliable trains enabling faster services across Sydney's rail network. Once complete, Sydney Metro is expected to:

- have a target capacity of about 40,000 customers per hour, similar to other metro systems worldwide
- increase the capacity of train services entering the Sydney CBD by around 60 per cent, resulting in trains running once every two minutes in each direction at peak times under the city, a level of service never seen before in Sydney.

In 2024, a Sydney Metro station will open within Central Precinct. This will provide connectivity to Tallawong in the north-west (via Chatswood) to Bankstown in the south-west, including access to other new stations at Crows Nest, Victoria Cross (North Sydney), Barangaroo, Martin Place and Pitt Street, and Waterloo. Largely due to the opening of the metro station, the number of daily passenger movements using Central Station is forecast to increase from 270,000 persons to 450,000 persons over 30 years.

To cater for this growth, Transport for NSW is investing in substantial upgrade to the existing Central Precinct. Key to this upgrade is Central Walk, which will create a new north south concourse linking the metro and suburban rail platforms and will extend from Railway Square in the west to Chalmers Street and the light rail stop in the east. This will result in a step-change in the quality of Central Precinct's transport environment. This improvement in quality, together with the greater accessibility due to the increased number and frequency of trains, is forecast to also increase the desirability of southern Central Sydney as a place to live, work and play.

Strategic Cycleway Corridors

The Strategic Cycleway Corridor program focuses on the delivery of a network of strategic cycleway corridors that will connect centres, precincts, and places. It is a key component of the Active Transport Strategy and aims to deliver more than 100 kilometres of new strategic cycleways by 2028. It identifies immediate opportunities that will provide safe and convenient cross-city connections.

Several strategic cycleways corridor will traverse through Sydney CBD and Central Precinct. This will provide better connection to suburbs including North Sydney, Pyrmont, Surry Hills, and Darlinghurst within the vicinity.

Fast Rail

Fast Rail is a vision for improving connectivity in regional NSW and is a key component of the 20-year Economic Vision for Regional NSW (NSW Government, 2018). The strategic planning and delivery for faster rail corridors within regional NSW will increase opportunities for people to live outside Greater Sydney, improving the capacity, frequency of journey times to and from regional centres.

Central Precinct plays a key role in connecting regional centres and destinations with Greater Sydney and will likely be a vital component of any future fast rail strategy. Upgrades to the tracks and signals as part of the Central Precinct project will enable the station to accommodate the expected growth in services across the regional platforms.

More Trains More Services

The More Trains More Services (MTMS) program is a significant investment in infrastructure and services to boost operational capacity on Sydney's busiest rail lines. It is designed to deliver more frequent and less crowded train services through new digital systems, infrastructure upgrades and additional trains. For Central Precinct, this will provide additional trains services arriving at and departing from the station during both peak and off-peak periods.

Sydney's Bus Future

Sydney's Bus Future is the NSW Government's holistic long-term plan to redesign Sydney's bus network to meet customer needs now and into the future. Designed to attract more customers through a simpler, faster and efficient bus services,

Sydney's Bus Future outlines a three-tiered network with rapid mass transit services between major centres, suburban transit delivering targeted, lower demand services, and local transit services which play several different roles across Greater Sydney.

Within the Sydney CBD changes to bus operations would provide progressive improvements to the bus network, creating more direct routes and rationalising bus stops. For passengers transferring from Central Precinct to the bus network, the redesigned system will make it easier to transfer between modes and continue to the end destination.

WestConnex

WestConnex is a program of significant infrastructure upgrades that will facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney. The program aims to resolve constraints on the M4 Western Motorway and the M5 East Motorway and provide better connectivity between the economic centres across Sydney and improve access into local communities and the Sydney CBD.

The M4-M5 Link is the final component of WestConnex, providing twin tunnels between the M4 East Motorway at Haberfield and the new M5 interchange at St Peters. When complete, the link allows WestConnex to act as the western CBD bypass, improving east-west connectivity to the south of the Sydney CBD and reducing vehicle demands on the arterial road network. The link is expected to reduce traffic volumes around Central Precinct, particularly to the west along Regent Street and to the south along Cleveland Street, allowing these corridors to accommodate alternative transport modes and uses.

2.4.2 Significant development

Pyrmont-Ultimo urban renewal

The Pyrmont Peninsula, which extends from Broadway west of Central Precinct to Johnstons Bay, contains a diverse mix of workplaces, innovation hubs and residences within one of the fastest growing hubs in Greater Sydney. The investment in Pyrmont through the new Sydney Metro station, will kickstart the renewal of the area, encouraging further investment to deliver jobs and great public spaces.

The Pyrmont Peninsula Place Strategy (December 2020) provides a 20-year framework that identifies areas that can accommodate future growth and areas for more gradual growth. The peninsula has the potential to accommodate 8,500 additional residents and 23,000 jobs, with the Ultimo Precinct near Central Precinct accounting for a large part of this growth.

Future forecasts of movement through Central Precinct will consider the quantum and type of activity the renewal of Pyrmont Peninsula will generate. This will ensure the analysis of movement to and from the Central Precinct captures key routes and links between the two areas and plans for the anticipated growth across different user types.

Tech Central

To help ensure Sydney's longer terms economic resilience and strengthen its role as Australia's only global city, the NSW Government is investing in the creation of Tech Central. Tech Central stretches from Central Precinct south to Ultimo in the west, Surry Hills in the east and Eveleigh in the south, and is planned to be the

future focal point of Sydney's innovation and technology community. It will have a particular focus on fintech, cyber and e-health, digital and deep technology including quantum, blockchain, Artificial Intelligence (AI), robotics, Internet of Things (IOT) and analytics, and creative industries including Virtual Reality (VR) and game design. Capitalising on its size, strategic location and unrivalled accessibility within Greater Sydney, Central Precinct is planned to become the northern anchor of Tech Central. Already, parts of the Sydney Terminus building have been adaptively re-used to house the Sydney Quantum Academy, and Atlassian has announced their plans to locate its global headquarters within Central Precinct.

Figure 2-2 provides an overview of the key destinations within Tech Central and their proximity to Central Precinct.

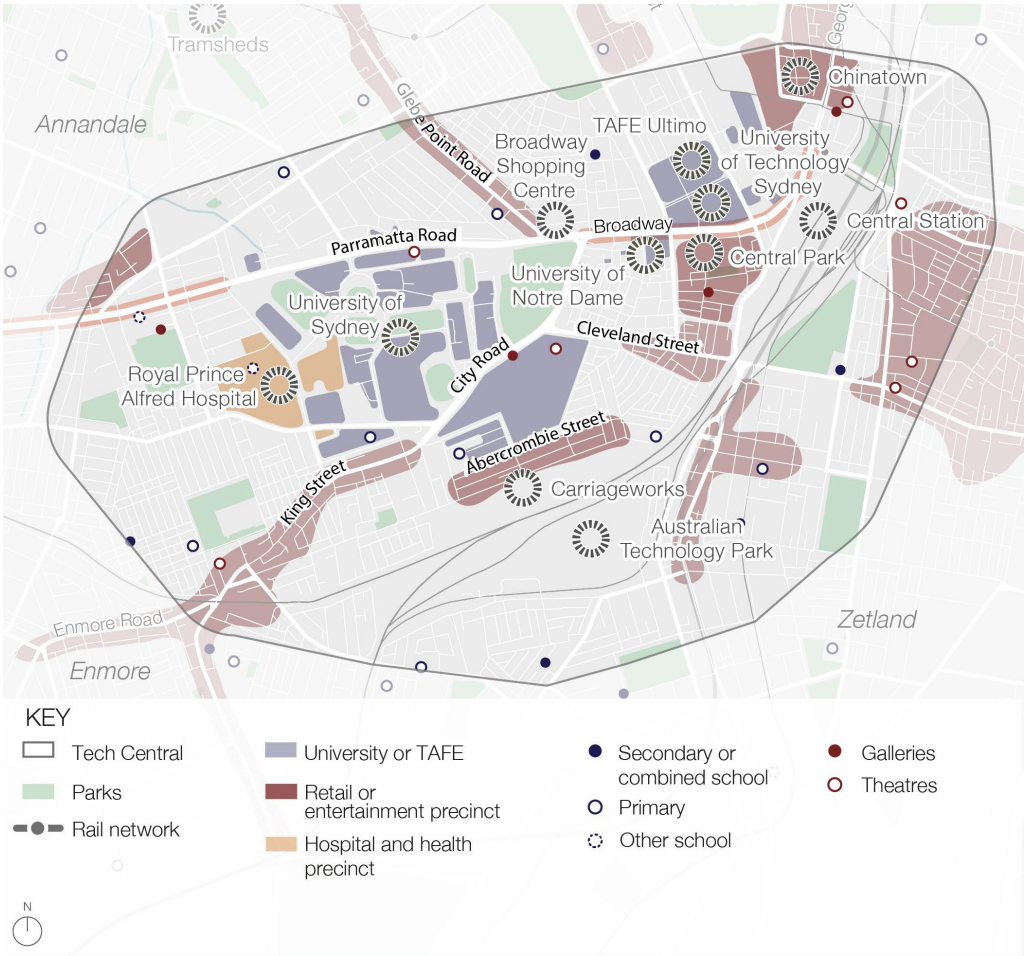


Figure 2-2: Key destinations within Tech Central
Source: Tech Central Camperdown-Ultimo Place-Based Transport Strategy, TfNSW (2021)

3. Existing Transport Conditions

3.1 Site location and existing land uses

Central Precinct includes 24 hectares of land located to the south of Sydney's CBD, covering a corridor of land running between Central Station and Redfern Station. At the core of Central Precinct lies Central Station transport interchange and associated rail infrastructure.

Central Precinct is located within the City of Sydney LGA and its neighbouring suburbs are Surry Hills, Haymarket, Chippendale, Ultimo and Redfern. It is also close to well-known Sydney attractions such as Broadway, Central Park, World Square, Darling Harbour and the Goods Line.

A locality plan depicting the site and surrounding area is provided in Figure 3-1.

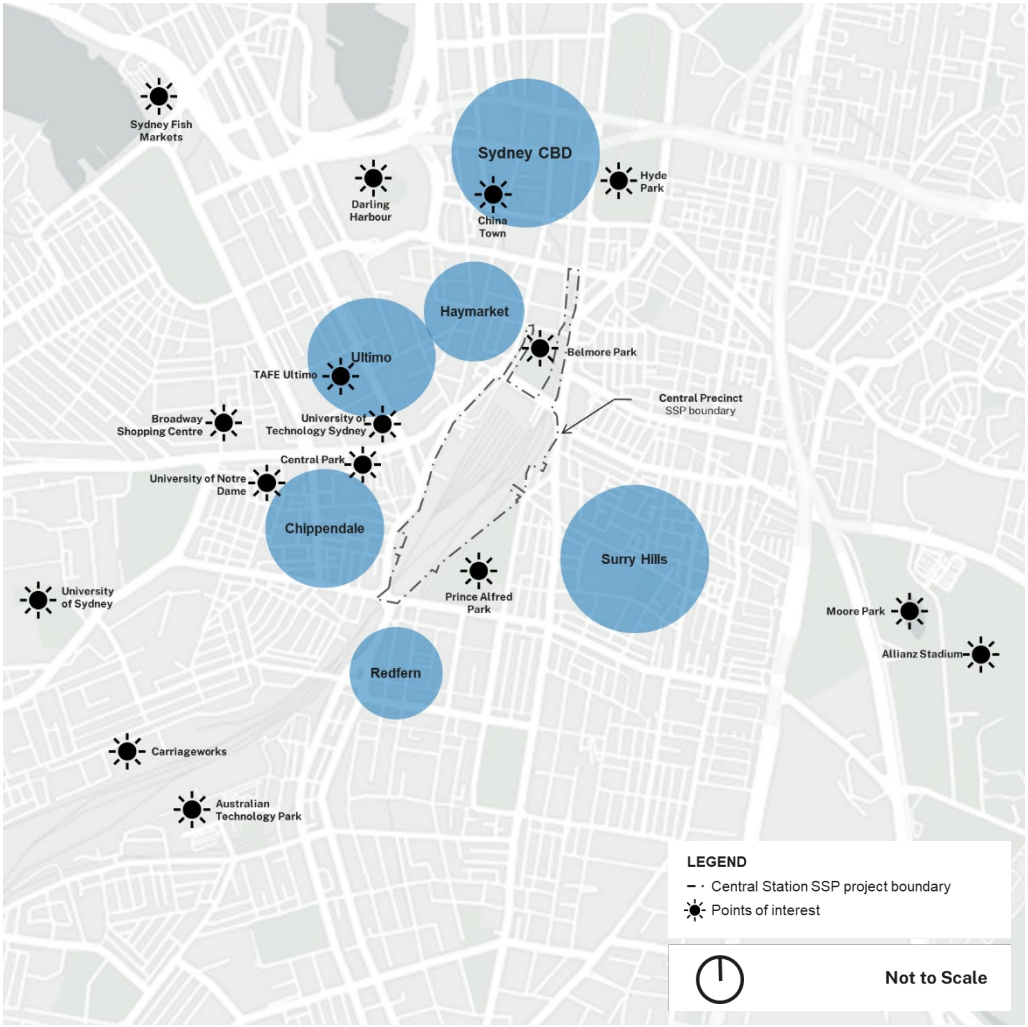


Figure 3-1: Location plan

Within Central Precinct, there are currently a relatively small number of businesses, with employment mainly linked to office, retail, and food and beverage land uses, and the operational requirements of managing Central Station. There are accommodation land uses within Central Precinct within the Western Gateway sub-precinct on its western edge, however there is currently no other accommodation or residential uses within the Precinct.

The main public open space for Central Precinct, Henry Dearne Plaza, also lies within the Western Gateway. The broader precinct is adjacent to significant parks and squares, including Belmore Park to the north, Prince Alfred Park to the east and Railway Square to the west.

The surrounding area comprises a wide range of land uses, including offices, higher education, retail, food and beverage outlets, together with cultural, community and leisure uses. There is also a diverse range of residential accommodation, including high rise residential flat buildings to the west and dense smaller scale hostels, boarding houses and residential flat buildings in Haymarket, Chippendale, Surry Hills and Redfern.

3.2 Travel patterns and mode share

3.2.1 COVID-19 impact

Commuter and recreational travel patterns have substantially changed due to the COVID-19 pandemic commencing in 2020. COVID-19 has resulted in a substantial reduction in overall travel demand and changed travel patterns across Australian cities due to localised lockdowns, and restrictions on interstate and international travel when introduced.

General impacts on travel patterns include:

- a reduction in travel demand caused by the temporary closure of non-essential services and a significant increase in the proportion of employees working from home
- changes in travel mode choice, with a relative increase in road traffic congestion during peak hours and a corresponding decrease in public transport demand. This is due to a reduction in capacity on public transport services to maintain social distancing requirements, and an increased reluctance to commute on public transport
- a flattening of peak hour demand with trips staggered over longer time periods as individuals have more flexibility around work and shopping.

COVID-19 will continue to pose a substantial challenge to accurately predicting future travel patterns. For example, there's an emerging trend for individuals and companies to adopt work from office three days a week and work from home two days a week. Consequently, the mode share and travel behaviour assessment this report are reflective of pre-COVID-19 conditions.

3.2.2 Journey to Work mode share

Census 2016 Journey to Work data collected by the Australian Bureau of Statistics (ABS) has been used to assess the current commuter travel behaviour in the area surrounding Central Precinct and characterise the public transport conditions near the site.

Residential travel behaviour was established using the ABS Level 1 Statistical Area (SA) datasets shown in Table B-1 of Appendix B with the assessed catchment shown in Figure 3-2.

Figure 3-2: Travel zone catchment

The mode splits of journey to work for residents living within the catchment area and workers commuting to the catchment area, are shown in Figure 3-3.

For residents within the catchment area, active transport modes (37 per cent) and public transport (49 per cent) are the predominant forms of transport. Commuters travelling into the catchment area for work largely catch public transport (72 per cent), with driving and/ or being dropped off within the area combining to account for nearly 20 per cent of commuter trips.

This suggests that the local pedestrian network is relatively permeable, with closely located land uses, activities and other attractors typical of inner-city locations. The high proportion of train commuter trips (52 per cent) is likely reflective of the nature of Central Station, and the connectivity it provides across the rail network.

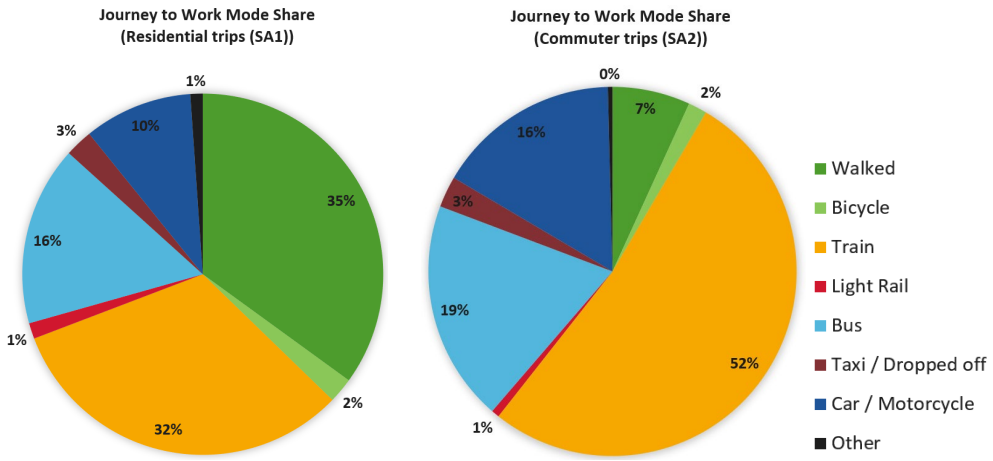


Figure 3-3 Travel mode distribution for residential trips (left) and commuter trips (right) from and to the catchment area around Central Precinct
Source: ABS 2016 Census

3.2.3 Origins and destinations

An assessment of trip origins and destinations travelling through the Central Precinct and Central Station was completed as part of broader study area investigations. In recognition of the role of Central Station and the breadth of user types travelling through the Precinct, mobile signal data was analysed in preference to ABS Census data to ensure the full spectrum of users, including commuters, students, recreational visitors and tourists were considered.

The analysis, conducted by data analysts, Place Intelligence, used de-identified and privacy compliant mobile signal datasets from 2019 to understand pedestrian movements within and around Central Precinct. This included analysing the patterns of place use and movement within Central Precinct, the surrounding precinct, and the journey origins and destinations across Greater Sydney.

The data was collected by extracting historic and real time mobile phone signals from a data base of human mobility data, focusing on place usage data from 2019 to understand a pre-pandemic baseline. Machine learning was then used to understand how people moved across the Precinct (and which mode they used), where they may be coming from, and how long they spent in the area. By evaluating a year's worth of movement data, specific trends were able to be identified of how people travel and interact within Central Precinct.

The broader analysis identified that, of all visitors to Central Precinct over the assessed period, 89 per cent reside in Australia, with most trips taken by those that live in NSW (87 per cent of the national total). Further analysis highlights that 89 per cent of trips through Central Station travel from the greater Sydney Metro area, with the remaining 11 per cent of users residing in regional NSW and the ACT.

Figure 3-4 shows the intensity of user origins by ABS SA boundaries across NSW and the greater Sydney region. When compared against the rail network, trip origins are generally higher in areas where there is access to rail services.

Analysis of user 'last leg' trips, the journey of passengers travelling through Central Station to their final location, was also completed. This considered device

location traces as they departed the Central Precinct, and the next location in their journey where the device was stationary for five minutes or more.

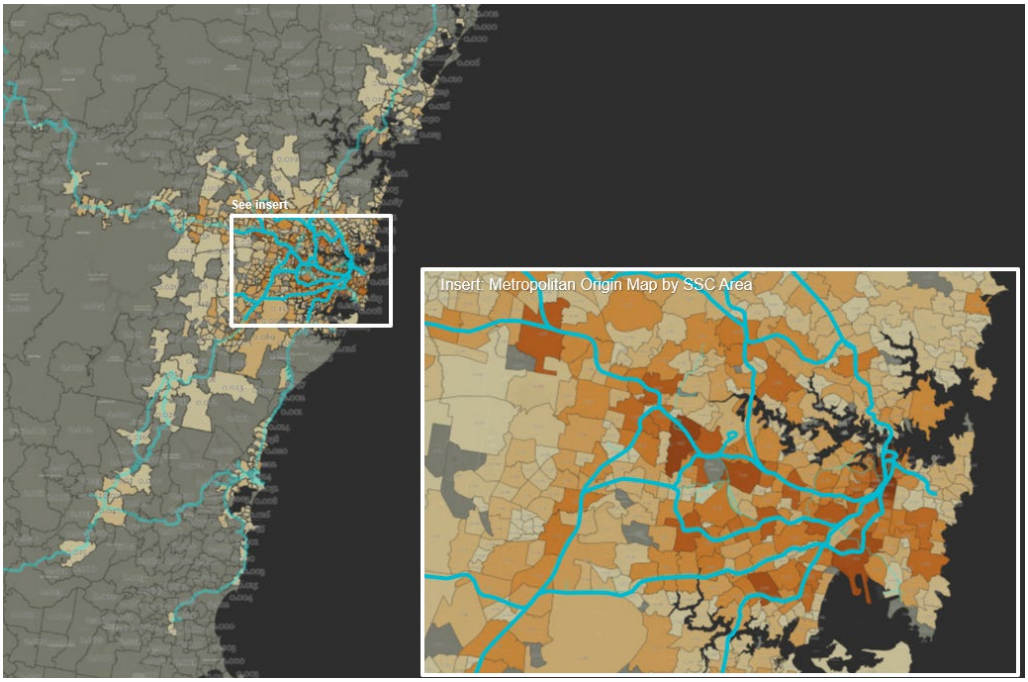


Figure 3-4 Origin breakdown
Source: *Central Station Renewal Precinct Data Analysis* report prepared by Place Intelligence for Arcadis, 2021

Figure 3-5 represents the outcomes of this assessment for trips within 1.6 kilometres from Central Precinct. The data identifies a strong movement to the north (towards the Sydney CBD) and west (towards Ultimo) of the station, including directly adjacent to Central Precinct within the Western Gateway.

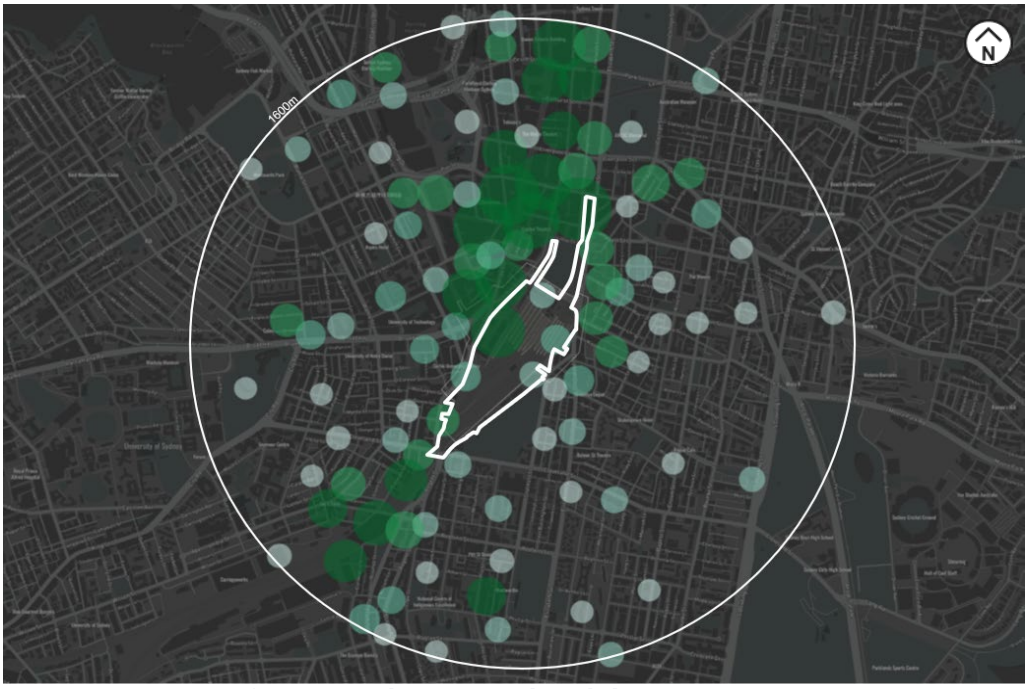


Figure 3-5 Journey 'Last Leg' destination breakdown
Source: *Central Station Renewal Precinct Data Analysis* report prepared by Place Intelligence for Arcadis, 2021

3.2.4 Trip purpose and length

Using 2018/19 Household Travel Survey (HTS) data, key trip characteristics of the Sydney Inner City catchment area have been compared with the Greater Sydney Metropolitan catchment area. HTS data is derived from a smaller sample size and is more effectively used in the analysis of larger areas. As Central Precinct is located within the City of Sydney LGA, it would tend to reflect the travel patterns of a central Sydney location.

Figure 3-6 compares the distribution of trip purpose recorded for trips occurring across the Sydney LGA and the greater metropolitan Sydney area. Within the Sydney LGA, social and recreational trips accounted for a larger proportion of trips than in metropolitan Sydney, and a much lower proportion of trips serving other passengers (i.e. point to point transport or private vehicle pick-up and drop off activities). There is also a slightly higher proportion of commute and retail orientated trios within the Sydney LGA.

When considering the average length of trips by trip purpose (shown in Figure 3-7), trips within the Sydney LGA are much shorter across all trip types in comparison to the greater Sydney metropolitan area. This is likely due to higher density and proximity of land uses within the Sydney LGA, in addition to the greater availability of public transport, walking and cycling connections for many trips across the inner-city area.

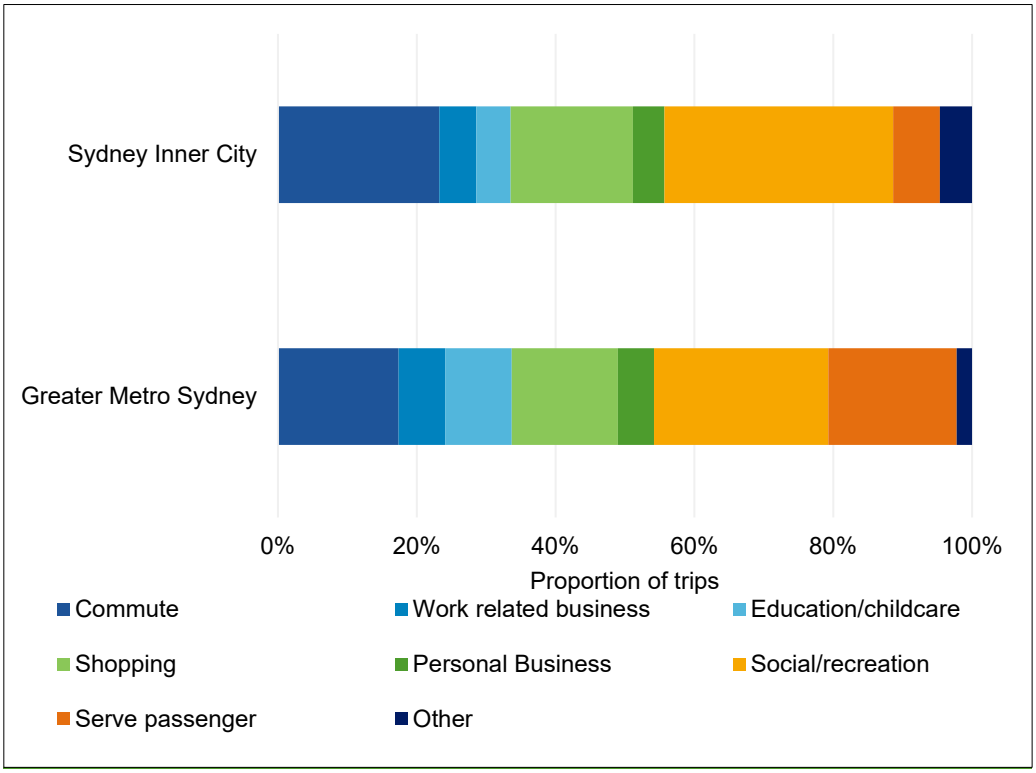


Figure 3-6: Distribution of trip purpose types (Sydney Inner City vs Greater Metro Sydney)
Source: Transport for NSW 2018/19 Household Travel Survey (Accessed 2021)

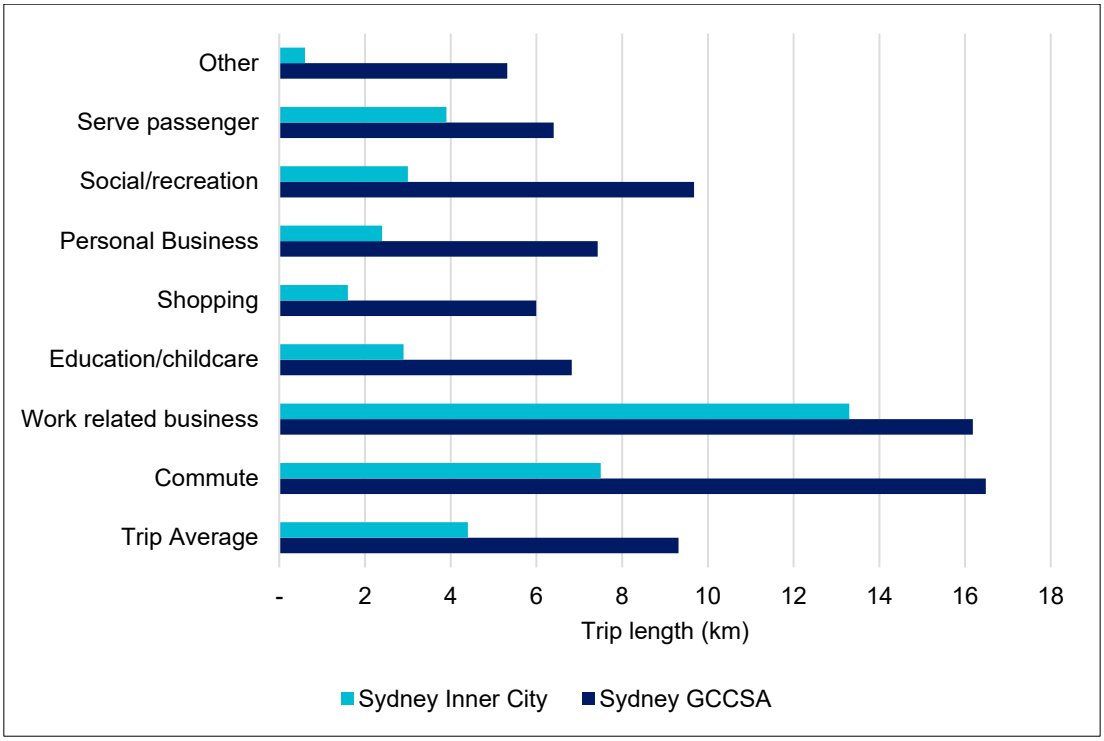


Figure 3-7: Average length of trips by trip purpose (Sydney Inner City vs Greater Metro Sydney)
Source: Transport for NSW 2018/19 Household Travel Survey (Accessed 2021)

3.3 Walking

The existing structure of the street network surrounding Central Precinct is generally well suited to walking. There is a clear grid pattern of streets and paths that allow direct connections and provides good permeability for pedestrians.

However, the size of Central Precinct and the broader rail corridor presents challenges for pedestrians, with the station acting as a barrier for east-west and north-south movements across the Precinct. Devonshire Tunnel, which links Chalmers Street to the east and Henry Dearne Plaza/ Lee Street to the west, provides the only direct east-west connection across the site between Cleveland Street and Eddy Avenue.

The surrounding road network also prioritises vehicle movement, with pedestrians often waiting for long periods to cross the road and continue their journey. The provision of pedestrian crossing facilities surrounding Central Precinct includes:

- a signalised pedestrian crossing across Lee Street, between Henry Deane Plaza and Railway Square
- signalised pedestrian crossings on all approaches of the Lee Street/ Broadway/ Quay Street/ George Street/ Pitt Street intersection
- signalised pedestrian crossings on all approaches of the Eddy Avenue/ Pitt Street/ Rawson Place intersection
- a signalised pedestrian crossing across Eddy Avenue, between Eddy Plaza and Belmore Park
- signalised pedestrian crossings on the eastern and southern legs of the Foveaux Street/ Elizabeth Street intersection with a separate signalised crossing of the light rail tracks at Chalmers Street

- signalised pedestrian crossings on all approaches of the Chalmers Street/ Randle Street/ Devonshire Street intersection.

Although crossing opportunities are provided at most intersections surrounding Central Precinct, pedestrian crossings to the north and west currently experience high demands during peak periods. With increased public transport patronage and land use changes around Central Precinct, these crossings may need to be upgraded to accommodate growing pedestrian demand across the Precinct.

The area surrounding Central Precinct comprises of medium to high density residential, educational and commercial land uses, which when combined with the inner-city locality, results in a high proportion of walking trips. George Street, Broadway and Harris Street are significant pedestrian movement corridors from the Precinct, connecting the station to the Sydney CBD (George Street), Ultimo and the Pyrmont Peninsula (Harris Street) and the broader Tech Central area (Broadway).

A study of pedestrian movement by data analysts, Place Intelligence, identified an average of 39,000 pedestrian movements across Central Precinct in 2019 during the AM peak hour, and 43,000 pedestrian movements PM peak hour, inclusive of trips made to and from public transport within the study area.

The Place Intelligence analysis identified a strong demand travelling to the north of Central Precinct, as well as to the west towards the Western Gateway and the intersection of Broadway and Harris Street. There was a relatively high desire line travelling east-west across the station along Devonshire Tunnel, and through to Railway Square and beyond to the Goods Line towards Darling Square.

With the high volumes of pedestrians travelling from and to the train station, footpaths and crossings become congested, with pedestrians competing for limited footpath space as they move throughout Central Precinct. Excessive wait times increases the risk of non-compliance with signals, increasing the likelihood of collisions between vehicles and pedestrians. There is also limited opportunity to cross east-west through Central Precinct, which funnels movement through Devonshire Tunnel and along Eddy Avenue.

Dynamic and static modelling of the 2019 pedestrian network identified:

- The Devonshire Tunnel is under increasing pressure, recording an LOS C and small sections of LOS D along the corridor during the AM peak hour.
- There is insufficient space between:
    - the Lee Street and George Street legs of the Pitt Street/George Street intersection
    - the Rawson Place and Pitt Street legs of the Pitt Street/Eddy Avenue intersection
    - the southern side of Eddy Street at the midblock crossing
    - the Chalmers Street (Light Rail) and Elizabeth Street legs of the Elizabeth Street and Foveaux Street intersection
    - the Foveaux Street leg of the Elizabeth Street and Foveaux Street intersection

The lack of available space will generally cause pedestrians to use areas outside of the indicative storage space at each intersection and obstruct other pedestrian movements. Observations of pedestrian activity have also identified occurrences of pedestrians to walk on the road where footpaths are congested to bypass queueing pedestrians, thus increasing the risk of being hit by a passing vehicle or

waiting on the Light Rail tracks along Chalmers Street, Eddy Avenue and Rawson Place.

The pedestrian network around Central Precinct with key walking corridors and daily pedestrian movements are shown in Figure 3-8.

Figure 3-8: Existing pedestrian network and flows around Central Station

3.4 Cycling

Central Precinct is located on Sydney's strategic cycleway network, linking the station to a broad catchment across the CBD and surrounding areas. Key destinations include Moore Park to the east, Redfern and Ultimo to the south, and Darling Harbour to the northwest.

Figure 3-9: Existing cycling network and flows around Central Station

The cycle network and daily cyclist movements surrounding Central Precinct is shown in Figure 3-9.

However, there are gaps in the existing cycling network, with no direct and accessible route for cyclists coming to or passing by Central Precinct. East-west movement is constrained by the station and broader rail corridor, limiting access between Moore Park and Surry Hills to Darling Harbour and Victoria Park. There are limited crossing opportunities across the Precinct, with cyclists required to dismount and walk-through Devonshire Tunnel or follow the constrained road network around the site. The cycle lane on Chalmers Street connecting to Belmore Park is interrupted by the pedestrian crossing at Foveaux Street and Elizabeth Street,

The surrounding area currently has a shared off-road cycle path through Prince Alfred Park and Belmore Park. There is a separated bi-directional cycle path on Castlereagh Street, connecting to Elizabeth and Liverpool Streets. There is a shared bicycle and pedestrian path on the eastern side of Regent and Cleveland Streets to Railway Square, providing access to Central Precinct, including Henry Deane Plaza. Bicycle parking is available at the Goulburn Street car park operated by the City of Sydney.

Central Precinct is expected to form part of the Strategic Cycling Corridor for the broader Sydney CBD, connecting the City Centre with Redfern to the south-west. This connection is an important gaps in the existing cycling network, and progressing this link will help fast-track the forming of our connected network and enable more people to ride safely for everyday trips.

At the intersections of Elizabeth Street/ Chalmers Street/ Eddy Avenue/ Foveaux Street and Cleveland Street/ Regent Street cycling counts have more than doubled between 2010 and 2019 (City of Sydney counts, 2020). The number of cyclists on major routes into Sydney has grown 10 per cent per annum on each of the major routes and is expected to grow further into the future, with the creation of new cycle links and the development of the principal bicycle network.

3.5 Public transport

Central Precinct is currently the busiest train station within the Sydney Trains rail network, with over 125,000 customers accessing the platforms each day. As Sydney's principal transport interchange, the station connects customers between intercity, regional and suburban services, with light rail and bus services and destinations within the local area. Figure 3-10 outlines the public transport network around Central Precinct.

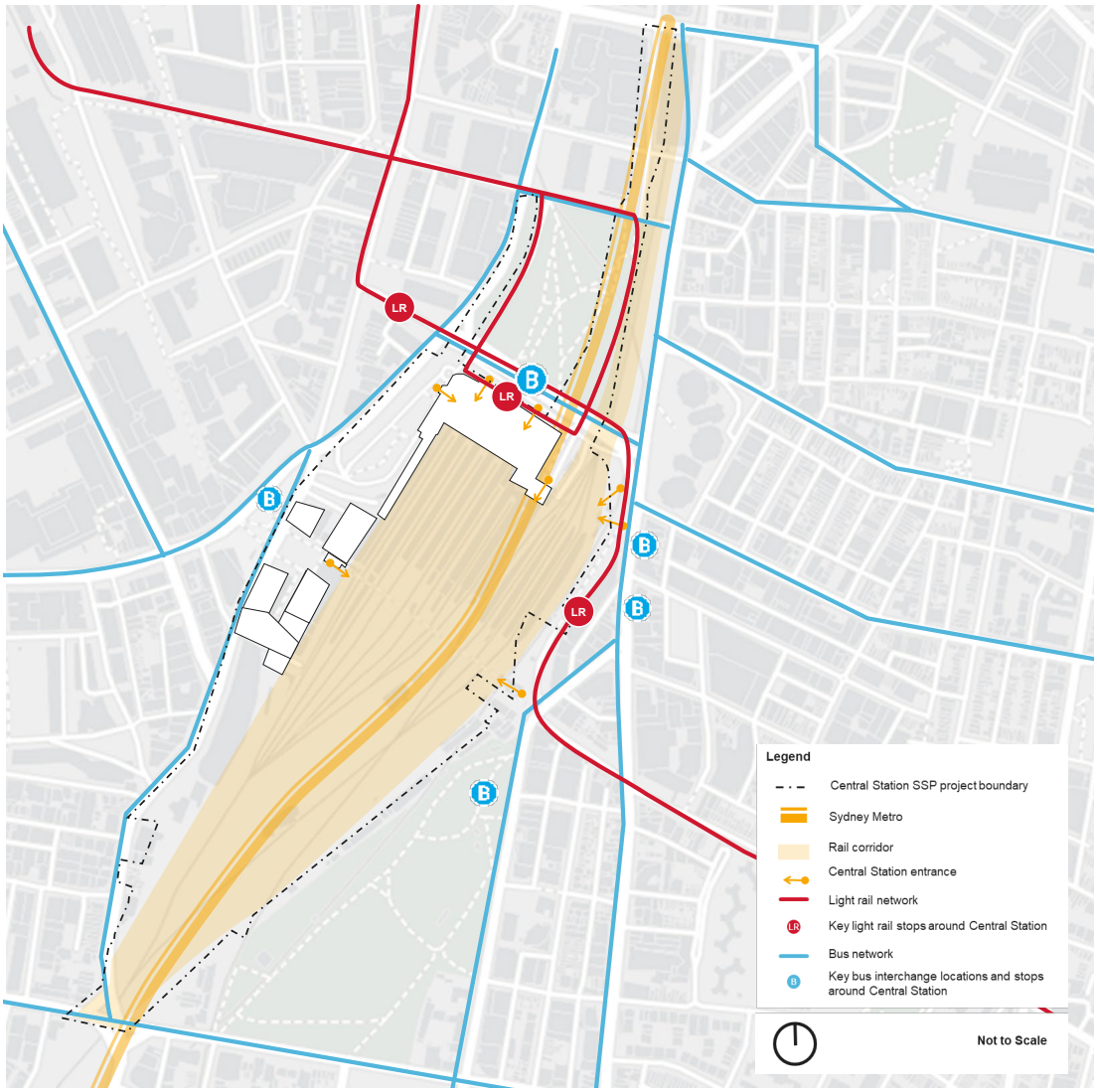


Figure 3-10 Existing public transport network around Central Station

3.5.1 Trains

Central Precinct is the key hub of the Sydney metropolitan and NSW regional rail network, serving as a major interchange between suburban, regional, and intercity services with transit and intercity bus services, private coach services, and light rail. As the busiest station on the Sydney Trains network, nearly 2000 services operate to and through the station each day across the 24 platforms.

There are two main platform groups within Central Precinct. The Terminal building accommodates Platforms 1 to 12, which serves intercity and regional services and some suburban services which terminate at Central. The suburban platforms comprise of Platforms 16 to 25, which serve most suburban services as well as accommodate the direct link to Sydney Airport. Of these, Platforms 16 to 23 are located above ground to the east of the main terminal building, with Platforms 24 and 25 located underground further east of the station.

Platforms 13 to 15 are currently closed due to construction works associated with Sydney Metro. The new metro platforms are currently being constructed under these platforms, with Platforms 13 and 14 due to reopen at the completion of the construction works in 2023. Platform 15 will be permanently closed to rail services.

All the platforms are connected by a series of concourses and pedestrian tunnels, which connect to the outside precinct via nine accessways:

- the Northern Entrance, which connects Eddy Avenue to the Northern concourse within Central Precinct
- the Elizabeth Street and Eastern Stair entrances, which connects Elizabeth Street to the Northern and concourses within Central Precinct
- the Chalmers Street and Railway Square entrance, which provides the main east-west connection across the site (Chalmers Street to Lee Street) through the Devonshire Tunnel, and connects to the South Concourse within Central Precinct
- the Forecourt, Pitt Street and East Deck entrances, which connect the upper colonnade and the western forecourt to the Grand Concourse of the Central Precinct terminal building.

As a transport interchange, the complex layout of Central Precinct makes transferring between platforms and modes difficult. The available space in some locations is unable to accommodate existing passenger demands, and navigation through the Precinct is difficult due to a highly complex layout, a lack of sightlines and an often counter-intuitive design.

Passenger demands are also high, with 26,000 exits and 5,800 entries from Central Station in 2019 for the AM peak hour, and a further 9,800 interchange movements within the station between services. The 2019 PM peak hour recorded slightly lower levels of movement, with 7,600 exits, 20,400 entries and 9,200 transfers. The high demand for passengers waiting for services during the peak leads to crowding on some suburban platforms as there is insufficient space to accommodate the waiting demand.

Table 3-1 summarises the entry, exit and transfer movements within Central Station for the 2019 AM and PM peak hours. Figure 3-11 provides an overview of the station access and AM peak hour movements to and from Central Precinct.

Table 3-1: Summary of Central Station demands - 2019 AM and PM peak hours

Station entrance	AM Peak hour		PM Peak hour	
	Exits	Entries	Exits	Entries
Eddy Plaza (Northern Entrance)	6,520	720	1,780	5,350
Elizabeth Street Entrance	3,920	630	1,230	3,440
Eastern Stairs	370	90	110	370
Chalmers Street Entrance	2,890	1,290	1,970	2,840
Devonshire Tunnel West	8,060	2,330	2,070	6,060
Forecourt Entrance	2,330	390	960	1,330
Colonnade Entrance West	1,220	200	330	860
Colonnade Entrance East	1,060	160	230	710
Transfers between services	9,840		9,150	
Total movements	**42,020**		**38,790**	

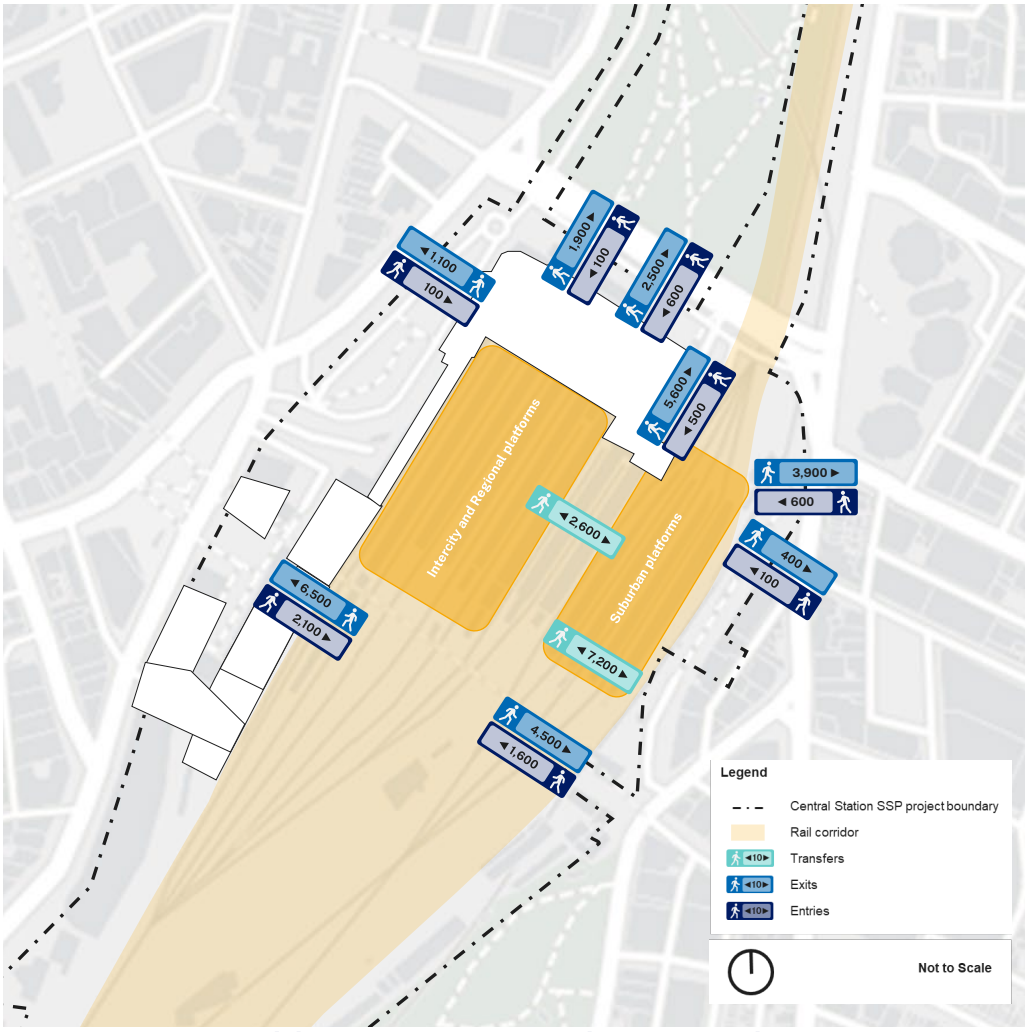


Figure 3-11: 2019 Peak hour movements to and from Central Precinct

Dynamic modelling of Central Station has been completed to understand and evaluate platform, concourse, gateline and vertical connection (stairs, lifts and escalator performance) in both a 2019 AM peak hour and 2019 PM peak hour. The modelling identified:

- Demands for the suburban platforms are high, with LoS D 'Queuing' recorded at vertical transport boarding areas and LoS F 'Walkways' in circulation areas
- Vertical connections around the station perform at differing levels of LOS, with the northern suburban platform stairs recording LOS E and LOS F
- There is generally sufficient capacity at the gatelines surrounding Central Station to accommodate 2019 demands
- The station concourses generally have sufficient capacity to accommodate 2019 passenger demands

Figure 3-13 present the mean density LOS between 8.30 and 8.45am at platform level and along the station concourse during the peak 15-minute period, based on the Fruin Walkways LoS and Fruin Queuing LoS. These maps show that the northern two platform stairs are generally the busiest, with suburban platforms 16-19, 20-21 and 24-25 showing the highest level of queuing around platform exits.

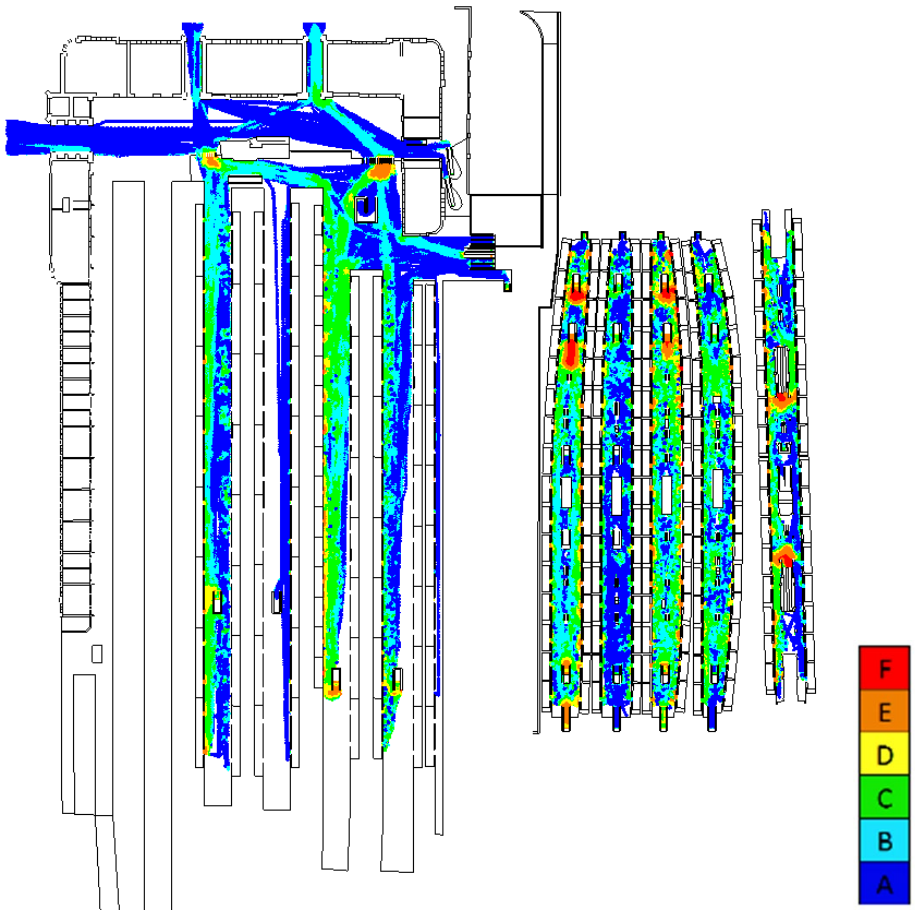


Figure 3-12: Central Station LoS map – Platform level (2019 AM peak 15 minute)

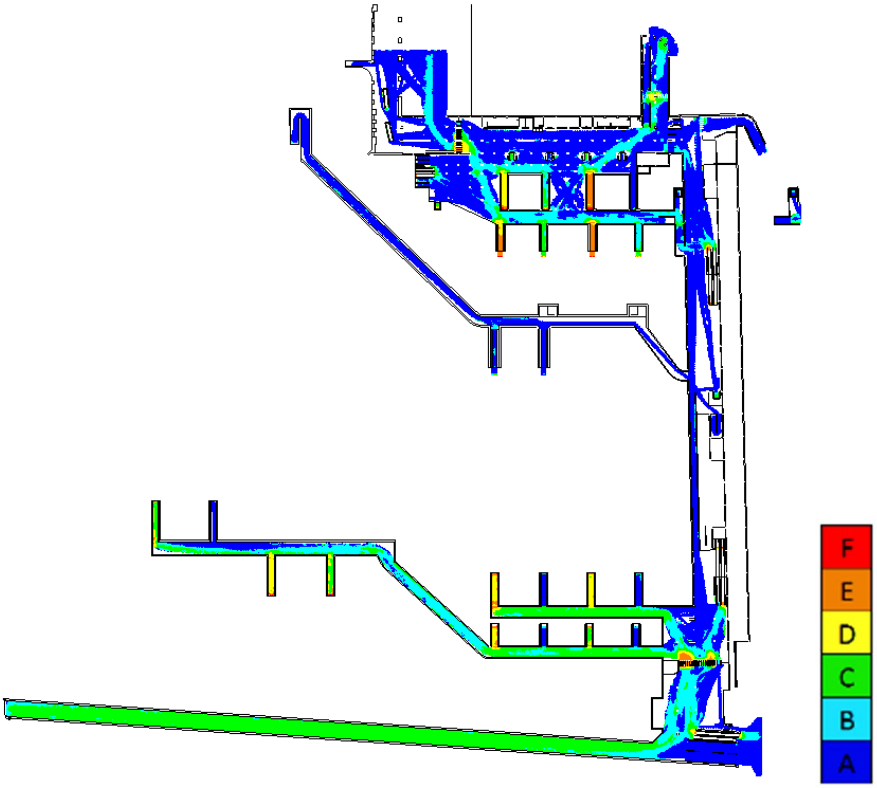


Figure 3-13: Central Station LoS map – Concourse Level (2019 AM peak 15 minute)

3.5.2 Light rail

Three light rail routes service the Central Precinct: connecting to Dulwich Hill along the Inner West route, and between Circular Quay to Randwick and Kingsford along the CBD and South East route. The Inner West Light Rail (IWLR) consists of 12.7 kilometres of track that connects Central Precinct and Dulwich Hill via 23 light rail stops. Central Precinct serves as one of the start/ end destinations for the service, with the stop located adjacent to the Pitt Street entrances on the Grand Concourse.

During the week, IWLR services generally operate every eight to 13 minutes. During the AM peak (between 8am and 9am) and PM peak (between 5pm and 6pm) periods, the service operates at the minimum eight-minute frequency.

The CBD and South East Light Rail (CSELR) dual route connects Circular Quay to Kingsford and Randwick, passing Central Precinct along Eddy Avenue and Chalmers Street. Opening in late 2019, the CSELR operates at up to 15 services per hour (four-minute frequency), connecting into Central Precinct at the Chalmers Street stop to the east of the station, and the Haymarket stop to the north-west of the station. CSELR experiences increased demand with customers travelling from the Chalmers Street stop to the Moore Park stop for special events.

Opal data from 4 March to 8 March 2019 has been analysed to determine the typical demand during the AM peak and PM peak periods for the IWLR service under pre-covid conditions. Demands for the CSELR were not evaluated in this assessment as the routes opened late in 2019, and demand had not settled into a 'typical' use setting.

Figure 3-14 identifies the AM peak and PM peak hour demands for the IWLR service at Central Precinct.

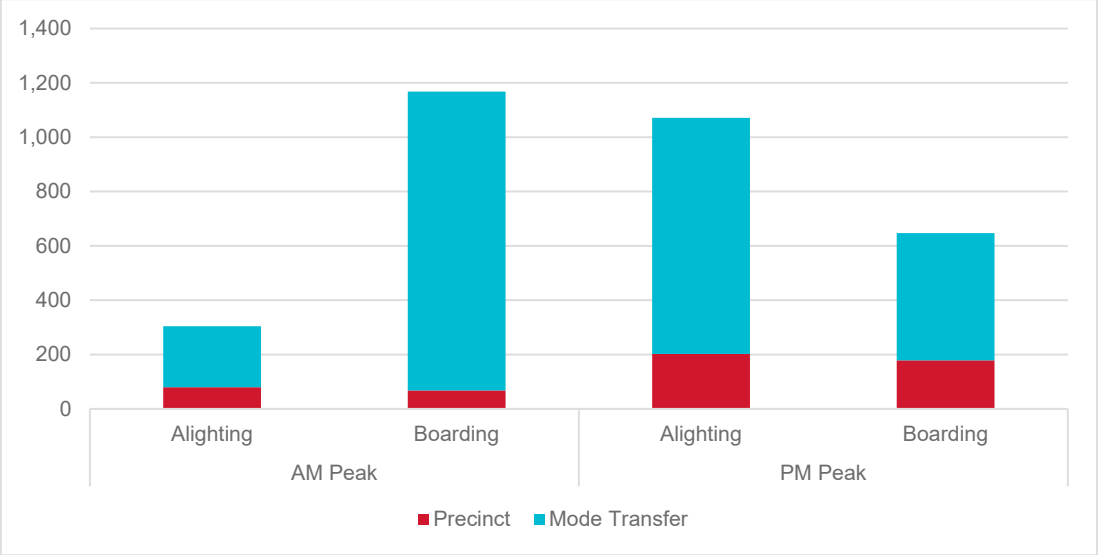


Figure 3-14: Light rail demand within Central Precinct (March 2019)

The Opal data identified an average of 1,168 passengers boarding the light rail at Central Precinct in the AM peak hour, and 304 passengers alighting at Central Precinct. In the PM peak hour, the trend was reversed, with 1,071 passengers alighting at Central Precinct and 647 passengers boarding the light rail from the station in the evening peak.

Transfers between train and bus services to the light rail services represents the bulk of demand, accounting for 83 per cent of all movement across the peak hour periods. This is despite the poor connectivity between the light rail stops and the suburban rail lines within Central Precinct, and the long distance between the bus interchange at Railway Square to the west of the station. Transferring between the IWLR and the CSLER is also challenging, given the position of the light rail stops within the broader network.

The integration of the light rail services within the road network has also at times impacted journey times and overall service reliability. While the light rail generally operates within a designated corridor within Central Precinct, services can be delayed due to traffic control signal timing and high pedestrian and traffic volumes.

3.5.3 Buses and coaches

Bus services and demands

Central Precinct has twelve bus stands assigned to the scheduled bus services, which services 51 routes into and around Sydney. Bus services around the Precinct provide connections between the Greater Sydney area and the CBD as well as facilitating interchange with train and light rail services. Streets around the Precinct count among the busiest bus corridors in Sydney but offer poor bus priority.

Over 50 bus services currently use the bus stands around the station, with 12 services beginning or ending within the Precinct. Of the 75,000 bus customers that

use the bus stops in the Precinct each day, nearly 45,000 customers transfer to or from rail services.

The AM peak and PM peak hour activity levels for each stand, together with the peak hour bus volumes along key roads, are presented in Figure 3-15 and Figure 3-16. This is based on analysis of Opal data for March 2019, presented in Table 3-2 below.

The analysis revealed that the busiest stands in the AM peak hour are Stand J (George Street northbound) and Stand D (Eddy Avenue eastbound). There is a strong transfer movement across the Precinct, with 76 per cent of passengers arriving to Central Station via train and transferring to a departing bus service.

George Street, between Broadway and Pitt Street, has the highest concentration of bus services in the AM Peak, with 466 buses travelling along the section (233 services in each direction). Eddy Avenue also experiences high bus volumes, with 176 services travelling eastbound and 82 services westbound.

During the PM peak hour, Stand A (Eddy Avenue westbound) and Stand J (George Street northbound) are the busiest stands within Central Precinct, with both stands experiencing high alighting passenger demands. Transfers between trains and buses (in both directions) remains high during the PM peak, accounting for 56 per cent of all bus activity.

Similar to the AM peak, George Street experiences the highest number of bus services in the PM peak hour (211 services in each direction). Eddy Avenue also experiences high bus volumes in the PM peak, with 118 services travelling eastbound and 85 services westbound.

Table 3-2: Summary of Central Station demands - 2019 AM and PM peak hours

Station entrance	AM Peak hour		PM Peak hour	
	Alightings	Boardings	Alightings	Boardings
Bus Stand A - Eddy Avenue	370	0	1360	20
Bus Stand B - Eddy Avenue	60	200	60	60
Bus Stand C - Eddy Avenue	30	640	30	640
Bus Stand D - Eddy Avenue	0	2210	0	0
Bus Stand E - Elizabeth Street	40	440	40	440
Bus Stand G - Chalmers Street	1030	100	680	40
Bus Stand J - George Street	1510	260	1470	150
Bus Stand K - Lee Street/ Railway Square	0	190	30	470
Bus Stand L - George Street/Railway Square	80	570	70	320
Bus Stand M - George Street/Railway Square	60	1520	110	1090
Bus Stand N - Lee Street	410	40	140	10
Total Movements	**3,590**	**6,160**	**3,990**	**3,220**

Analysis of service frequency and stand capacity suggests the majority of stands across Central Precinct currently meet service demands. Stands A and C, both located on Eddy Avenue, currently have insufficient space to accommodate bus service demand, with passengers required to board and alight buses wherever the bus can stop, which can be up to 40 metres from the stand.

Bus services around Central Precinct are also impacted by traffic congestion around the Precinct. This can limit the space available for buses to enter and exit the bay, in addition to delays on service journey times.

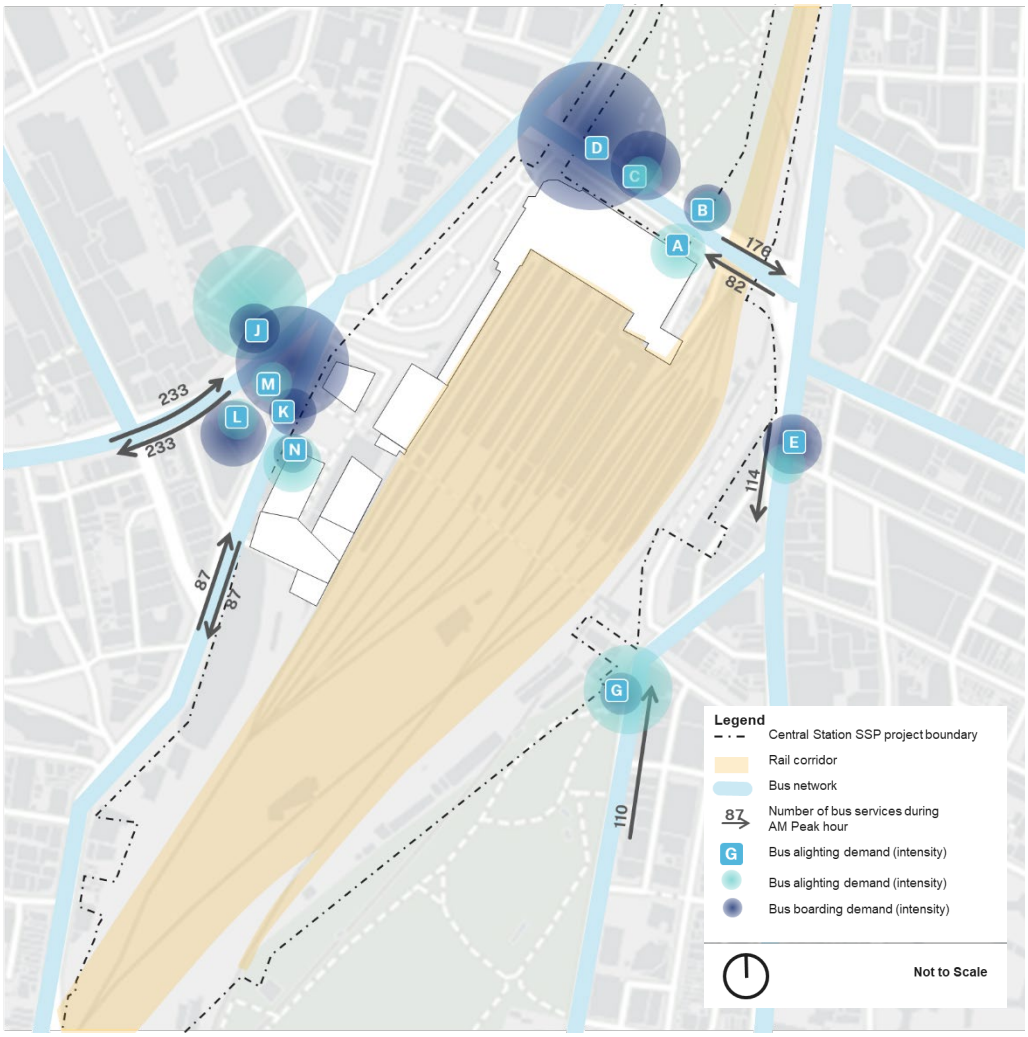


Figure 3-15: Central Precinct bus stand activity in the AM peak hour (8am – 9pm)

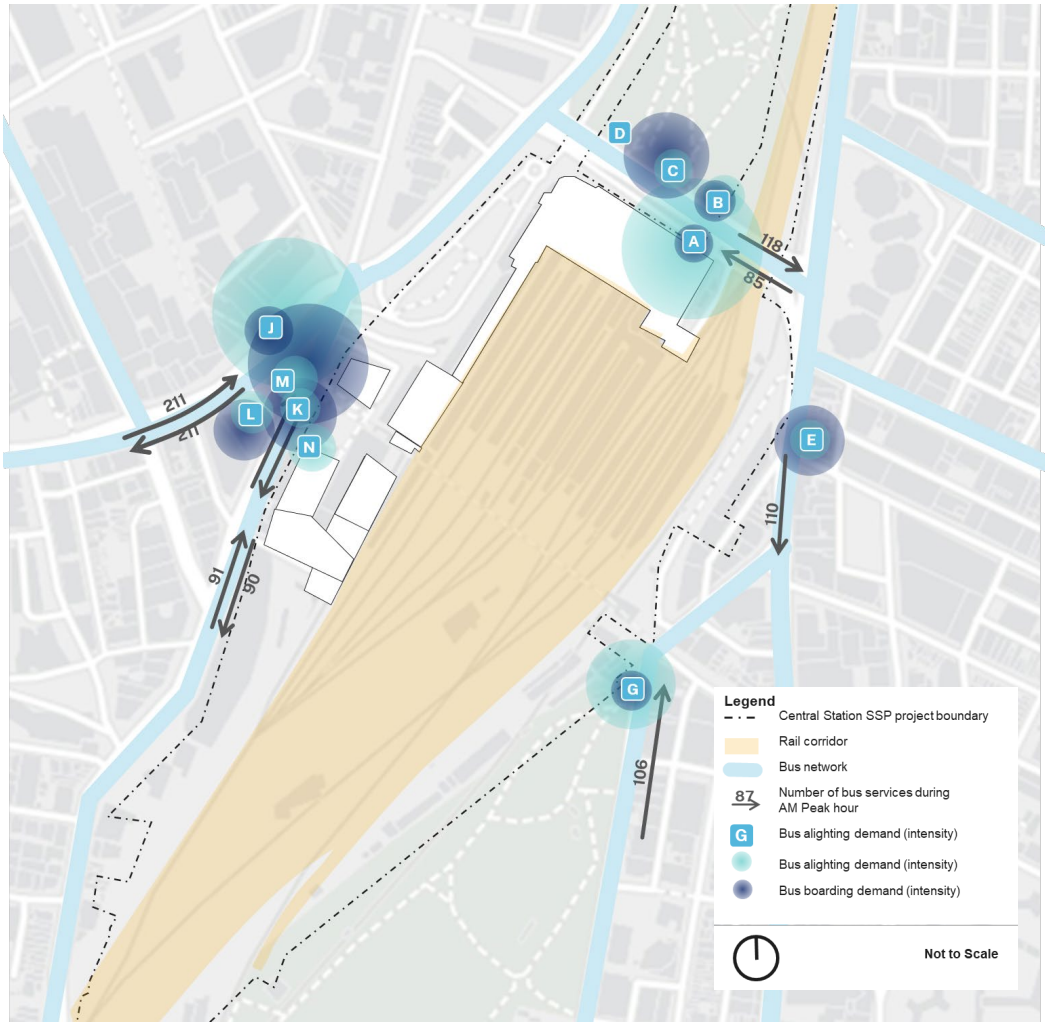


Figure 3-16: Central Precinct bus stand activity in the PM peak hour (5pm – 6pm)

Coach services and frequency

The Sydney coach terminal is located within Central Precinct, with coach pick-up and set-down locations within the Western Forecourt and along Pitt Street adjacent to the station terminal building. While these stops generally service private, regulated operators with regular, timetabled services, they are also used by tourist, hotel and NSW Trainline coach services on an ad-hoc basis.

The coach service demand in 2019 for Central Precinct is provided in Figure 3-17. Over 100 coach and tourist services operate from Central Precinct each day, with the highest demand occurring during the day, outside of peak bus and station operations The peak demand for coaches across a typical weekday is six services in the evening, between 6pm and 7pm.

Coach services generally operate at consistent frequencies throughout the day, with the operations aligning to the broader period of pedestrian and commuter activity around Central Precinct. Coaches have longer wait times than other vehicles and occupy space in high demand areas like the Western Forecourt for up to 30 minutes. With growing demands on road space around the Precinct, the longer dwell time of coaches creates an inefficient use of highly congested kerb space.

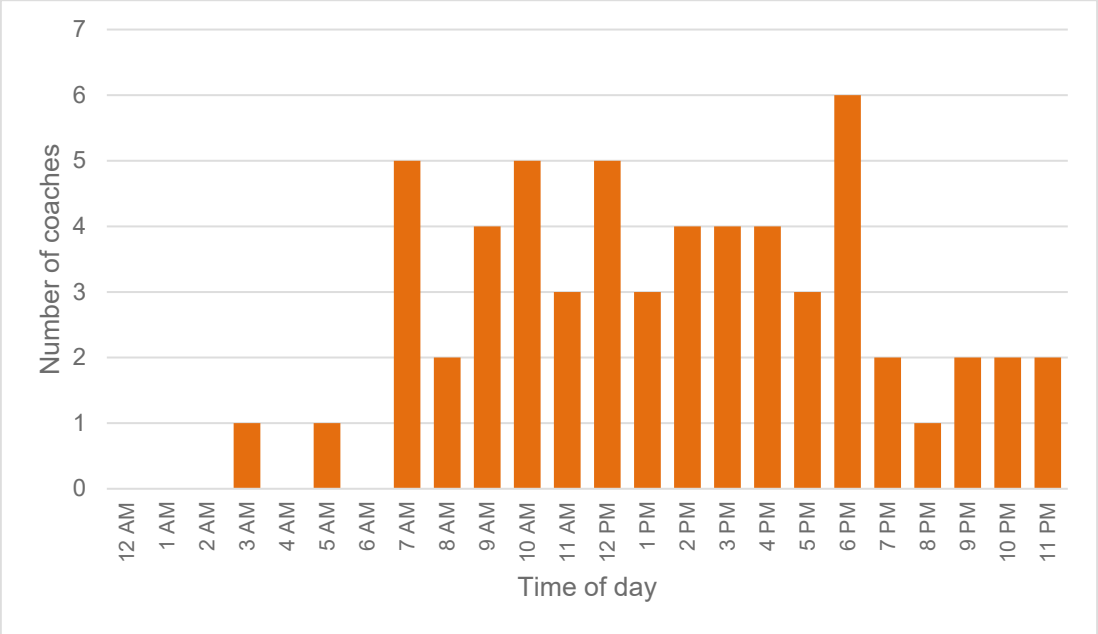


Figure 3-17: Central Precinct coach demand profile

Service layover capacity

Central Precinct also encompasses the Lee Street bus layover, located directly south of the Western Gateway precinct. The layover functions as a waiting layover for buses and coaches starting at Central Precinct, with buses entering at the northern end of the site and exiting mid-site at the signalised intersection of Regent Street and Lee Street.

Vehicle counts conducted in November 2019 identified a peak demand of 13 buses and coaches (combined) at any one time on-site, well below the layover capacity of 23 vehicles. On averages, buses remain at the layover between five and 15 minutes, with coaches remaining on-site for between 30 minutes and two hours. Figure 3-18 demonstrates the variability in demand within the bus layover facility.

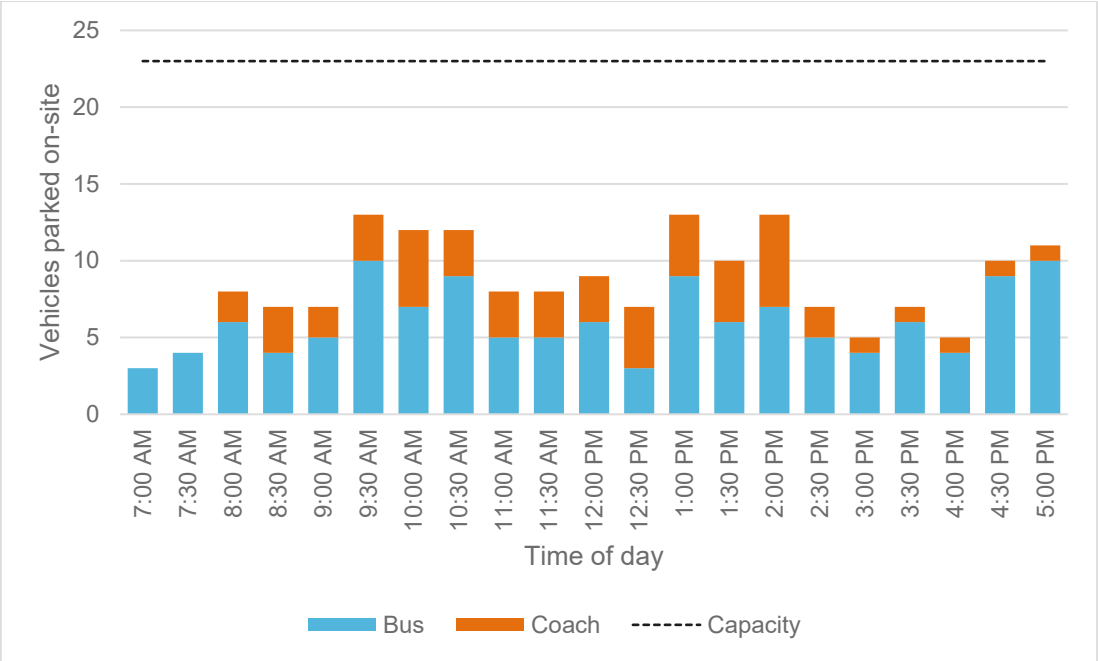


Figure 3-18: Lee Street layover demand profile

Train replacement services

During rail shutdowns for maintenance, construction, or emergency events, Transport for NSW operates temporary additional bus services to accommodate the displaced passenger demand. At Central Precinct, rail replacement services can operate from the following locations, depending on the direction and scale of movement:

- Within the Western Forecourt from the coach stands
- Along Pitt Street, adjacent to the Central Station Terminal building
- On Chalmers Street, south of Devonshire Street.

Temporary weather protection and static signage is provided for customers of the rail replacement services, including the location of any bus and/ or coach services displaced because of the rail replacement operations.

3.6 Road network

Central Precinct is bounded by a network of arterial roads that impede walking and cycling connectivity to and surrounding Central Precinct. Key roads include:

- Elizabeth Street, which runs north-south to the east of Central Precinct and is five lanes wide (two northbound general traffic lanes, two southbound general traffic lanes and a southbound bus lane).
- Eddy Avenue, which generally runs east-west directly north of Central Precinct and accommodates four lanes in each direction (three general traffic lanes and a bus lane). The CSLER also runs along Eddy Avenue, between the traffic lanes and Central Precinct.
- Pitt Street, which runs north-south to the west of Central Precinct and is six lanes wide (three northbound general traffic lanes and three southbound traffic lanes).
- George Street, which generally runs north-south to the west of Central Precinct. South of the Pitt Street/ Lee Street intersection, George Street is eight lanes wide (four northbound general traffic lanes, three southbound general traffic lanes and a southbound bus lane). North of the Pitt Street/Lee Street intersection, George Street narrows to two through lanes and a parking lane in each direction.
- Lee Street, which runs north-south to the west of Central Precinct between Henry Dearne Plaza and Railway Square. Lee Street is five lanes wide (two southbound general traffic lanes, two northbound traffic lanes and a northbound bus lane).
- Cleveland Street, which runs east-west to the south of Central Precinct and is generally four lanes wide (two lanes in each direction, with additional turning lanes at major intersections).

On-street parking around Central Precinct is generally not permitted. The roads adjacent to Central Precinct have a posted speed limit of 40 kilometres per hour, except for Cleveland Street, which currently has a posted speed limit of 50 kilometres per hour.

Figure 3-19 shows the key movement corridors and peak hour volumes in 2019 across Central Precinct.

Figure 3-19: Arterial road network around Central Precinct

The road network around Central Precinct serves an important traffic function for road based public transport as well as for private and freight vehicles. In 2019, over 88,000 vehicles travelled within the area during the AM peak and PM peak periods, with 42,000 of those vehicles travelling through the Central Precinct.

High traffic volumes occur on Eddy Avenue, creating a barrier to pedestrians accessing Belmore Park and leading to poor pedestrian amenity on Eddy Avenue Colonnade. High traffic volumes are also a barrier to pedestrians attempting to cross Pitt Street and Lee Street and limit the opportunity to provide additional space for the high pedestrian volumes along the Broadway/ George Street corridor. The pedestrianisation of George Street north of Ultimo Road has improved pedestrian flow. There is further opportunity to improve the pedestrian network by pedestrianising the southern end of George Street in the future

When considering broader traffic movement, east-west connectivity around the Precinct is limited to Eddy Avenue and Cleveland Street, with Cleveland Street serving as one of the few arterial bypasses around the Sydney CBD. Analysis of the Strategic Traffic Forecasting Model (STFM) highlights that nearly half of all vehicles travelling along Eddy Avenue, Pitt Street and George Street are passing through the Precinct with business elsewhere. This places increased pressure on the streets surrounding Central Precinct and limits its ability to become a desired destination.

3.7 Parking, servicing, and access

Vehicular access to Central Precinct is limited, with parking, deliveries and point-to-point activities generally restricted to:

- The Western Forecourt and the Colonnade ramp
- Ambulance Avenue
- Pitt Street loading dock.

Eddy Avenue has also been observed as a location where deliveries and point-to-point activities occur, however there are no formalised loading or parking locations are provided.

Three further access points allow rail operations and construction vehicles to access Central Precinct:

- Chalmers Street service access
- Eddy Avenue metro construction access
- Regent Street rail corridor/ metro construction access.

Parking within Central Precinct is generally limited to short-term public parking within the Western Forecourt, with longer parking permitted for authorised users both within the forecourt and across the broader precinct. No commuter parking spaces are currently provided for use for train commuters travelling to and from Central Precinct.

Public drop-off and pick up facilities, including designated point-to-point facilities, are in the Western Forecourt and at the top end of the Colonnade Ramp above Eddy Avenue. Vehicle activity surveys completed in April 2021 indicate over 1,100 pickup and drop movements (taxis and private vehicles combined) occurring within the Western Forecourt over a 24-hour period.

Central Precinct has a wide range of vehicles that need to access the site on any given day for different activities, including for rail operations, station and precinct deliveries, maintenance, and waste collection. Deliveries and service vehicles are generally accommodated for within the Western Forecourt, Ambulance Avenue and within the Pitt Street loading dock. Currently, around 400 delivery and service vehicles are estimated to be accessing the station each day.

Figure 3-20 identifies the key access points and parking areas around Central Precinct.

The availability of kerbside across the broader precinct places limitations on safely accommodating the high level of passenger drop-off and pick up activity occurring around Central Precinct. Surveys of activity during April 2021 highlighted over 100 instances of drop-off and pick up activities occurring over a 24-hour period within 'No Stopping' or 'Bus Only' zones, impacting traffic movement and pedestrian safety.

As land uses across the Precinct intensifies, passenger drop-off and point-to-point activity will increase, adding to the existing high demands and access challenges across Central Precinct. The servicing and delivery task associated with the Precinct will grow as the area is developed, with more deliveries, building maintenance activities and waste collection to occur as well as during the construction phases. Managing these demands, as well as ensuring activities don't interfere with pedestrian and public transport movement, will be critical to ensuring the ongoing success of Central Precinct.

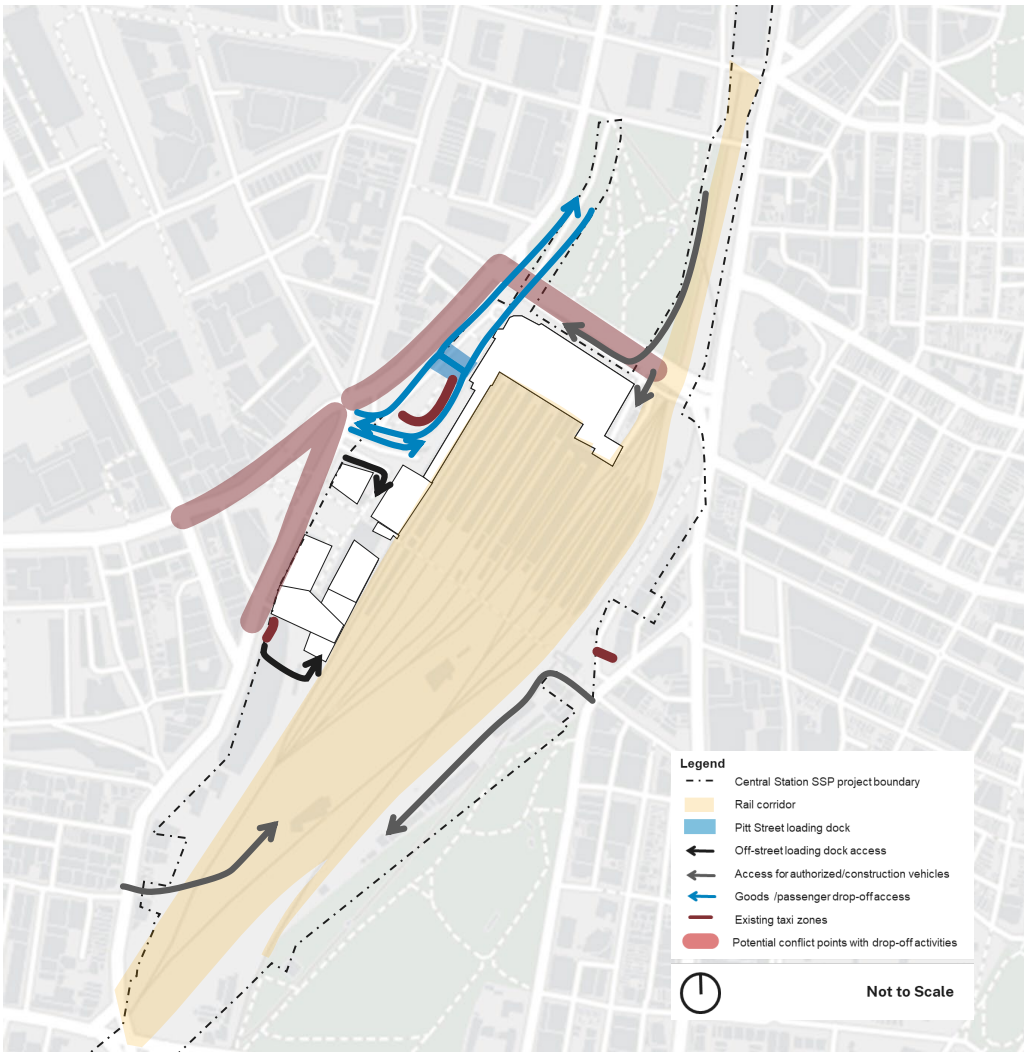


Figure 3-20: Existing parking and access around Central Precinct

3.8 Summary of key issues and opportunities

The analysis and review of the strategic transport context, existing conditions and behavioural trends have identified a range of issues and matters that need to be addressed to support the growth of Central Precinct.

The following sections provide a summary of the key issues across Central Precinct, and outlines opportunities for these issues to be addressed, either as part of the Central Precinct project, or through another mechanism.

The key identified transport issues and opportunities for Central Precinct is provided in Figure 3-21.

Figure 3-21: Summary of issues and opportunities

3.8.1 Walking and Cycling

The analysis and review of the existing walking and cycling conditions and context have identified a range of issues for people who walk or cycle through the Precinct. These are outlined in Table 3-3.

Table 3-3 Identified issues and opportunities for walking and cycling within and around Central Precinct

Ref	Identified Issues	Opportunities and future actions
WC1	The Lee Street and George Street intersection, and the Elizabeth/Foveaux/Chalmers streets intersection experience high pedestrian volumes, creating congestion, inciting unsafe pedestrian behaviours, potential conflicts with other modes and safety risks.	While outside the immediate boundaries of the SSP, the operation of these intersections will need to be reviewed as pedestrian demands increase to ensure movements can be safely accommodated. In the longer term, there may be opportunities to close part of the road network to improve pedestrian connections and expand the public domain. Lee Street has been identified as one location where road reallocation could occur, as shown in Figure 3-21. At Elizabeth/Foveaux/Chalmers streets intersection there could be an opportunity for green time and space reallocation to the benefit of pedestrians in the longer term. Investigating grade separation is another opportunity for both intersections that would improve pedestrian priority whilst maintaining vehicle priority.
WC2	There are limited opportunities for pedestrians to cross the rail corridor between Eddy Avenue to the north, and Cleveland Street to the south. Devonshire Tunnel is the only unpaid east-west connection through Central Station, with 75,000 pedestrian movements each day.	The redevelopment of Central Precinct provides an opportunity for increased permeability over the rail corridor, including direct access into Prince Alfred Park. The extension of Central Walk, with the eastern section currently being constructed as part of Sydney Metro, will alleviate pedestrian demands through Devonshire Tunnel and provide commuters with a direct connection east and west out of the station. These connections are shown in Green in Figure 3-21.
WC3	Cycle routes within Central Precinct, such as Lee Street and Chalmers Street are not well connected to wider bicycle network. Central Station also creates a barrier in the cycling network, restricting east-west and north-south movement.	There will be opportunities as part of Central Precinct to improve north-south cycling connections around the study area, including along Lee Street and/or Regent Street, and east-west across the station along the Devonshire Tunnel alignment. Beyond the study area, potential future improvements include dedicated connections across Cleveland Street towards Redfern, and across Regent Street to Meagher Street and the local bicycle network west of the Precinct.
WC4	There is limited bicycle parking at station entries, and no long-term storage or end of trip facilities	Any upgrades or development around Central Station should include provisions for public end-of-trip facilities across the Precinct, both for future workers, residents, and visitors to Central Precinct, and for commuters travelling to Central Station. Future possible locations for end-of-trip facilities include Railway Square, around Mortuary Station, and underneath the Precinct with access from Devonshire Tunnel.
WC5	Localised points of conflict have been identified where key	Any upgrades to the surrounding pedestrian, cyclist and road network should balance

Ref	Identified Issues	Opportunities and future actions
	cycling corridors cross pedestrian movement corridors, including at the intersection of Elizabeth Street and Foveaux Street.	movement priorities and minimise the potential for conflict
WC6	George Street is currently experiencing high pedestrian volumes	A future opportunity is extending the pedestrianisation of George Street southwards to cater for the increased pedestrian demand for access. This will also provide direct connections to the future corridor.

3.8.2 Public Transport

The analysis and review of the existing public transport conditions and future infrastructure changes have identified a range of issues for people who travel through and interchange at Central Station each day. These are outlined in Table 3-4.

Table 3-4 Identified issues and opportunities for public transport within and around Central Precinct

Ref	Identified Issues	Opportunities and future actions
PT1	Current passenger demands add to train loading and unloading times, increasing wait times for trains during busy periods.	Increased frequency and capacity of services will be necessary to accommodate future train patronage growth. Service improvements are currently planned and being progressively rolled out by Transport for NSW as part of ongoing infrastructure upgrades.
PT2	Access between regional and suburban platforms is poor, with interchanging customers walking long distances to reach their next service.	The introduction of Central Walk as the main east-west connection through the station provides a significant improvement to connectivity within the station. The expansion of this link to the west as part of Central Precinct will provide greater opportunity to access major land uses and developments around the Precinct.
PT3	There is poor connectivity between the light rail stops and the bus interchange at Railway Square as well as to the suburban rail lines within Central Station. It is also difficult to transfer between Inner West and CBD and Southeast Light Rail services at Central Station given the position of the light rail stops within the broader road network.	Future improvements within and around Central Station should consider improving connectivity between transport modes, including how passengers move between the different levels of Central Station. Future investigation should also consider if transferring between light rail services is more efficient at the Chinatown stop and the Capitol Square stop rather than at Central station. Future planning should also support a potential expansion of the light rail network, as outlined in the Central Sydney Planning Strategy.
PT4	Commuters waiting for bus services restrict pedestrian movements along footpath next to the bus stops, including along Eddy Avenue, and at the bus interchange at Railway Square.	There may be opportunities as part of Central Precinct to improve waiting areas for buses, by reallocating road space to support pedestrian activity. Public realm improvements should also include bus shelters, seating, information,

Ref	Identified Issues	Opportunities and future actions
		or ticketing around the Precinct to optimise overall customer amenity.
PT5	Bus and light rail services are often stopped at traffic lights for long periods of time resulting in increased journey time.	The future road network around Central Precinct should prioritise bus and light rail movements at intersections ahead of through traffic to support and maintain service frequency and reliability.
PT6	The coach terminal at Central Precinct has poor integration with other transport modes and does not provide a clear waiting area for passengers transferring from other transport modes.	The renewal of Western Forecourt provides an opportunity to upgrade existing coach facilities to provide direct access for customers transferring from coach services to the suburban, metro and regional rail lines.

3.8.3 Road Network

The analysis of the existing road network and traffic demands have identified both broader and localised issues that will need to be considered as part of Central Precinct. These are identified in Table 3-5.

Table 3-5 Identified issues and opportunities for the road network around Central Precinct

Ref	Identified Issues	Opportunities and future actions
RN1	High northbound traffic volumes on Pitt Street, Lee Street and along the Broadway/George Street corridor restricts pedestrian movements to and from the station. These volumes are a barrier for pedestrians accessing Belmore Park and creates poor pedestrian amenity on Eddy Avenue Colonnade.	Changes to the broader Sydney road network, including the construction and opening of WestConnex, will change how people drive through the CBD, including around Central Precinct. There may be opportunities as part of the renewal of Central Precinct to reallocate road space to provide more space for pedestrians and cyclists. Lee Street has been identified as one location where road reallocation could occur, as shown in Figure 3-21. Reconfiguration of the signal timing to increase pedestrian green time should also be investigated.
RN2	Nearly half of all vehicles travelling along Eddy Avenue, Pitt Street and George Street are passing through the Precinct with business elsewhere, placing additional pressure on local roads. (Source: Strategic Traffic Forecasting Model). High traffic volumes conflict with bicycle movements, impacting on the safety and attractiveness of cycling.	Road reconfiguration and the reallocation of road space to sustainable transport modes may help encourage through vehicle traffic to use alternative roads. Space could be reallocated to cyclists along Regent Street, Lee Street and Eddy Avenue to enable separated facilities to be provided.
RN3	Road safety issues and road crashes in the Precinct with an over representation of pedestrians and cyclists in crash	There is an opportunity to investigate lowering the speed limit and implementing safe system aligned infrastructure improvements around Central Precinct to align with surrounding land

Ref	Identified Issues	Opportunities and future actions
	data and high fatal and serious injury crashes.	uses and support a safe and integrated network.

3.8.4 Parking, loading and site access

The analysis and review of existing parking, access and station operations have highlighted several issues that will need to be managed as activity around Central Precent, including ensuring Central Station continues to operate efficiently as a key transport interchange. These issues and opportunities are presented in Table 3-6.

Table 3-6 Identified issues and opportunities for parking, loading and site access within and around Central Precinct

Ref	Identified Issues	Opportunities and future actions
PL1	Existing vehicle and service access points are close to pedestrian access locations. The existing deliveries and servicing of the station occur within the Western Forecourt, impacting amenity and conflicting with pedestrian desire lines.	Future access locations should consider how pedestrians move through the Precinct and be located away from key movement corridors.
PL2	There is limited kerbside space for kiss and ride - these activities are taking place in unsafe locations around the station, impacting traffic movement and pedestrian safety.	There will be opportunities to reposition kiss and ride locations around Central Precinct, so that both public transport users and surrounding land uses have access to safe and convenient point to point facilities.
PL3	Rail infrastructure and other safety requirements may limit vehicle access above the rail corridor.	There is an opportunity to create a car-free precinct on the proposed deck, enhancing the urban realm and place as a result, by restricting access to emergency vehicles only. Autonomous vehicles could provide supporting accessible services from future collection nodes around Central Precinct.
PL4	The freight task associated with the Precinct will grow as the area is developed, with more deliveries, building maintenance activities and waste collection to occur as well as during the construction phases.	There is an opportunity to provide an integrated delivery, distribution, and logistics hub as part of the renewal of the Precinct to consolidate 'last mile' deliveries and waste collection. Such facilities should connect with the integrated logistics hub within Dexus Fraser and Atlassian basement to provide greater flexibility in managing delivery and service vehicle access across the Precinct.
PL5	Security requirements will not allow loading and servicing arrangements around the Precinct to occur above or below rail infrastructure. This presents a challenge in servicing the proposed development above the station.	A series of sub-surface tunnels could provide access to future development above the station, connecting through to a centralised loading dock. This will allow for the movement of goods and waste away from the public realm.

4. Proposed transport provisions

4.1 Modal hierarchy

The planning of the transport network within and around Central Precinct has been informed by a defined modal hierarchy (shown in Figure 4-1).

In the development of the Reference Master Plan, it was recognised that there is not enough space in the surrounding road network to accommodate all transport modes and their activities.

The modal hierarchy recognises that not all transport modes should be given equal priority when planning for the renewal of a precinct that is home to a major multimodal interchange. To effectively use space and accommodate transferring between different transport modes, priority should be given to the more sustainable and efficient modes of transport, such as walking, cycling, and road-based public transport.

Prioritising these modes above others supports mode shift from private cars, reduces congestion and improves safety around Central Precinct. The hierarchy is intended to guide the location and accessibility of facilities for different modes of transport in terms of their proximity to the station or stop entrance.

The transport initiatives proposed as part of the CPRP build on the proposed modal hierarchy, while ensuring that the station and broader precinct can operate efficiently and safely.

Figure 4-1: Adopted modal hierarchy

Source: *Central Precinct Renewal Program Integrated Transport Strategy*, Arcadis

4.2 Transport provisions

Central Precinct will be transformed into a world-class interchange that builds upon the significant investment being spent to upgrade and improve the safety, reliability, efficiency and integration of the Sydney transport network. The revitalisation will strengthen the arrival experience and significantly improve the way people move through and interchange between modes.

A summary of the key transport provisions proposed by the CPRP are outlined in Figure 4-2 and detailed in the following sections below.

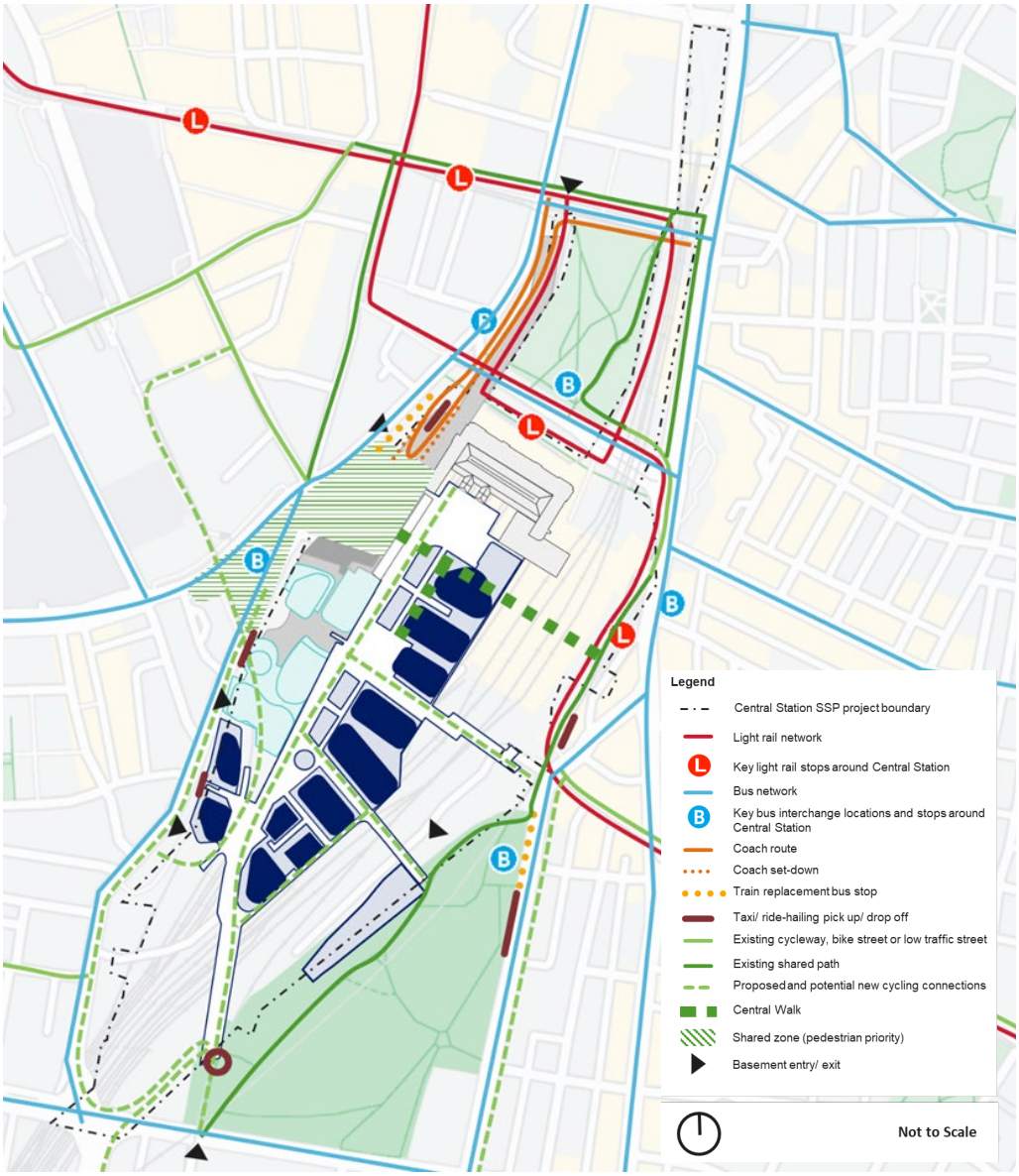


Figure 4-2: Summary of proposed transport provisions

4.2.1 Public transport changes

Within Central Precinct, connectivity between platforms and the broader precinct will be greatly improved through upgraded concourses and new accessways. The introduction of Central Walk as the main east-west connection through Central Precinct will improve connectivity within the station, providing direct access to the CSELR services on Chalmers Street, and to the major land uses and surrounding developments.

The realignment of the terminal building tracks and platforms allows for a significant increase in train services to the terminal building platforms. This enables additional regional and intercity services to be accommodated, as well as allowing for diversion of some suburban services to the terminal building.

Vertical connectivity within the station will also be improved through the addition of new stairs, escalators and lifts, allowing passengers to move within the station and transfer between modes and services with ease. New access to the deck above the rail corridor via the Grand Concourse provides direct access for regional, intercity and IWLR passengers to the new development. Additional connections to the proposed deck will be provided within Central Walk, allowing all other rail commuters to directly access the future development from the station.

Beyond Central Precinct, an upgraded bus layover facility will also be provided as part of the redevelopment of the existing Lee Street layover site, providing amenities for bus drivers and future electric bus provisions.

Coach access for pick up and drop off will still be accommodated for within the Western Forecourt and along Pitt Street, with the forecourt reconfigured to prioritise coach movements. The Reference Master Plan also considers the design of the Western Forecourt should coach operations be relocated away from Central Precinct, with the pedestrian realm expanded across the forecourt.

Both arrangements are shown in Figure 4-3 and Figure 4-4.

Figure 4-3: Western Forecourt with coach terminus

Figure 4-4: Western Forecourt without the coach terminus

4.2.2 Pedestrian movement and access

The CPRP proposes significant upgrades to the public realm around Central Precinct and new connections across the rail corridor. A 15 to 24-metre wide Central Avenue will provide the primary north-south corridor along the deck, providing a direct connection from the Terminal Building through the site, supporting adjacent open space and opportunities for pedestrians to dwell.

Three over-rail connections will provide for new east-west connections across the rail corridor, linking Devonshire Street with George Street as well as new connections to Prince Alfred Park. This will enhance access and circulation through Central Precinct, as well as provide pedestrian and bicycle connections across it to build a more integrated active movement network.

New vertical connections between street level, the colonnade and the deck will allow pedestrians to move with greater freedom across CPRP. The Goods line extension under George Street will be open to the public, allowing pedestrians to transition between Prince Alfred Park, through Mortuary Station and along the Goods Line towards Darling Harbour.

Central Walk is a new underground concourse that will aid access for passengers to trains, light-rail and the new Sydney Metro platforms. Central Walk will be approximately 19 metres wide and connect Chalmers Street to the east and Lee Street to the west. The eastern section of Central Walk, travelling under the suburban platforms between the Sydney Metro platforms and Chalmers Street, is currently being constructed as part of the Sydney Metro project. The western section (Central Walk West) will be constructed as part of Central Precinct, connecting the eastern section with a new tunnel under the regional rail platforms, and opening onto a new pedestrian plaza adjacent to Lee Street.

4.2.3 Cyclist facilities and access

The CPRP provides an opportunity to address connectivity and cyclist amenity issues around the station. The future cycling network will provide improved east-west connectivity across the rail corridor and strengthen north-south connections through Central Precinct to the surrounding areas.

The opening of the Goods Line tunnel enables shared pedestrian and cycling connections from the west towards Mortuary station, and across to Prince Alfred Park. A new link is also being considered along the rail corridor, connecting Redfern to Central Precinct along the rail corridor up to Prince Alfred Sidings. From here, cyclists will be able to travel across the deck to the east and north, or through Prince Alfred Park towards Surry Hills.

End of trip facilities for cyclists will be provided across the CPRP, including at:

- Railway Square
- Around Mortuary Station
- Prince Alfred Park
- Underneath the Precinct with access from Devonshire Tunnel.

Visitor and short-term bicycle parking will also be provided at station entrances and on the deck.

4.2.4 Vehicle access and parking

The provision of space to support point-to-point transport is key to providing a safe integrated, multimodal transport hub within the CPRP. The demand for point-to-point facilities is expected to increase around Central Precinct as renewal occurs.

Drop-off and pick up facilities will be provided across the CPRP near key entrances and pedestrian access points, including:

- Along the colonnade ramp on the approach to the Western Forecourt coach terminal
- On the eastern side of Central Precinct around Chalmers Street
- On Pitt Street adjacent to the terminal building
- Towards the southern end of the over station development around Mortuary Station.

A new connection into Prince Alfred Park from Cleveland Street will also provide drop-off and pick up facilities, with an autonomous vehicle shuttle service providing the last-mile connection from this stop, across the railway corridor and onto the deck. This connection will also provide access for emergency vehicles, with additional connections from Lee Street and Regent Street west of the Precinct boundary.

The CPRP will also encourage car-sharing and electric vehicle use, through supporting on-street spaces for these vehicle types, and allocating car spaces within private development to these vehicle types. The broader provision of public and private parking will be discouraged, in reflection of Central Precinct's inner-city location and the availability and accessibility of alternative transport choices.

4.2.5 Deliveries and servicing

To accommodate delivery and servicing tasks, a series of integrated loading and distribution facilities will be provided as part of Central Precinct to consolidate 'last mile' deliveries and waste collection.

Integrated loading facilities will be provided:

- Underneath the Western Forecourt, with a connection onto Pitt Street
- Underneath the Grand Concourse of the Central Station's terminal building, connecting through to the Western Forecourt facility and out onto Pitt Street, as shown in Figure 4-5
- As part of the Regent Street Sidings development
- As part of the Prince Alfred Sidings development

Future development on the proposed deck above the rail corridor will be serviced through a tunnel network below, connecting the Western Forecourt /Terminal Building and Regent Street Siding facilities. This enables the movement of goods and waste to occur away from the public realm and reduce unexpected interaction between pedestrians and vehicles.

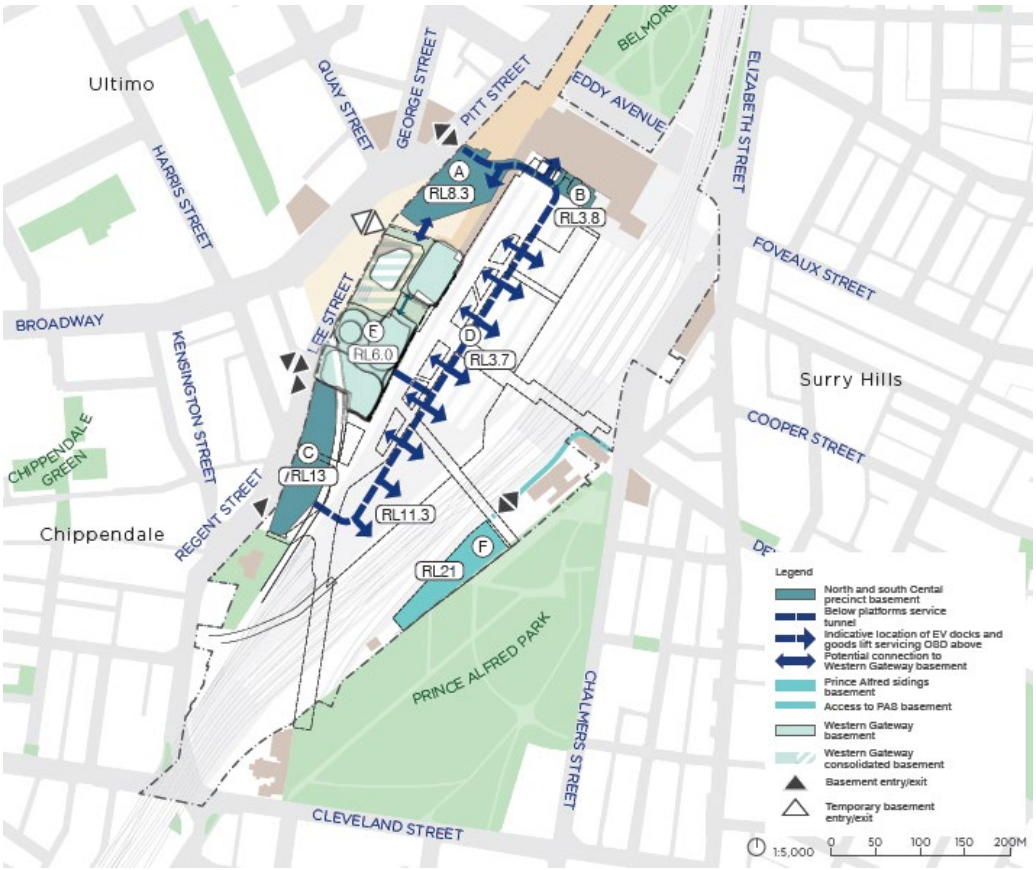


Figure 4-5 Indicative concept of logistics and sustainability strategies
Source: Central Precinct Urban Design Framework, July 2022

There will also be opportunities to connect the Western Forecourt and Regent Street Sidings loading facilities through to an integrated logistics hub with the Dexus Fraser and Atlassian basements. This will enable greater flexibility and allow for a holistic approach in managing delivery and service vehicle access across Central Precinct.

4.2.6 Road network changes

No changes are proposed to the road network surrounding Central Precinct as part of the SSP process. Longer term, there may be opportunities to further enhance the road network to provide a greater balance between the movement of people and goods and creating spaces for people. These opportunities will be further explored in following sections.

5. Transport assessment

5.1 Assessment overview

This chapter presents the transport assessment of Central Precinct. The forecast additional demands on the transport network have been quantified and the impacts to all transport modes has been assessed. Mitigation measures have been proposed where required to maximise the safety and efficiency of all road and public transport users.

As previously mentioned in this report, COVID-19 has substantially impacted the existing and future demands on the transport network and the travel patterns of people across the Sydney CBD. Transport for NSW has prepared revised forecasts to account for these substantial changes in the way people travel now and are likely to travel in the future given the needs of customers. These revised forecasts have been used as a basis for background demands, with detailed transport and pedestrian models developed with this data to fully assess the impact of the development of Central Precinct in support of the SSP.

Scoping meetings were held with Transport for NSW and City of Sydney to confirm study area, extent, and methodology of this assessment on 25 October 2021 and 4 May 2022. In line with the SSP study requirements (identified in Section 2), a 'Vision and Validate' approach has been adopted for this assessment, drawing on an understanding of the aspirations of Central Precinct and what can be done to achieve it.

The vision and the mode share scenarios identified to support this vision have been assessed through the following components:

- Trip mode share targets and validation – as described in Section 5.2
- Development trip generation assessment – as described in Section 5.3
- Pedestrian network and movement assessment – as described in Section 5.4
- Cycling impact assessment– as described in Section 5.5
- Public transport capacity assessment – as described in Section 5.6
- Road network performance assessment – as described in Section 5.7
- Access and parking assessment – as described in Section 5.8
- Safety assessment – as described in Section 5.9
- Movement and place analysis – as described in Section 5.10
- Cumulative impact assessment – as described in Section 5.11.

5.1.1 Assessment overview

Transport modelling of Central Precinct has been completed to understand the potential impacts and support the development of infrastructure plans, renewal initiatives and provide key stakeholders with an understanding of the future operation and performance for all transport modes.

The modelling aims to make best use of available pedestrian, traffic and public transport data and modelling software to determine base and future conditions for the project and surrounding area. These conditions were then used to assess the operational performance of the network to understand the resultant impacts

created by the future development within the Central Precinct and the surrounding area.

An overview of the modelling approach is presented in Figure 5-1.

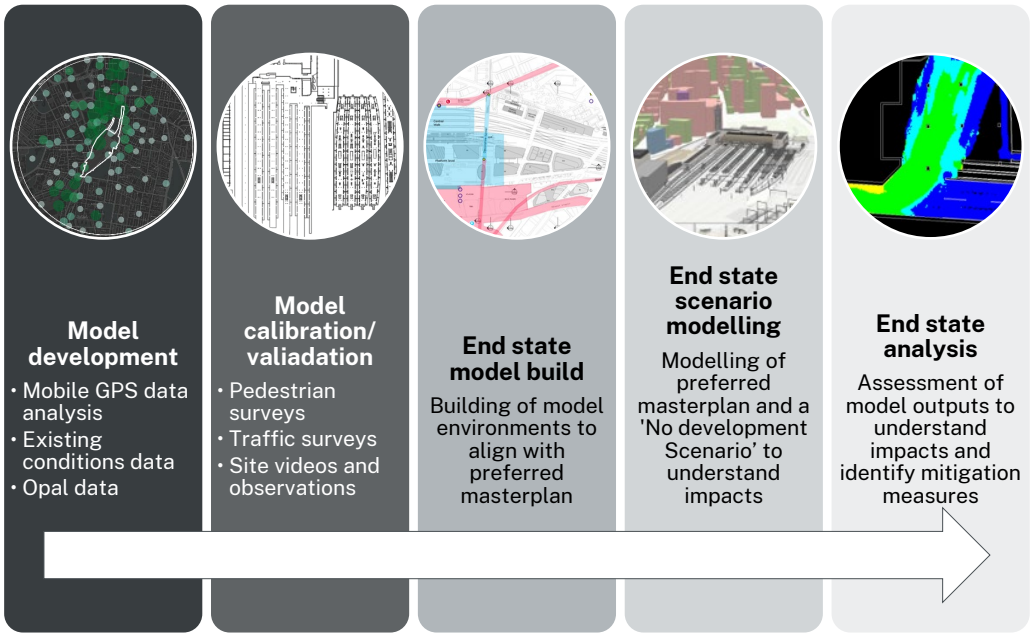


Figure 5-1: Dynamic modelling overview

Three levels of transport modelling have been undertaken for the assessment of Central Precinct, namely:

- **Precinct Transport Model**, which focuses on all transport models within Central Precinct, but external to the rail station and the future over station development. This model interfaces with both pedestrian models.
- **Internal Station Pedestrian Model**, which focuses on pedestrian activity within the rail station
- **Over Station model,** an external pedestrian-only model which considers pedestrian activity within the Over Station Development (OSD)

For the Precinct Transport Model and the Internal Station Model, both a 'Reference Masterplan' model and a 'No development Scenario' were developed to understand the impacts of proposed masterplan on the surrounding precinct in comparison to a non-project scenario. The Over Station model was developed for the Reference Masterplan scenario.

The Over Station model has been updated as part of the 'Response to Submissions' phase in accordance with the revised masterplan. This updated report reflects the findings of the updated model.

Figure 5-2 demonstrates how the three models overlap and interact. A summary of the transport models developed for the assessment of Central Precinct are summarised in subsequent sections.

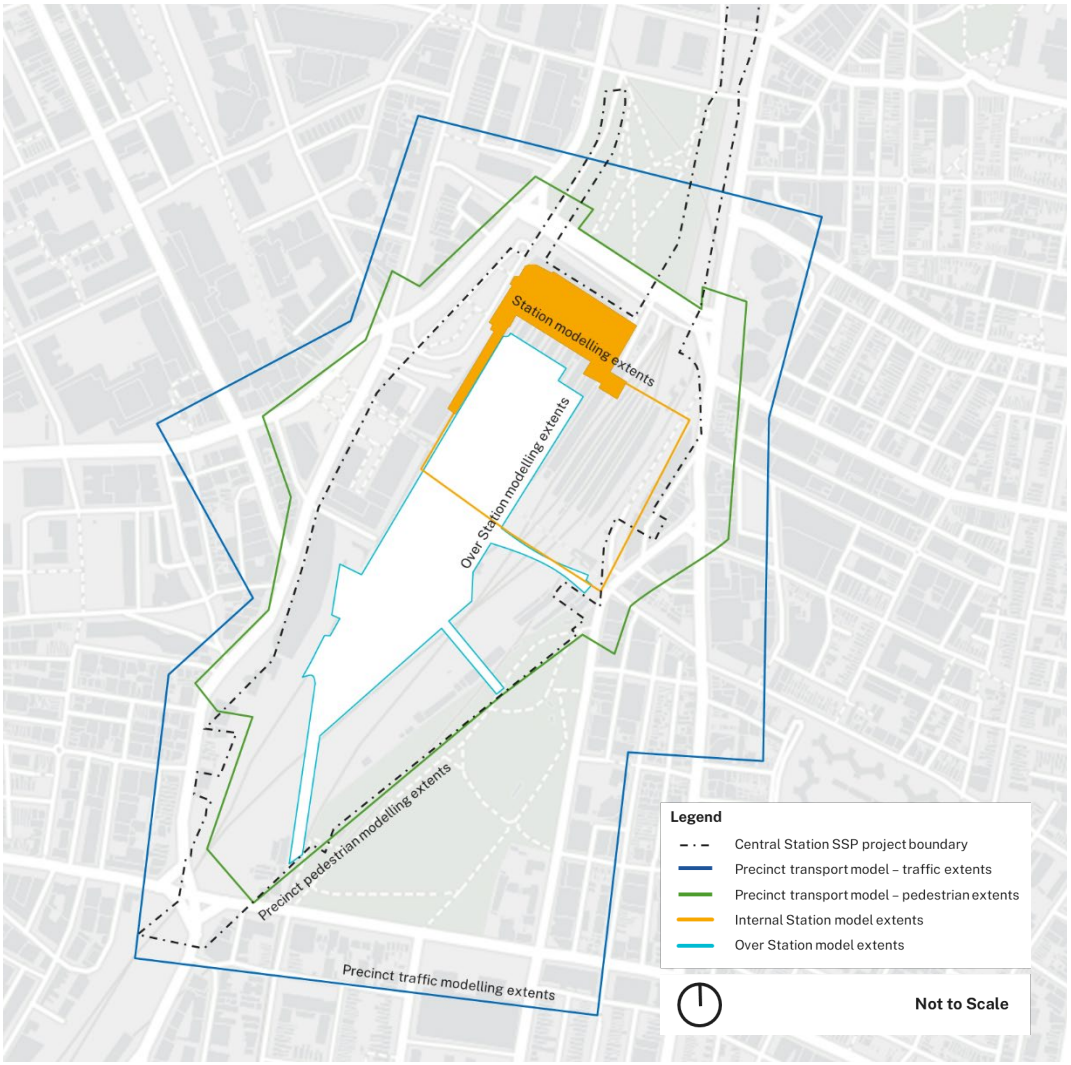


Figure 5-2: Investigation area

Precinct transport model

A multi-modal micro-simulation transport model for the area surrounding Central Precinct has been developed to understand the impacts of Central Precinct on the surrounding road network.

The Precinct Transport Model covers a region broadly defined by the following roads:

- Eddy Avenue to the north
- Regent Street and George Street to the west
- Cleveland Road to the south
- Elizabeth Street and Chalmers Street to the east.

The base year model has been calibrated and validated to weekday commuter peak periods, providing a sound tool which has been used to assess the cumulative transport impacts of known developments, and proposed infrastructure plans and concepts.

The micro-simulation model was developed using VISSIM and VisWalk (version 2021), developed by PTV as part of the PTV VISION modelling suite. The model includes:

- all arterial roads and important local road connections
- all road based public transport infrastructure, including bus, coach and light rail provision
- roadside pedestrian footpaths through the core model area, including the interface with the Internal Station model and the Over Station pedestrian model
- exclusive bicycle lanes, and
- intersection pedestrian crosswalks located outside the core model area have been coded as "static pedestrians" using VISSIM links.

Figure 5-3 outlines the extent of the VISSUM external precinct model.

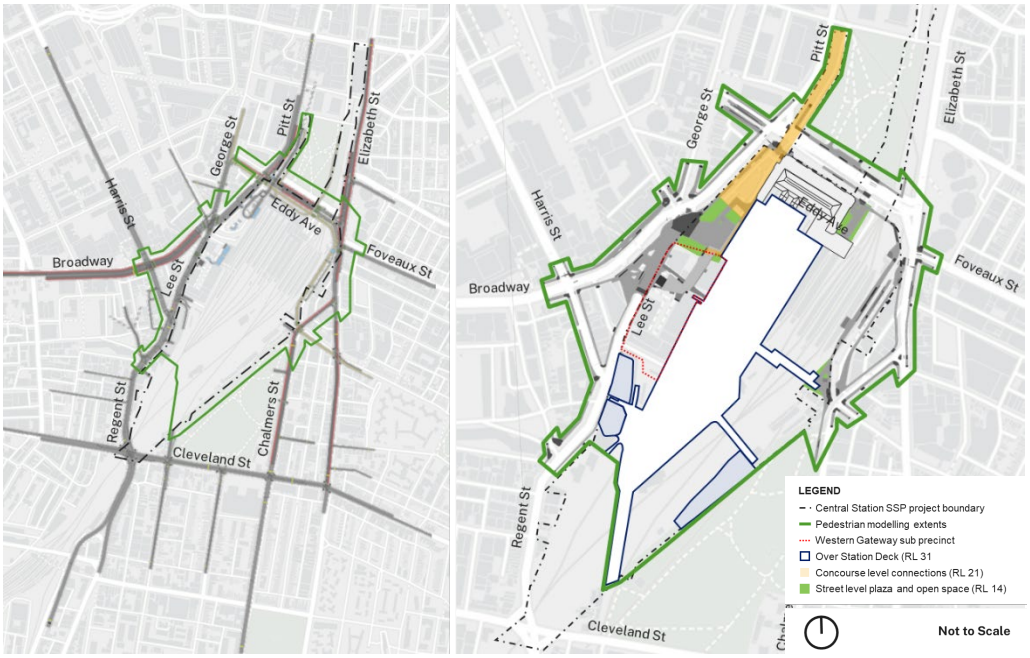


Figure 5-3: Assessed extent for the precinct traffic and pedestrian models

Internal station model

A pedestrian model was developed in Legion to understand the impact of Central Precinct on pedestrian flows and activity within the station. The internal station model was calibrated and validated to weekday peak periods using intersection counts, travel time surveys, and origin-destination data provided by Place Intelligence (as outlined in Section 3.2.3).

The purpose of the internal station model is to understand and assess the impact of future development associated with the Central Precinct, as well as understand the impact of future internal reconfigurations to improve commuter and passenger access within the station. This assessment focuses on the internal area of the station only, focusing on pedestrian movements and interactions with station infrastructure including gatelines, lifts, platforms and trains.

The internal model encompasses all publicly accessible areas within the station, with each station entrance acting as a direct interface between the external precinct and over station models.

The assessed Central Station layout includes:

- Central Walk East

- Sydney Metro Platforms
- Central Walk West
- Mezzanine Deck above Platforms 1-15
- Reconfiguration of Grand Concourse

The model extents of the analysis are shown in Figure 5-4.

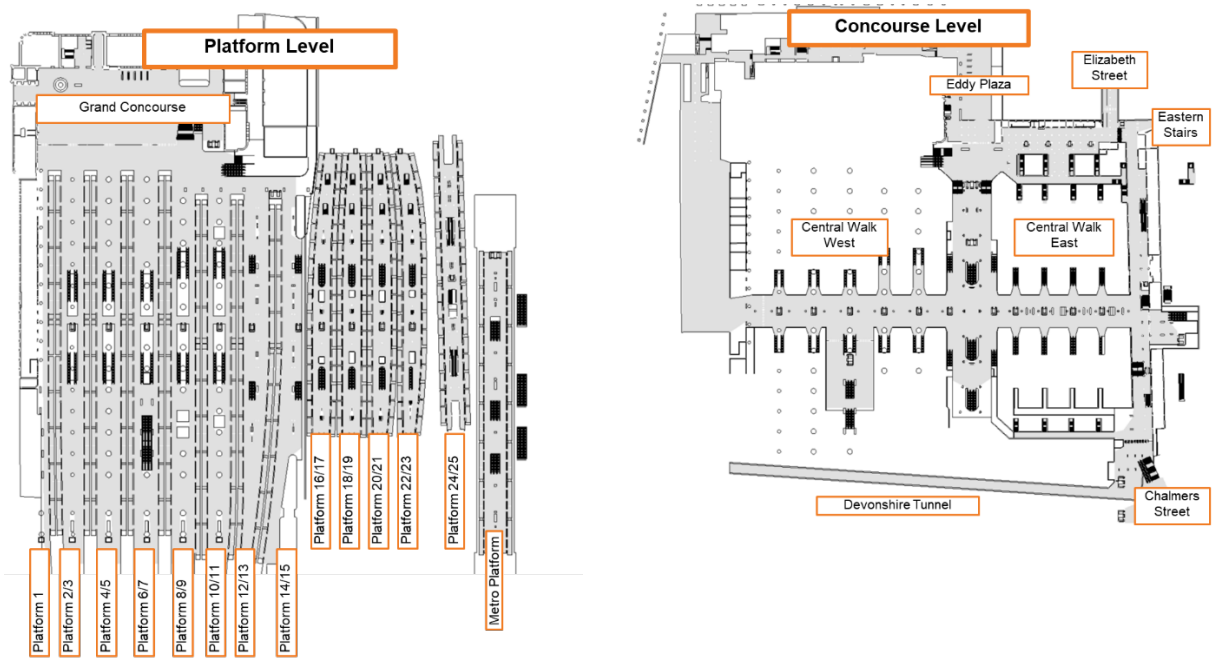


Figure 5-4: Assessed layout for the internal station model

Over station model

PTV Viswalk software was used in producing a pedestrian model of the over station development at Central Station, for the weekday commuter peak periods in the future year 2036.

The purpose of the over station model is to understand and assess the impact of future movements associated with the proposed buildings on the proposed deck, which would have commercial, community and retail uses. Elements assessed include walkways across the deck and new vertical transport connections to the station and street level. The model covers the extent of the proposed deck over the railway lines, assessing the movements between the buildings, the station and the street level to the east and west.

This model has been updated to consider the revised demand forecasts prepared by Transport for NSW and finalised in June 2022. The results and detailed analyses from this update have been included in this report.

The model extends from Central Station's grand concourse in the north to Mortuary Station and Prince Alfred Park in the south. New connections in the west include the Goods Line, Henry Deane Plaza and City Square; and connections in the east include Devonshire Street and Prince Alfred Sidings. Escalators will allow people to move directly between the deck and the unpaid area of Central Walk, located below the deck.

Figure 5-5 shows the extent of the over station model, showing the location of deck connections in the context of the surrounding environment.

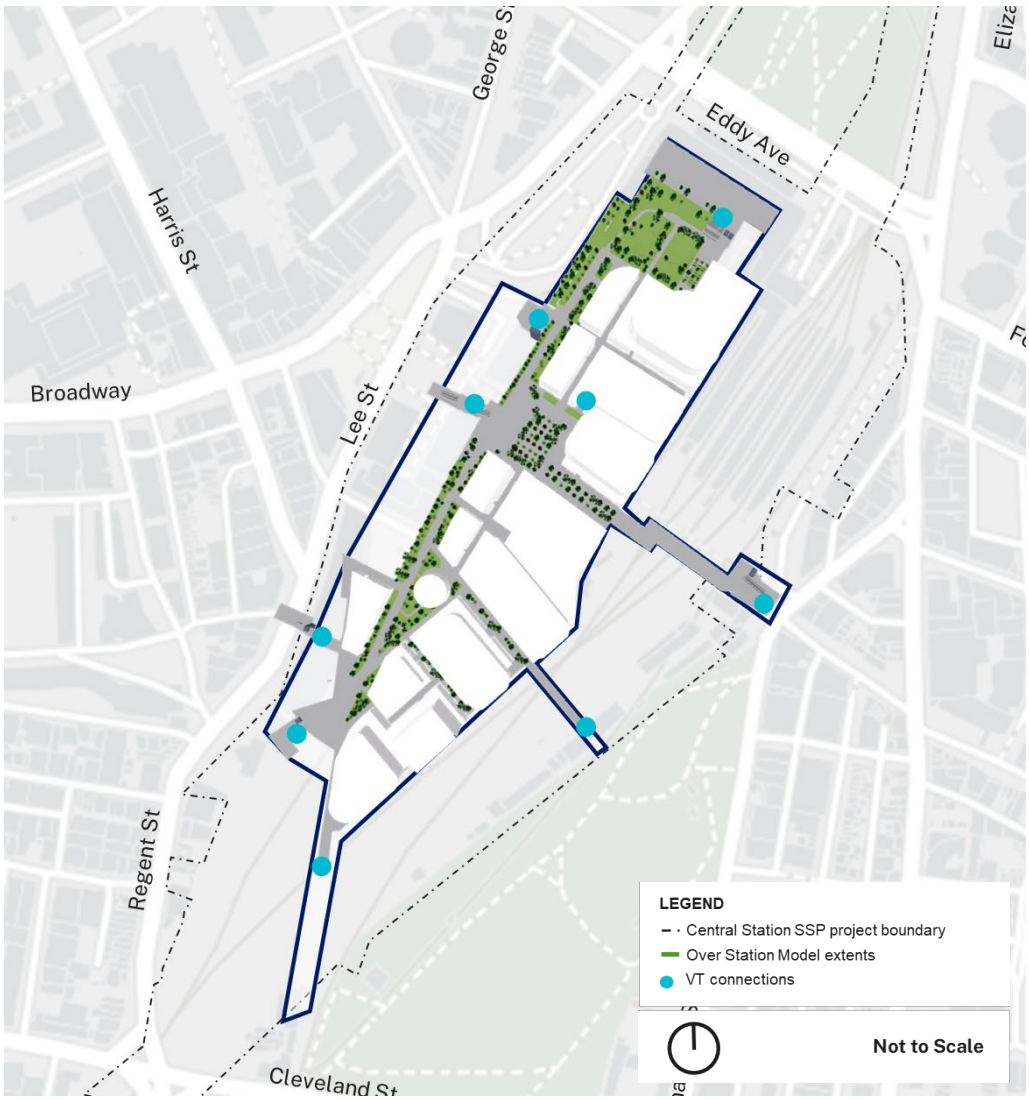


Figure 5-5 Over station model extent

5.1.2 Design requirements

The following design standards and guidelines were used to inform the pedestrian and traffic modelling:

- *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013) – Over station model and precinct transport model
- *Station Planning Standards and Guidelines* (Transport for London, 2012) – Internal station model and over station model
- *Station Capacity Planning Design Manual* (Network Rail, 2011) – Internal station model and over station model
- *Guide to Traffic Management Part 3: Transport Study and Analysis Methods* (Austroads, 2020) – Internal station model and over station model
- *Walking Space Guide* (Transport for NSW, 2020) – Over station model.

Pedestrian analysis - Over station and External precinct models

The *Guide to Traffic Management Part 3: Transport Study and Analysis Methods* (Austroads, 2020) states that for pedestrian capacity analysis, the modelled time period should be one hour, with analysis of results at 15-minute intervals. This is accepted as being the shortest interval during which stable flow exists.

The level of service (LOS) for pedestrian modelling is a measure of the level of density experienced at various elements such as walkways, stairs or waiting areas. In train stations, LOS C or better operation is targeted for all elements including walkways and stairs.

In addition to the Fruin LOS criteria, walkways in the over station model were assessed against the NSW Walking Space Guide (the Walking Guide) criteria for LOS. It guides the design of streets and footpaths to provide an environment that encourages more people to walk, with lower LOS flow rate thresholds adopted to support increased amenity. The Walking Guide is calibrated to Australian urban norms by allowing more space for pedestrians, with an LOS C as the adopted threshold for adequate pedestrian space.

The external footpath and OSD pedestrian networks have been assessed using both Fruin LOS, as a means to understand pedestrian safety in relation to peak flow density, and the Walking Space Guide, as a means to assess pedestrian comfort levels. For the external precinct, the Walking Space Guide has been used as the trigger to identify where road space reallocation may be required, in accordance with the TfNSW's Road User Space Allocation Policy.

Microsimulation models use random number sequences to produce a level of variability (stochasticity) within simulation runs to reflect the range of behaviours that would be exhibited in the real work. The *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013) have provided initial seed values for simulation runs, which would influence model operation and outputs. The first five seed values have been adopted for the over station pedestrian model in PTV Viswalk simulation software, and the seeds' average have been reported.

Table 5-1 compares the Fruin LOS and the NSW Walking Space Guide.

Table 5-1 Fruin and Walking Space Guide LOS thresholds

Level of Service	Fruin LoS thresholds			Walking Space Guide Walkway flow rate (ped/min/m)
	Description	Walkway flow rate (ped/min/m)	Stair flow rate (ped/min/m)	
A	Free circulation	Less than 23	Less than 16	Less than 4
B	Minor conflicts, passing and speed restrictions	23 to 33	16 to 23	4 to 6
C	Slightly restricted circulation; reverse and cross flows with difficulty	33 to 49	23 to 33	6 to 10
D	Restricted circulation for most pedestrians; significant difficulty for reverse and cross flows,	49 to 66	33 to 43	10 to 13
E	Restricted circulation for all; some stoppages and serious difficulties for reverse and cross flows,	66 to 82	43 to 56	13 to 18
F	Complete breakdown in circulation; many stoppages.	Greater than 82	Greater than 56	Greater than 18

Station design criteria – Internal station model

The internal station model has considered the performance of the proposed Central Station layout in 2036 layouts using Fruin Level of Service (LoS) parameters against the recommended design criteria from the Network Rail Station Capacity Planning Design Manual. These criteria have been derived to ensure that the station provides reasonable passenger comfort during a range of operational scenarios.

The relevant planning criteria to this analysis are presented in Table 5-3.

Table 5-2 Considered Planning Criteria, Network Rail Station Capacity Planning Design Manual 2021

Station Area	Normal Operation			
	Level of Service (Walkways)	Level of Service (Queuing)	Level of Service (Stairways)	Quantitative Measure
Passageways – one way	D	-	-	50 p/m/min
Passageways – two way	C	-	-	40 p/m/min
Stairways – one way	C	-	D	35 p/m/min
Stairways – two way	B	-	C	28 p/m/min
Concourse Circulation Area	C	B	-	40 p/m/min
Concourse Waiting Area	D	B	-	1.0 m^2/p
Platform Circulation Area	C	B	-	40 p/m/min
Platform Waiting Area	D/E	C	-	0.93 m^2/p
Ticket gates	E	D	-	25 p/gate/min
Escalators	-	-	-	100 p/escalator/min

In addition, Network Rail Station Capacity Planning Design Manual states the following criteria:

- Platforms should clear of alighting passengers within 120 seconds of a train arrival on a through-platform, and within 240 seconds on a terminus-platform
- The approach to gatelines should not exceed LoS D 'Queuing' and must not impede circulation of other passengers
- The approach to stairs and escalators should not exceed LoS C 'Queuing' and must not impede circulation of other passengers

5.1.3 Modelled scenarios

To guide the assessment of CPRP, the following scenarios were modelled:

- An existing conditions model for the year 2019
- A 'CPRP Reference Masterplan' model for the year 2036
- A 'No development Scenario' model for the year 2036, that allows for the assessment of conditions without CPRP.

For each of the above scenarios, the following time periods were modelled:

- AM peak – 8am to 9am
- PM peak – 5pm to 6pm.

A 15-minute warm-up period was included for both peak hours to ensure an accurate representation of pedestrian demand in the network could be achieved at the beginning of the recorded peak hour. A 15-minute cool-down period where no demand was introduced into the network was also included following the peak hour, to ensure all pedestrians would be able to clear the network.

5.1.4 Pedestrian, public transport and vehicle demand data

As noted in Section 4.2.1, the COVID-19 pandemic has substantially altered and reduced travel demand across Australia. This impacted traffic and pedestrian data collection activities that would have previously been used to build, calibrate, and validate transport models prepared for an assessment of the CPRP. The pandemic also stopped migration, especially international migration, which has been the main driver of population growth in Sydney for decades. Consequently, future growth patterns have changed fundamentally from pre- COVID expectations. Forecasts of pedestrian movement in Central Precinct take into account the revised forecasts of population, employment and lower travel rates provided by TfNSW.

To ensure the prepared models are robust and reflective of current travel patterns, a range of transport data was sourced and collected for the Precinct as part of the calibration and validation process. This data included:

- Pedestrian survey data (2019)
- Pedestrian origin-destination data (2019)
- Public transport patronage and interchanging movements (2019)
- Historical classified intersection counts (2017 to 2019)
- Traffic surveys (2021) – classified intersection counts, queue length surveys and travel time data

- SCATS volume data, 2019 and 2021
- Automatic tube counts (2019)
- Vehicle travel time and speed data (2019, 2021)
- Public transport stop scheduling data (2021).

The 2017 and 2019 datasets were used to inform base demands and general movement patterns for both pedestrians and vehicles. The 2021 post-COVID datasets were used to inform broader changes to specific movement patterns brought on by the opening of the new Light Rail routes (L2/L3) through the study area. This was done to ensure the developed base models were both reflective of pre-covid demands and responded to specific changes to the transport network.

5.1.5 Key assumptions

The following assumptions were adopted in undertaking the transport impact assessment:

- Light rail services along Chalmers Street begin operations from December 2019, with demands in 2026 aligning with forecasted volumes identified in the Stop Access and Design Plan: Zone S - Surry Hills report (2018) prepared for the Sydney Light Rail project
- Precinct development assumptions:
    - Atlassian, Toga and Dexus Fraser developments within the Western Forecourt are completed and occupied by 2026
    - The Terminal Building redevelopment is completed and occupied/ operational by 2036
    - Central Walk West will be completed and operational by 2036
    - The proposed over station/ deck developments, Lee Street Siding developments and Prince Alfred Siding developments are completed and operational by 2036
- The person trip generation rates for the development within Central Precinct have been taken from the TRICS trip generation database, based similar land uses and locational characteristics (as detailed in Section 5.3.3).
- The development floor area, and associated land use breakdown, assessed for the trip generation has been taken from the reference master plan land use schedule dated 28 August 2019
- For the AM peak period, inbound pedestrian trip distribution has been based on the distribution of population data for relevant travel zone catchments around Central Precinct. Outbound trips have used the distribution of employment and student demands for the same catchments
- Growth was based on 2019 Opal and PTIPS databases, increased by three per cent annually. Following the pandemic, TfNSW studied the potential reduction in public transport patronage and the impact of working from home. On the basis of the study, TfNSW recommended that the modelled patronages be reduced by between 25 per cent and 30 per cent
- Train trips for each of the future years have been taken from the internal station matrices, to ensure interactions between the two sets of matrices align.
- For the over station model:
    - Origins and destinations on the deck above the station were consolidated to the primary entrances to the buildings. Activity associated with

individual retail storefronts was consolidated to the larger building boundaries, and have not been modelled separately

- East-west through movements without an origin or destination on the deck were included in the model. These movements travel between the City Square, Henry Deane Plaza, the Goods Line or Mortuary Station in the west, and Devonshire Street, Prince Alfred Sidings or Prince Alfred Park in the east.

5.2 Target mode share and validation

5.2.1 Overview

Travel mode share is an important part in understanding how future workers and residents are expected to travel to and from Central Precinct. The ABS census data provides insight into existing travel patterns and how transport infrastructure and service availability support the adoption of one mode over others.

For the future state mode share, mode share targets are often adopted to drive policy decisions and actions, so that future travel patterns reflect the desired vision and aspirations of the Precinct. However, it is important that the development and selection of these targets are grounded and reflective of the characteristics and planned infrastructure for the area. Without this, the resulting assessment and any mitigation measures identified may not be a true reflection of the future state and limit the overall potential of the Precinct.

For the assessment of Central Precinct as part of the dynamic modelling, the target mode share governs how trips and demands are allocated, influencing route selection and the resultant design requirements for pedestrian movement corridors and vertical transport. The target mode share also influences the planning provisions for different transport modes such as vehicles and bicycle parking, and at a broader level, directly impacts on the Precinct's ability to deliver on the desired objectives and outcomes of Central Precinct. These targets intend to reflect the movement of people only and do not include freight and servicing trips.

In consideration of this, the development of the mode share targets reflects a 'Vision and Validate' approach which looks to manage changing land use and transport demand in line with the vision and aspirations of Central Precinct.

The final mode share adopted for Central Precinct will be used in the assessment to inform the mode share distributions for the future development travel demand forecasts within in the dynamic modelling and allow identification of initiatives and strategies that support the adopted target.

5.2.2 Benchmarking

Understanding travel patterns of areas with similar density and transport availability is a useful tool in determining drivers of transport mode choice. The development of mode share targets for the CPRP draws on this benchmarking, which has been used to identify key parameters and requirements needed to drive behaviour change.

Noting the size, scale and availability of public and active transport within Central Precinct it is hard to replicate at the neighbourhood level, the benchmarking analysis considered ABS Level 2 Statistical Area (SA2) datasets that held similar

location, urban form, transport infrastructure and services, and density to that of Central Precinct. The areas analysed include:

- **Sydney CBD:** represents the SA2 'Sydney - Haymarket - The Rocks' area, located to the north of Central Precinct. The Sydney CBD forms part of the broader statistical area in which Central Precinct is located.
- **Pyrmont – Ultimo:** represents the SA2 of the same name located west of Central Precinct. The Pyrmont – Ultimo area forms the second part of the broader statistical area in which Central Precinct is located, and is earmarked to undergo significant urban regeneration.
- **Redfern – Chippendale** represents the SA2 of the same name located south west of Central Precinct. The area includes the suburbs of Chippendale, Everleigh and Redfern, and encompasses both Redfern Station and the Redfern North Eveleigh Renewal Precinct.
- **Melbourne CBD:** represents the SA2 'Melbourne' area in Victoria, which broadly encompasses the Melbourne CBD and extends from Spencer Street to the west, along Yarra River to the south, Spring Street to the east and Victoria Street to the north.
- **Docklands:** represents the SA2 'Docklands' area, located west of Melbourne in Victoria and extends from Spencer Street along the Melbourne CBD's western boundary to the Yarra River and Moonee Ponds Creek.

The assessment of these areas considered the available residential, employment and 'Journey to Work' mode share data at the ABS Statistical Area 2 level. Due to limitations with the dataset, a finer-grained assessment was not able to be completed.

Public transport availability

Table 5-3 provides a comparison of the current and planned public transport infrastructure and services between Central Precinct and the five identified SA2 areas. This demonstrates that Central Precinct will experience public transport and connectivity comparable to the Sydney and Melbourne CBDs, which currently have best accessibility to public transport. Docklands is the only area not to be serviced by more than 20 bus routes or by future Metro services, however, the area is well serviced by Light Rail, providing a comparable provision of public transport services.

Table 5-3: Comparison of available public transport infrastructure

Area	Available Public Transport Infrastructure		
	Train/ metro	Light rail	Buses
Central Precinct	1 train station 1 future metro station 12 suburban and 3 regional lines	5 stops 3 routes	>20 routes
Sydney CBD	6 train stations 5 future metro stations 12 suburban and 3 regional lines	15 stops 3 routes	>20 routes

Area	Available Public Transport Infrastructure		
	Train/ metro	Light rail	Buses
Pyrmont - Ultimo	1 future metro station	7 stops 3 routes	>20 routes
Redfern - Chippendale	1 train station 1 future metro station 12 suburban and 3 regional lines	N/A	>20 routes
Melbourne CBD	4 train stations 2 future metro stations 16 suburban and 5 regional train lines	> 20 Stops > 20 routes	>20 routes
Docklands	1 train station 16 suburban and 5 regional train lines	19 stops 6 routes	6 routes

Population and jobs density

Population and employment density are also drivers of sustainable transport mode share. Table 5-4 provides a comparison of population and jobs density between Central Precinct and the five identified SA2 areas. Central Precinct is expected to have a similar population density to the Redfern-Chippendale SA2 area (133 persons per hectare and 127 persons per hectare, respectively). Sydney CBD and Melbourne CBD record the lowest density (77 persons per hectare and 65 persons per hectare, respectively), which is over 42 per cent less than the planned Central Precinct area. Melbourne CBD has the highest employment density across all study areas (224 persons per hectare).

Considering job density, Central Precinct is expected to have a far greater job density than the assessed study areas, with 1,420 jobs per hectare expected across the Precinct. This is more than 10 times the job density within the Sydney CBD (132 jobs per hectare), and seven times the next highest area in Docklands (201 jobs per hectare).

Table 5-4: Comparison of population and jobs density

Area	Size (ha)	Estimated Residential Population (2020)	Population density (persons / ha)	Jobs (2018)	Job density (persons / ha)
Central Precinct[1]	24	3,200	134	13,333	1,432
Sydney CBD	429	33,238	77	56,759	132
Pyrmont - Ultimo	149	24,661	165	26,759	179
Redfern - Chippendale	216	27,363	127	26,044	120
Melbourne CBD	237	53,180	224	47,569	201
Docklands	244	15,803	65	14,803	61

1 Taken from Central Renewal Precinct Population and Demographics Preliminary Projections prepared by SGS Economics and Planning (May 2021)

Journey to Work trends

Table 5-5 compares the ABS 2016 Census 'Journey to Work' mode share from the across six main transport modes between the five identified SA2 areas for commuters travelling into the area. This suggests that trains and metro services account for around 55 per cent of commuter trips into the Sydney CBD, Melbourne CBD, and the Docklands SA2 area across Sydney/ Melbourne/ Docklands. Active transport had a slightly higher share outside of the CBD areas, accounting for over 11.6 per cent of trips into the Pyrmont-Ultimo and Redfern-Chippendale areas. These areas also had a higher car trip (including driver, passenger and rideshare trips) mode share, accounting for over a third of all commuter trips.

For the Sydney CBD, which encompasses a portion of Central Precinct, sustainable transport modes accounted for 84 per cent of all trips into SA2 area.

Table 5-5: Comparison of journey to work trends (place of employment)

Area	Mode Share					
	Walking	Cycling	Train/ Metro	Light Rail	Buses	Car
Sydney CBD	6.2%	1.4%	55.0%	0.4%	21.2%	15.8%
Pyrmont – Ultimo	9.1%	2.5%	36.1%	3.4%	14.2%	34.7%
Redfern – Chippendale	9.6%	2.9%	42.7%	0.1%	7.5%	37.1%
Melbourne CBD	5.7%	3.2%	54.3%	12.3%	2.8%	21.7%
Docklands	4.8%	3.3%	55.1%	7.7%	1.2%	27.9%

Note: car mode share includes private vehicle trips as the driver, private vehicle trips as the passenger, and point to point trips

A comparison of distances travelled to work across each of the identified SA2 areas is provided in Table 5-6. The Pyrmont – Ultimo and Redfern – Chippendale SA2 areas have a comparatively high proportion of commuter trips within 2.5 kilometres (10 per cent and 12 per cent, respectively), which may reflect the higher population and job density observed in both areas. Most trips across all areas (92 per cent or higher) are under 50 kilometres in length, suggesting the broader employment catchment falls within the metropolitan area.

Table 5-6: Comparison of distances travelled to work

Area	Distance travelled to work				
	0 to 2.5 km	2.5 to 10 km	10 to 30 km	30 to 50 km	50 km+
Sydney CBD	5%	34%	43%	11%	7%
Pyrmont - Ultimo	10%	36%	39%	10%	6%
Redfern - Chippendale	12%	34%	35%	10%	8%
Melbourne CBD	7%	31%	46%	12%	5%
Docklands	6%	25%	49%	14%	6%

Journey from Home trends

Table 5-7 compares the ABS 2016 Census 'Journey to Work' mode share from the across six main transport modes between the five identified SA2 areas for residents within each area. In the Sydney CBD, walking is the predominate travel mode for residents, accounting for 47 per cent of resident trips, with similar levels experienced in both the Melbourne CBD (42 per cent) and the Pyrmont – Ultimo (43 per cent) SA2 areas. Outside of the city CBD areas, car usage is higher with Pyrmont – Ultimo, Redfern – Chippendale and Docklands comprising of over 24 per cent of all trips (which includes driver, passenger and rideshare trips).

For the Sydney CBD, which encompasses a portion of Central Precinct, sustainable transport modes accounted for 86 per cent of all trips from the SA2 area.

A comparison of distances travelled to work from the place of residence within each of the identified SA2 areas is provided in Table 5-8. Notably, all areas have a high proportion (81 per cent or greater) of work locations within 10 kilometres of their residence, which may reflect the higher job density across these areas. Most trips across all areas (97 per cent or higher) are under 50 kilometres in length, suggesting the broader employment catchment falls within the metropolitan area.

Table 5-7: Comparison of journey to work trends (place of residence)

Area	Mode Share					
	Walking	Cycling	Train/ Metro	Light Rail	Buses	Car
Sydney CBD	47.4%	0.8%	24.7%	0.9%	12.6%	13.6%
Pyrmont – Ultimo	42.8%	2.1%	13.8%	2.1%	13.4%	25.8%
Redfern – Chippendale	24.1%	5.2%	32.0%	0.4%	13.8%	24.5%
Melbourne CBD	41.6%	1.6%	14.6%	28.3%	2.1%	11.8%
Docklands	28.1%	1.4%	7.7%	32.8%	0.9%	29.2%

Note: car mode share includes private vehicle trips as the driver, private vehicle trips as the passenger, and point to point trips

Table 5-8: Comparison of distances travelled to work (place of residence)

Area	Distance travelled to work				
	0 to 2.5 km	2.5 to 10 km	10 to 30 km	30 to 50 km	50 km+
Sydney CBD	60%	22%	13%	2%	3%
Pyrmont - Ultimo	47%	36%	13%	2%	2%
Redfern - Chippendale	32%	52%	13%	2%	1%
Melbourne CBD	65%	21%	10%	1%	2%
Docklands	47%	34%	14%	2%	2%

5.2.3 Strategic enablers

In recognition of the 'Vision and Validate' approach to transport planning and infrastructure provision for the CPRP, the development of the target mode share for the Precinct will also need to consider the broader aspiration of the Precinct, and the strategic enablers that will be in place across the Precinct. Three key enablers have been identified that will integrate transport and land use outcomes to support the delivery of the CPRP, and include:

- **SSP Statutory Framework and Design Guidelines**, which set out the Precinct planning principles, objectives and performance outcomes for the CPRP through the application of controls and guidelines.
- **Travel demand management strategies and action plans** for the CPRP that support and encourage a mode shift to sustainable transport, discourage car trips for those who have alternative options and reduce the need for long-distance travel.
- **Upgraded transport infrastructure and new services** – a range of transport infrastructure projects and service improvements that facilitate a broad-reaching and effective multi-modal transport network. These projects have been identified in *Future Transport Strategy* and supporting plans and strategies as necessary to increase sustainable transport mode shares across Greater Sydney, and include:

- safe, efficient and reliable light rail and bus services, with frequencies, access and capacities responding to customer demand
- an extensive, dedicated bicycle network with separated bicycle facilities built on all key roads and streets, to support the needs of cyclists from confident commuters through to occasional recreational riders
- an expanded Sydney Metro network, including the extension of Sydney Metro West to Malabar/ La Perouse providing fast and reliable transit between the Harbour CBD and the southeast, with connections to services travelling to Central Precinct
- provision of on-demand transport services, support for autonomous vehicles and the provision of public infrastructure which caters for private non-combustion modes of transport such as electric vehicles and electric bicycles.

These strategic enablers are critical in providing a fine-grained network of transport infrastructure and services to support the aspirations of the CPRP. To encourage a shift towards sustainable transport and create a balanced transport mode share, an integrated, multi-modal network with dedicated walking and bicycle facilities, and provide for connections between train, metro, light rail, and bus services is required.

5.2.4 Mode share scenarios

Three potential mode share scenarios have been identified to support the CPRP vision and principles, as summarised in Figure 5-6.

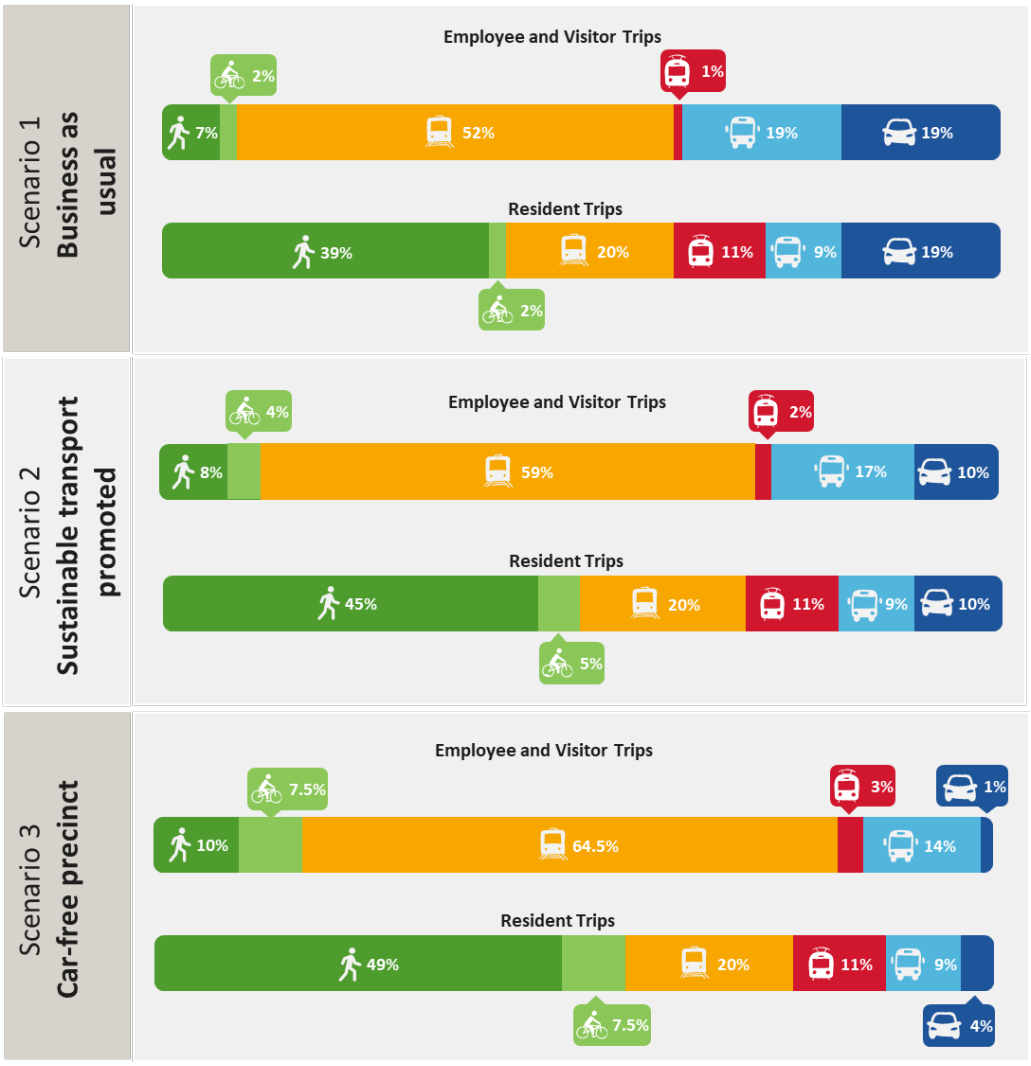


Figure 5-6: Central Precinct future mode share target scenarios

Scenario 1: Business as usual

The Business as Usual (BAU) approach assumes there is no significant change to existing travel patterns (as identified in Section 4.2.2), with the mode share generally reflecting 2016 behaviours. There would be limited investment in active transport networks under this scenario; while walking remains popular for local trips, cycling infrastructure within and around Central Precinct remains disconnected with minimal end-of-trip facilities available.

Rail would continue to be the predominant mode, with some existing suburban train commuter trips redistributing to the new Metro station at Central Precinct. There would also be some redistribution of trips between light rail and bus services to reflect the opening of the CBD and South East Light Rail (CSELR) services. There would be limited expansion of bus and light rail services under this scenario, and private vehicle usage (18 per cent) and ride share (one per cent) would remain constant.

The BAU scenario assumes that no additional transport initiatives have been completed except for the following committed and/ or underway projects:

- CBD and South East Light Rail

- More Trains More Services program to increase rail network capacity (in peak periods) on the T8 and T4 Lines
- Sydney Metro City and Southwest
- Sydney Metro West (to Eastern Harbour City CBD).

Scenario 2: Sustainable transport promoted

The 'Sustainable Transport Promoted' (STP) scenario redistributes 10 per cent of the private vehicle trips to active and public transport modes. Under this approach, local walking and cycling trips would grow through increased investment in the active transport network around Central Precinct, supported by green travel behaviour programs.

Increased bus and light rail services to Sydney's southeast has improved connectivity between the Precinct, Moore Park and Coogee, supporting the shift from private vehicles. The opening of the CSELR services has also seen the redistribution of some trips between light rail and bus along these corridors. Rail demand is also expected to increase due to the new metro connection at Central Precinct, supporting the redistribution of some private vehicle trips and suburban rail trips to the new services. Private vehicles would account for nine per cent of all commuter trips, with ride share demand remaining constant at one per cent.

The STP scenario assumes that the following transport initiatives have been completed and/ or in operation:

- CSELR
- More Trains More Services program to increase rail network capacity (in peak periods) on the T8 and T4 Lines
- Sydney Metro City and Southwest
- Sydney Metro West (to Eastern Harbour City CBD)
- New rapid bus lines linking strategic centres, employment hubs and the Harbour CBD, including Railway Square to Sutherland Hospital (via Princes Highway) and Harbour CBD to La Perouse (via Green Square and Eastgardens)
- The delivery of the Principal Bicycle Network (PBN) within South East Sydney, a co-designed network linking local centres and strategic centres across Greater Sydney and Central Precinct
- Prioritising pedestrian crossing movements along streets with a high place function by allocating more time, more often to pedestrians and implementing continuous footpath treatments.

Scenario 3: Car-free precinct

The Car-Free Precinct (CFP) scenario represents a significant mode-share shift for trips to and from the Precinct, with all private vehicle trips redistributed to other modes. Significant investment in active transport networks, reductions in road traffic volumes and speeds, and supporting travel behaviour programs and policies support a high walking and cycling mode share from surrounding precincts, drawing residents to activity and employment.

Further investment in public transport enables the expansion of the bus and light rail network, with on-road public transport given higher priority. New metro lines across Greater Sydney increase the rail catchment, supporting a broader shift away from private vehicles. Across the Precinct, an increase in point-to-point and

car-share provisions support an increase in ride share activity to two per cent of all trips.

The CFP scenario assumes that the following transport initiatives have been completed and/ or in operation:

- CSELR
- More Trains More Services program to increase rail network capacity (in peak periods) on the T8 and T4 Lines
- Sydney Metro City and Southwest
- Sydney Metro West (to Eastern Harbour City CBD and extended to Malabar/ La Perouse)
- New rapid bus lines linking strategic centres, employment hubs and the Harbour CBD, including Railway Square to Sutherland Hospital (via Princes Highway) and Harbour CBD to La Perouse (via Green Square and Eastgardens)
- The delivery of the Principal Bicycle Network (PBN) within South East Sydney, a co-designed network linking local centres and strategic centres across Greater Sydney and Central Precinct
- Additional point-to-point and car share parking across Central Precinct
- Prioritising pedestrian crossing movements along streets with a high place function by allocating more time, more often to pedestrians and implementing continuous footpath treatments.

5.2.5 Mode share scenario assessment

When comparing the availability of public transport infrastructure across the similar urban areas, Central Precinct has access to CBD scale transport provisions across a much smaller area. The Precinct has greater accessibility to public transport than the neighbouring areas of Pyrmont-Ultimo and Redfern-Chippendale, with equal or greater number of routes, services and stops across train, light rail and bus modes.

In terms of population and job density, Central Precinct will have a similar population density to Pyrmont-Ultimo and Redfern-Chippendale (134 persons per hectare), which is nearly double that of the Sydney CBD. However, Central Precinct has a much higher concentration of jobs than any of the assessed areas, with 1,432 jobs per hectare expected.

Journey to work trends highlight the attractiveness of rail when travelling into the city, with over half of all commuter trips into the Sydney CBD, Melbourne CBD and Docklands occurring via train and/ or metro services. This is likely to increase the availability and coverage of the rail network. Further out of the city centre, Pyrmont-Ultimo and Redfern-Chippendale experience higher walking and cycling activity. These areas also experience a greater proportion of commuter trips under 2.5 kilometres in comparison to the city, suggesting a higher likelihood of residing closer to work.

For the CPRP, the data suggests a BAU scenario is unlikely to be realistic. Central Precinct has a far greater availability and access to public transport, and its location to south of the Sydney CBD would support a higher active mode in comparison to the broader area. The high density of the Precinct would also increase the attractiveness of walking and cycling as opposed to private vehicle travel, with traffic congestion and parking availability impacting on vehicle travel

time. Furthermore, in the absence of changes to travel patterns, Central Precinct and the broader Sydney CBD would be unable to realistically expand road capacity to meet future car-orientated travel demands.

Both STP and CFP scenarios reflect a higher proportion of active and public transport commuter trips that would be supported by the current characteristics of Central Precinct. The STP scenario is an achievable target due to the location, access to train, bus and light rail services, and the expected investment in walking and cycling infrastructure supporting the shift in travel behaviour.

However, for a project the scale and density of the CPRP, even a small proportion of private vehicle trips may lead to increased road congestion and reduced accessibility and amenity for residents, workers and visitors. Given the sustainability and transport aspirations of the project, the STP scenario is likely better suited to a smaller scaled development.

The CFP scenario represents an ambitious target that requires significant change to culture and travel patterns. The underlying characteristics and supporting infrastructure provide a sound base to shift travel behaviour towards sustainable transport modes.

5.2.6 Adopted target mode share

The above analysis indicates:

- The concentration of public transport services, population and jobs within Central Precinct is very high in comparison to neighbouring areas and other CBD type locations. Consequently, sustainable transport modes are likely to be more attractive than the mode share distribution identified in **Scenario 1: Business as Usual**. This suggests BAU will not be reflective of likely travel patterns based on existing conditions and planned infrastructure improvements
- **Scenario 2: Sustainable Transport Promoted** is achievable and reflects the increased attractiveness of sustainable transport to the area. While the modal shift identified in this approach might be appropriate for smaller developments, the scale of activity introduced by the CPRP may conflict with the vision and aspirations of the Precinct
- **Scenario 3: Car-Free Precinct** is an approach that would enable the realisation of the vision and aspirations of the Central Precinct project. The underlying characteristics of the Precinct and expected infrastructure investment could support the desired mode shift with supporting travel behaviour programs and interventions.

It is recommended that the Car-Free Precinct (CFP) mode share target be adopted for the CPRP, as shown in Figure 5.4. These targets inform the mode share distributions used in the CPRP future development travel demand forecasts.

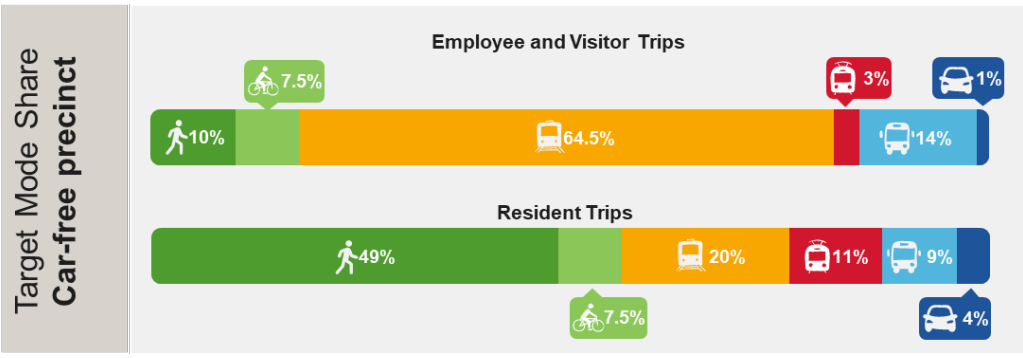


Figure 5-7: CPRP future mode share targets

The target mode share is supported by the broader road capacity constraints and spatial constraints around Central Precinct and across the Sydney, In the absence of a wider shift in travel patterns, the Precinct and the Sydney CBD would not be able to increase road space to accommodate vehicle demands as they are today.

The adoption of the CFP as a mode share target ensures that non-car-based transport is considered and assessed at the appropriate level in recognition of these capacity constraints.

It should be noted that these mode share targets reflect the movement of people only, and do not include freight and servicing trips.

5.3 Demand and trip generation assessment

5.3.1 Overview

There are many facets of trip demand across the Precinct, including transfers between transport modes, pedestrian and vehicle movements to and from the station, and non-Central Precinct related pedestrian and vehicle movements. To understand the complex interactions between public transport services, pedestrians, cyclists and private vehicles, detailed trip matrices were prepared for 2019 in both the AM and PM peak hour periods to determine the scale and direction of movement between each mode.

The development of the 2019 matrices used:

- An assessment of trip origins and destinations travelling through Central Precinct for 2019, completed by data analysts, Place Intelligence
- Opal data for train, bus and light rail movements, including transfer demands between each mode
- Traffic surveys and SCATS data
- Boarding and alighting data for bus travel
- Bus operation data.

To understand the impact of the CPRP, a series of 2036 matrices were prepared using the 2019 matrices as a base, using:

- Public transport demand was scaled up using annual growth rates and compared against outputs from the Public Transport Project Model (PTPM) to ensure the degree of growth was appropriate

- Population growth data across Central Precinct and surrounding areas was used to factor the relevant increases pedestrian only movements
- Vehicle data
- Servicing data
- Future development yields as per the proposed master plan.

A summary of this process is provided in Figure 5-5.

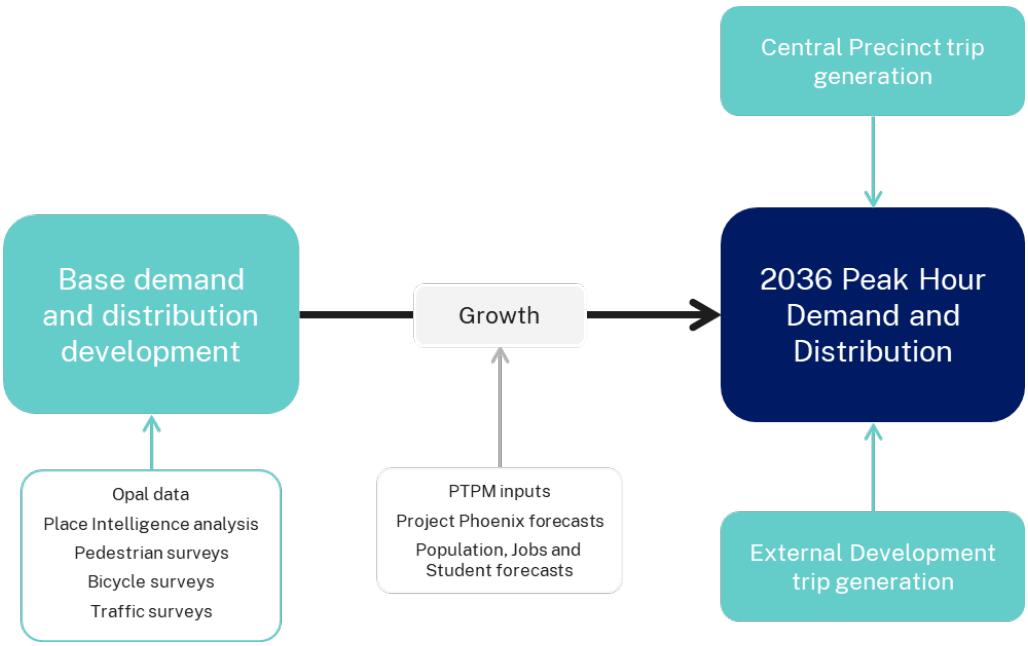


Figure 5-8: Trip generation demand development

It is recognised that pedestrian and broader travel demands are in flux, as travel patterns, behaviours and societal expectations continue to evolve following the COVID-19 pandemic. While this assessment has been completed using the revised forecasts prepared by Transport for NSW, earlier evaluations have considered higher growth patterns and movements reflective of pre-COVID-19 conditions. This has identified there is potential for a change in travel patterns and movement, with subtle changes in access or land use creating unexpected alterations to pedestrian demands within and around the precinct.

As the Precinct evolved, further work will be necessary re-evaluate and assess pedestrian impacts so opportunities and solutions can be refined ahead of implementation. To support this, continuous monitoring and surveying of the transport environment is necessary to ensure transport infrastructure and service upgrades are implemented as necessary to support the development of the Precinct as a vibrant place.

5.3.2 Background demand

The process for forecasting the background demand across Central Precinct (that is, non-development demand) was based on growing the 2019 current matrices using forecast growth rates. This process was carried out for individual platforms within Central Precinct, and for each bus stop and light rail. In general, each stop or platform (or groups of platforms, like the Sydney Terminal platforms) service specific lines and routes that service specific areas.

Within the station, arrivals at each platform were forecast by growing the movements in the current matrices by the forecast growth of population and workers in the areas services by the trains arriving at the platform. Departures from each platform were grown from current matrices by the forecast growth of employment and other activities in areas serviced by trains leaving the platform.

Growth rates were taken from the Transport for NSW land use and demographic forecasts for 2019, with adjustments made that account for the impacts of the COVID-19 pandemic on population, employment and travel rates that are lowered by working from home. Movements between platforms for interchanges between services were forecast using forecast public transport trip matrices and taking into consideration changes in services, including Sydney Metro, Sydney Metro West, changes to the South Coast Line and other potential changes in operation of the station.

For the bus and light rail demands, annual growth rates aligning with the PTPM were applied to understand the overall demand across the Central Precinct network. From there, each individual service for the Precinct was reviewed to ensure frequencies and services aligned with planned changes to the network. For transfers between different modes, the 2019 transfer distribution was maintained, with each movement reviewed individually to ensure the right balance of interaction was achieved.

While strategic models are meant to represent broad areas and their representation of localised areas is weak, the overall results of the forecasting are entirely consistent with public transport modelling.

5.3.3 Development demands

A three-step approach was used to develop the AM peak and PM peak hour trip generation for the expected future development within the CPRP. This process involved:

- Reviewing the Reference Master Plan development yields for the various land uses
- Calculating the AM peak and PM peak person trip generation for each of the proposed land uses
- Applying the adopted Target Mode share for the CPRP to understand the quantum of trips to and from Central Precinct for each mode.

Once the overall demands were calculated, the trips for each mode were distributed across the base demand movement matrix.

Trip generation calculation

In order to calculate the total trip generation of the proposed development, 'people trips' data was required for a broad range of land uses. The rates provided in the RMS/ TfNSW Guide to Traffic Generating Developments document do not include all land uses proposed as part of CPRP; for land uses that are specified, vehicle trips are the predominate dataset captured, with people trip data not available for all land uses.

To cover this gap, people trip generation rates for each land use were obtained from TRICS, a UK database that contains surveys of the vehicle and multimodal trip generation of a wide variety of sites which are classified by land use and various other attributes. Analysis of databases from other countries showed that

the weekday peak TRICS vehicle trip rates where similar to the current RMS/TfNSW rate for comparable developments, and as such was considered to be a more holistic approach to determining overall trip generation. This approach was agreed to by TfNSW in 2019.

The calculation of goods trip generation associated with the Central Precinct development is outlined in Section 5.8.2.

The trip rates used for the assessment of the Central Precinct development are provided in Table 5-9.

Table 5-9: Land use trip generation rates

Land Use	Trips per 100 m² GFA			
	AM arrival	AM departure	PM arrival	PM departure
Community	2.98	0.13	0.13	2.15
Education	0.62	0.1	0.38	0.44
Food & beverage	1.16	0.59	1.59	1.83
Hotel	0.15	0.18	0.21	0.17
Office	2.98	0.13	0.13	2.15
Residential	0.08	0.44	0.28	0.16
Retail	1.16	0.59	1.59	1.83
Student housing	0.08	0.44	0.28	0.16

Resultant demands

The trip generation rates, along with the mode share distributions, were then applied to the development to identify the total number of trips for each building in the AM peak and PM peak periods (for both arrival and departing movements) for each mode. The trip demand generated by the proposed development are summarised in Table 5-10 and Table 5-11.

Table 5-10: Central Precinct development demand – AM peak hour

Area	Mode Share (trips)					
	Walking	Cycling	Train/ Metro	Light Rail	Buses	Car
Community	58	47	353	23	80	12
Education	35	28	222	12	50	6
Food & beverage	41	34	214	23	55	20
Hotel	18	15	106	8	24	4
Office	827	626	5,257	262	1,154	102
Residential	248	42	101	59	49	24
Retail	21	21	60	20	23	20
Student housing	58	11	25	15	12	7
Total	**1,306**	**824**	**6,338**	**422**	**1,447**	**195**

Table 5-11: Central Precinct development demand – PM peak hour

Area	Mode Share (trips)					
	Walking	Cycling	Train/ Metro	Light Rail	Buses	Car
Community	45	35	259	18	60	11
Education	41	32	252	14	56	6
Food & beverage	68	57	405	28	94	22
Hotel	20	16	122	8	28	4
Office	610	465	3,857	196	849	80
Residential	214	34	88	53	42	21
Retail	25	24	108	20	30	20
Student housing	51	10	21	13	11	6
Total	**1,074**	**673**	**5,112**	**350**	**1,170**	**170**

5.3.4 Demand summary

The demand generation assessment determined the proposed development of Central Precinct is expected to generate 10,532 trips in the AM peak hour and 8,549 trips in the PM peak hour.

Figure 5-9 and Figure 5-10 provide a summary of the overall movements within Central Precinct in 2036 for the AM and PM peak hours.

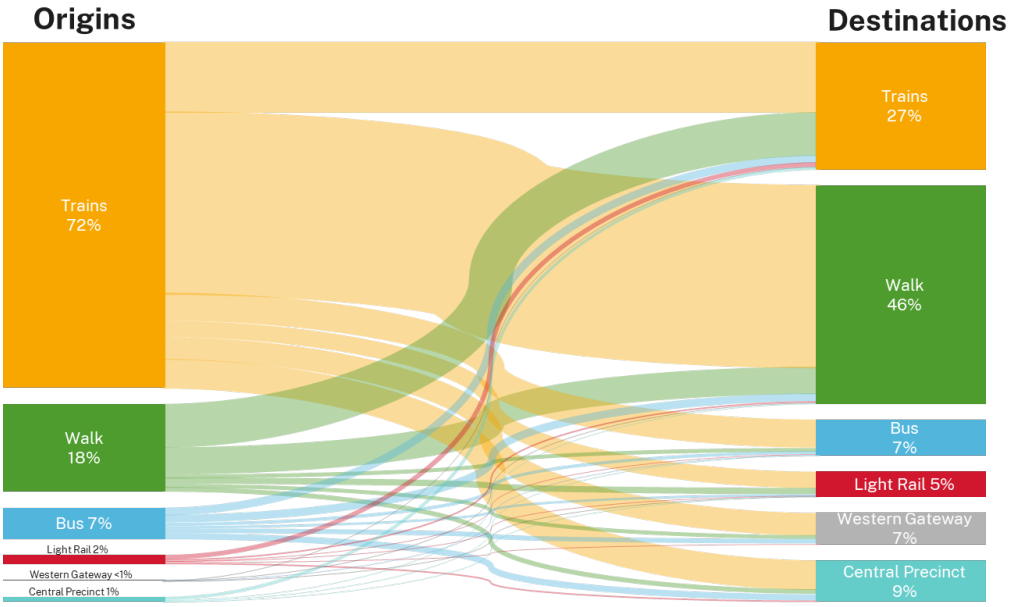


Figure 5-9: 2036 AM Central Precinct demand

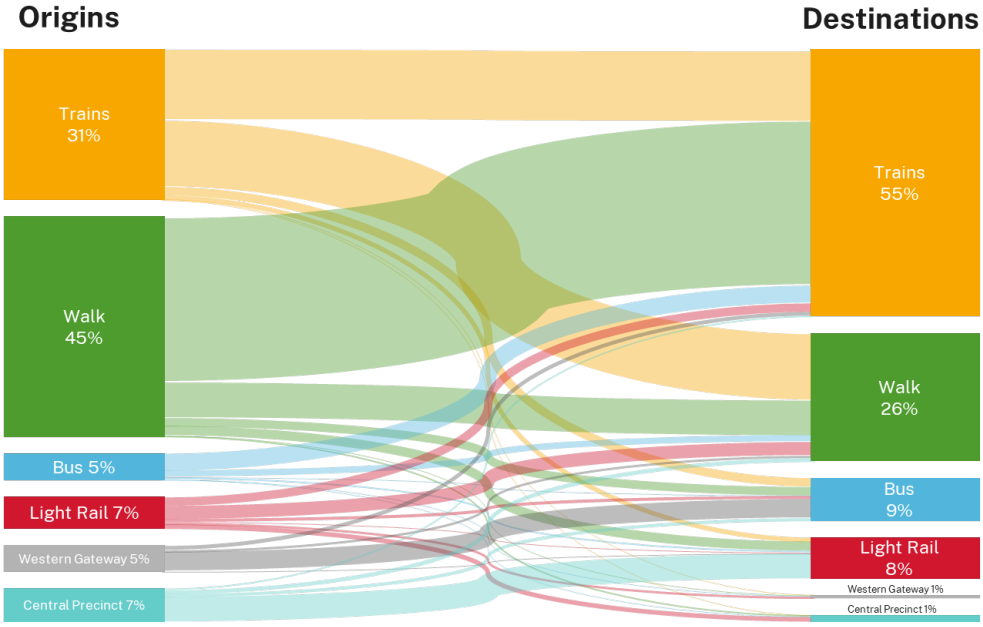


Figure 5-10: 2036 PM Central Precinct demand

5.4 Pedestrian assessment

5.4.1 Street level pedestrian analysis

The future pedestrian demand around Central Precinct will comprise train, bus and light rail passenger demand, pedestrians travelling to and from the proposed development, and background pedestrian movement (trips not associated with public transport or surrounding development).

With the high active and public transport target mode share for Central Precinct, there is expected to be a high portion of pedestrian movement to and from the proposed development. The future development of Central Precinct is forecasted to account for four per cent of all pedestrian movements within the Precinct. Given the low proportion, the impact of walking trips generated by Central Precinct

development on the study area and surrounding pedestrian network is considered minimal compared to the impact of the forecasted growth within the Precinct.

Pedestrian demand in 2036 across Central Precinct is expected to increase by 105 per cent on 2019 demand. Given this expected growth, the assessment of pedestrian infrastructure included in this section has been completed to ensure that the planning of the pedestrian environment is consistent with the vision of Central Precinct.

The expected key routes and future distribution of pedestrian trips to/ from Central Precinct during the AM peak period are shown in Figure 5-11. This shows the major pedestrian desire lines extending outward of Central Station towards:

- Ultimo and the Railway Square bus interchange, heading across Lee Street and George Street west of Central Station
- Haymarket, across the intersection of Pitt Street and Eddy Avenue
- Belmore Park and the Eddy Avenue bus interchange, crossing at the pedestrian signals on Eddy Avenue
- Surry Hills, crossing at the intersection of Elizabeth Street and Foveaux Street
- East-west (and west-east) across Central Station.

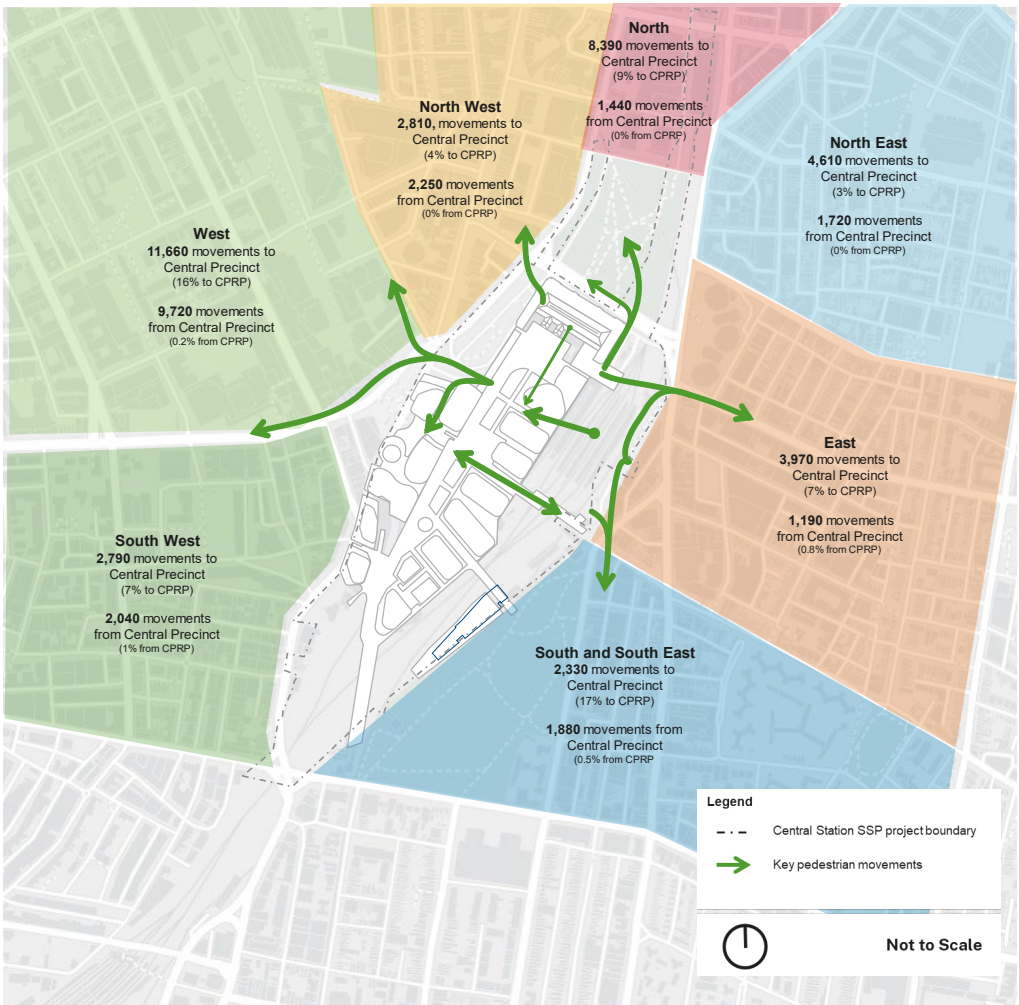


Figure 5-11: AM peak future key pedestrian routes and movement distribution

The pedestrian demands shown in Figure 5-11 reflect the movements between Central Station and the proposed development to the boundaries of the study area, or other key transport nodes within the precinct (such as bus and light rail stops).

Dynamic modelling was completed as part of the External Precinct model (as outlined in Section 5.1.1) Detailed analysis has identified that the footpaths and pedestrian crossings around Central Station will remain congested in 2036. The external pedestrian movement corridors identified above expected to increase in future years, placing significant pressure at the intersections and limiting their ability to function safely and efficiently.

The demand for existing elements of the Precinct will increase between 10 and 100 per cent between 2019 and 2036 during the morning peak. However, direct impact from demand associated with CPRP is low, accounting for between 0.2 and 9 per cent of movement on the footpath network in the surrounding precinct.

A summary of the performance of the change in pedestrian demands in intersections across the precinct are identified in Table 5-12 and Table 5-13.

Table 5-12 Demand increase from 2019 to 2036 AM peak hour

Intersection location	Two-way AM Peak hour pedestrian volumes		
	2019	2036 'Without project'	2036 'With project'
Harris St/ George St/ Broadway	5,210	5,760	5,890
Pitt Street/ George Street/ Lee Street	8,600	9,440	9,630
Pitt Street/ Eddy Avenue	5,040	9,350	9,370
Eddy Street pedestrian signals	5,260	5,670	5,790
Elizabeth Street/ Foveaux Street	8,890	13,050	13,340
Elizabeth Street pedestrian signals	2,110	3,450	3,500
Chalmers Street/Devonshire Street	5,960	6,530	6,680

Table 5-13 Demand increase from 2019 to 2036 PM peak hour

Intersection location	Two-way PM Peak hour pedestrian volumes		
	2019	2036 'Without project'	2036 'With project'
Harris St/ George St/ Broadway	5,210	5,760	5,890
Pitt Street/ George Street/ Lee Street	8,600	9,440	9,630
Pitt Street/ Eddy Avenue	5,040	9,350	9,370
Eddy Street pedestrian signals	5,260	5,670	5,790
Elizabeth Street/ Foveaux Street	8,890	13,050	13,340
Elizabeth Street pedestrian signals	2,110	3,450	3,500
Chalmers Street/Devonshire Street	5,960	6,530	6,680

The results of pedestrian modelling conducted of key intersections across the Precinct have been reported in Table 5-14**.** Performance was measured against the following LOS criteria:

- Fruin LOS criteria for walkways – when assessing the crosswalk areas and to understand peak density in footpath locations areas where pedestrian movement is expected.
- Fruin LOS criteria for queueing areas – on the sidewalk or corners of intersections where pedestrians wait at traffic lights.
- The Walking Space LOS criteria for footpaths – to understand overall level of comfort on footpaths and other non-transport interchange areas. (

Fruin LOS pedestrian density maps of intersections reported on in Table 5-14 can be found in *Appendix C – Precinct transport model results*.

The average LOS experienced during the 15-minute peak demand period (8.45am to 9.00am) was reported. Results are based on experienced density, which measures the density within the immediate vicinity of each individual pedestrian.

Table 5-14 AM peak pedestrian performance at intersections

Location	AM peak hour average – walkways	AM peak hour average – queuing areas	Compliance
City Square to Henry Deane Plaza development	C	-	Yes
Intersections			
George Street/ Regent Street/ Harris Street	C	B	Yes
George Street/ Pitt Street/ Lee Street	C	C	Yes
Lee Street – pedestrian signals	C	A	Yes
Pitt Street/ Eddy Avenue	F	F	No
Eddy Avenue – pedestrian signals	C	D	No
Elizabeth Street/ Foveaux Street	F	F	No
Elizabeth Street – pedestrian signals	B	A	Yes
Chalmers Street/ Devonshire Street	C	A	Yes
Walkways			
Goods Line pedestrian tunnel	B	-	Yes
Light rail waiting areas			
Haymarket light rail station	-	B	Yes
Central Chalmers light rail station	-	A	Yes

As detailed above, three intersections were identified as not meeting the LOS criteria for queuing in the AM or PM peak periods. These locations are further considered below.

Pitt Street and Eddy Avenue

Moderate pedestrian growth is expected on Pitt Street and Eddy Avenue between 2019 and 2036, with 9,370 movements associated with CPRP and 9,350 movements in a 'No development scenario". Without CPRP, the intersection is expected to be overcapacity in 2036, and may not function adequately without intervention. Figure 5-12 shows the Fruin LOS (Footpath) on the approach to the intersections for both the AM and PM peak hours.

Intervention will be required to ensure the intersection adequately manages the competing movements of pedestrians, buses and light rail. Further investigation and consultation with stakeholders to ensure any intersection upgrades provide the best outcome for the pedestrian and transport network.

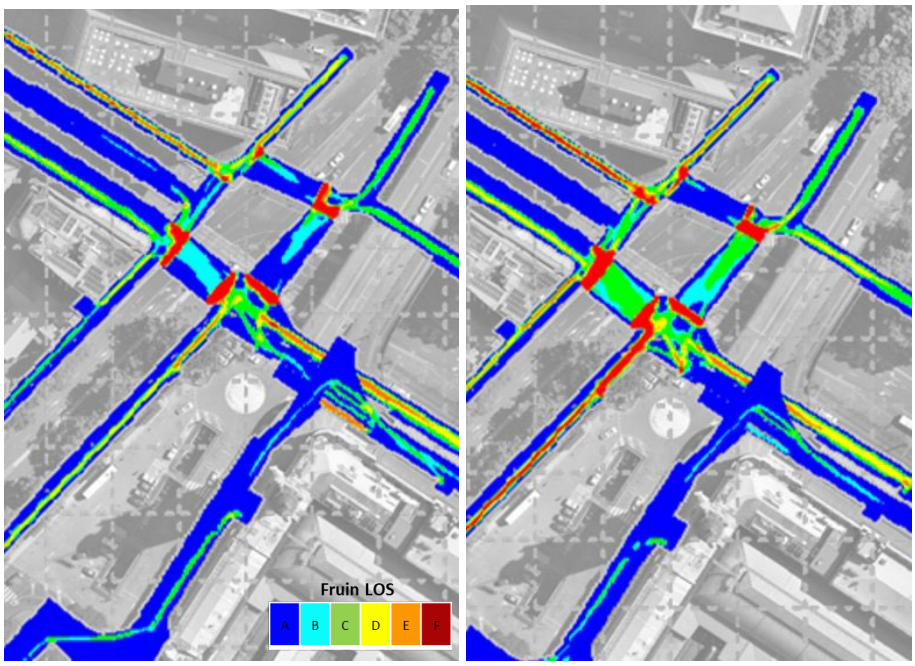


Figure 5-12 2036 AM (left) and PM (right) peak hour pedestrian movements on Pitt Street and Eddy Avenue

Eddy Avenue pedestrian signals

The pedestrian signals on Eddy Avenue are expected to have a moderate level of growth 2019 and 2036, with 5,790 movements associated with CPRP and 5,670 movements in a 'No development scenario". Similar to the intersection of Eddy Avenue and Pitt Street, the intersection is expected to be overcapacity in 2036 without Central Precinct, and may not function adequately without intervention. Figure 5-13 shows the Fruin LOS (Footpath) on the approach to the pedestrian signals for both the AM and PM peak hours.

Intervention will be required to ensure the intersection adequately manages the competing movements of pedestrians, cyclists, buses and light rail. Further investigation and consultation with stakeholders to ensure any intersection upgrades provide the best outcome for the pedestrian and transport network.

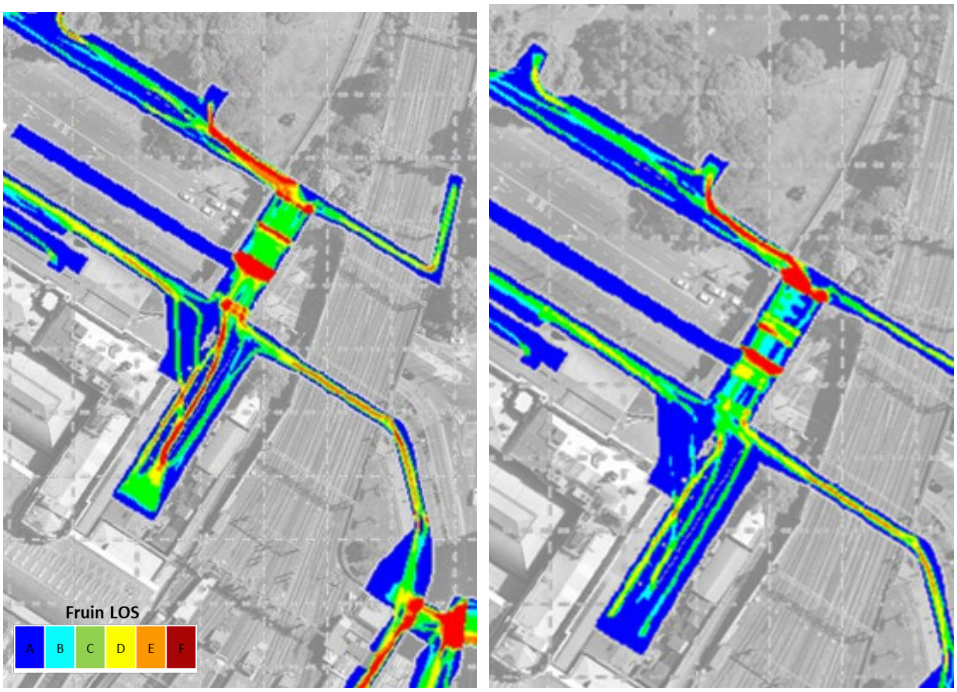


Figure 5-13 2036 AM (left) and PM (right) peak hour pedestrian movements on Eddy Avenue near pedestrian signals

Elizabeth Street and Foveaux Street

The intersection of Elizabeth Street and Foveaux Street currently experiences issues with queuing at the intersection, and this is expected to continue into 2036 without intervention. In 2036, the intersection is expected to have 13,340 pedestrian movements with CPRP, and 13,050 movements in a 'No development scenario". Figure 5-14 shows the Fruin LOS (Footpath) on the approach to the intersection for both the AM and PM peak hours.

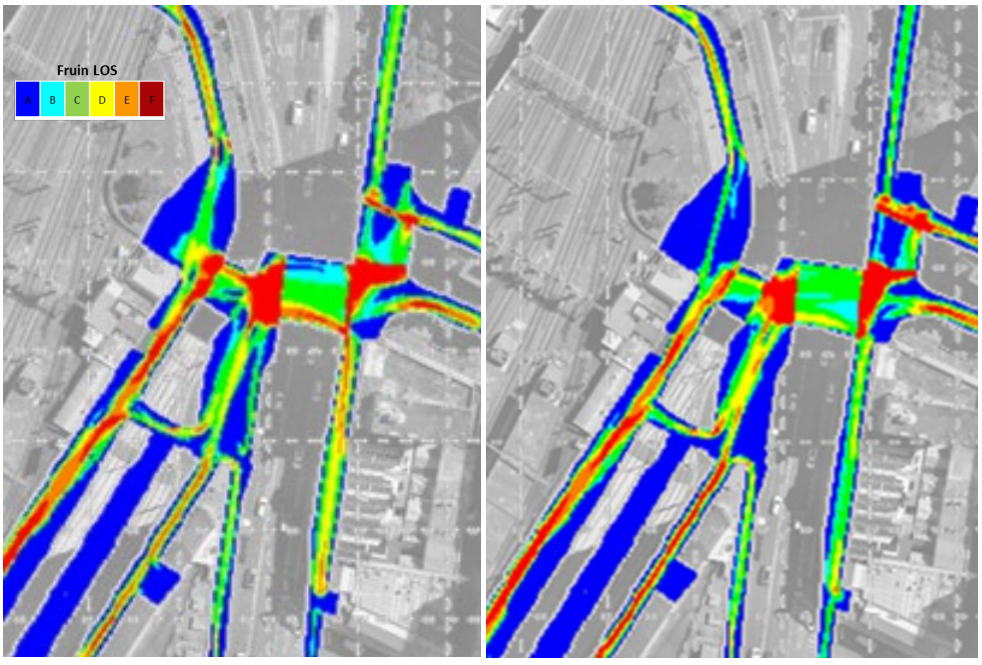


Figure 5-14 2036 AM (left) and PM (right) peak hour pedestrian movements near Elizabeth Street and Foveaux Street

Intervention is needed in the short to medium term to resolve pedestrian congestion at the intersection, as well as remove the existing conflict with the Elizabeth Street cycleway. Further investigation and consultation with stakeholders to ensure any intersection upgrades provide the best outcome for the pedestrian and transport network.

Walking Space Guide assessment

The results of pedestrian modelling for the footpath network across the Precinct Transport Model for the AM peak hour have been reported in Table 5-15. Performance was measured against the following LOS criteria:

- The Walking Space LOS criteria for footpaths – to understand overall level of comfort on footpaths and other non-transport interchange areas. A LOS C or better is required for satisfactory performance.

Table 5-15 Walking Space Guide Assessment – 2036 AM Peak hour

Location	Available width	Without CPRP		With CPRP	
		Pedestrian flow rate	LOS	Pedestrian flow rate	LOS
George Street, midblock between Harris St and Quay St (N)	6.6m	2,280	B	2,330	B
George Street, midblock between Harris St and Quay St (S)	4.0m	3,280	E	3,350	E
Lee Street, above the Goods Line (W)	4.0m	1,810	C	1,840	C
Lee Street, above the Goods Line (E)	4.3m	1,200	A	1,220	A
Pitt Street, between Lee St and Eddy Av (W)	4.1m	640	B	640	B
Pitt Street, between Lee St and Eddy Av (E)	4.3m	1,240	B	1,240	B
Pitt Street, north of Eddy Av (W)	3.1m	1,650	D	1,650	D
Pitt Street, north of Eddy Av (E)	3.8m	1,300	C	1,300	C
Eddy Avenue, along Colonnade (S)	4.3m	2,960	D	3,030	D
Eddy Avenue, adjacent to Bus Stand B (N)	2.7m	1,400	E	1,430	E
Eddy Avenue, east of the Pedestrian signals (N)	3.8m	1,360	C	1,390	C
Eddy Avenue, east of the Pedestrian signals (S)	6.1m	2,490	C	2,540	C
Elizabeth Street, south of the T5 bus stop (W)	3.6m	2,280	D	2,310	D
Elizabeth Street, south of the T5 bus stop (E)	4.0m	1,070	C	1,090	C
Rawson Place, midblock between Pitt St and George St (N)	4.0m	1,780	C	1,780	C

Location	Available width	Without CPRP		With CPRP	
		Pedestrian flow rate	LOS	Pedestrian flow rate	LOS
Rawson Place, midblock between Pitt St and George St (S)	5.0m	1,810	B	1,810	**B**
Chalmers St, midblock between Randle St and Elizabeth St (E)	4.7m	2,220	C	2,270	**C**
Chalmers St, midblock between Randle St and Elizabeth St (W)	8.0m	4,870	D	4,970	**D**

Based on the Walking Space Guide assessment, the following locations were identified as not achieving a LOS C in the AM peak periods.

- On the southern side of George Street, midblock between Harris Street and Quay Street
- Along the western side of Pitt Street, north of Eddy Avenue
- On the southern side of Eddy Avenue along the station colonnade
- On the northern side of Eddy Avenue, adjacent to Bus Stand B
- On the western side of Elizabeth Street, south of the T5 bus stop
- On the western side Chalmers Street, midblock between Randle Street and Elizabeth Street adjacent to the Light Rail stop

For each of these locations, the observed LOS was similar for both the CPRP and 'No Development' scenarios. While the footpaths across the precinct generally operate at a FRUIN LOS C or better, the Walking Space Guide assessment highlights where the growth in pedestrian demand may lead to undesirable amenity outcomes for pedestrians. With the exception of the Chalmers Street location, each of the locations identified should be considered for road space reallocation in line with *the TfNSW Road Space Allocation Policy and Procedure*.

It should be noted that pedestrian demands are in flux, with various changing factors that would impact on demand. Continuous monitoring and surveying of the transport environment is necessary to ensure additional pedestrian upgrades are implemented as necessary to support the development of the Precinct as a vibrant place.

A summary of the locations identified for further investigation to resolve pedestrian congestion are shown in Figure 5-13.

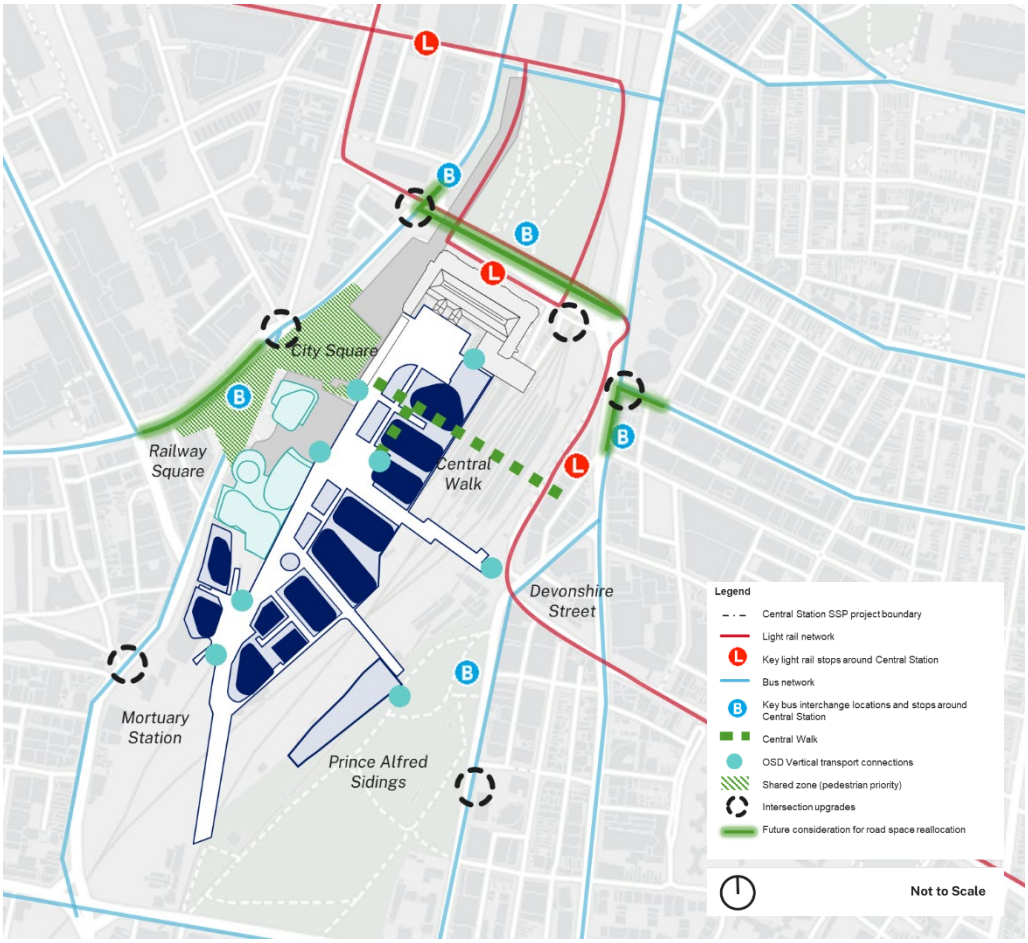


Figure 5-15: Future potential pedestrian upgrades around Central Precinct

5.4.2 OSD pedestrian analysis

The OSD pedestrian network was modelled within the over station model (as outlined in Section 5.1.1). It included access to the OSD via stairs and escalators, and major walkways across the deck.

Vertical connections, including stairs, escalators and elevators have been provided at key locations around the OSD to support accessible movements from the surrounding street and footpath network to the deck. The connections include those from within Central Station, Chalmers Street to the east, Lee Street and Regent Street to the west, and from Prince Alfred Park to the south. The mix and spread of the vertical connections ensure that people of all ages and abilities can safely access the OSD from the surrounding area, and support pedestrian through movement across the rail corridor.

Figure 5-16 shows the location of the vertical transport connections assessed within the over station model.

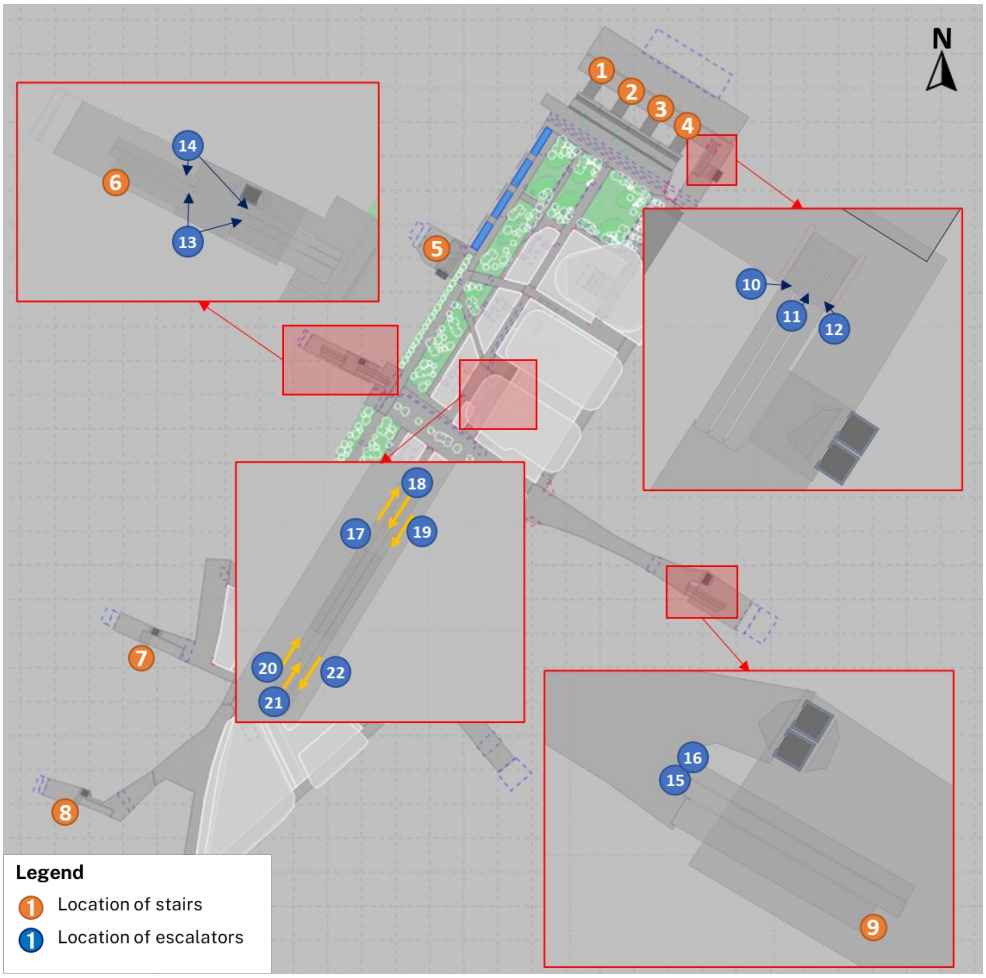


Figure 5-16 Location of stairs and escalators to the OSD

The performance of walkways has also been assessed, including main movement corridors and critical connections to vertical transport. Three north-south walkways enable movement across the deck, and the demand across them have been adjusted to varying degrees to produce the base case scenario in the over station model:

- Walkway 1 – Passing by green spaces and water features on the deck. Seating will be provided along this walkway
- Walkway 2 – Passing by green spaces on the deck and providing access to four buildings
- Walkway 3 – The primary north-south movement corridor across the deck will provide access to the commercial lobbies of most buildings on the deck. The demand on this walkway was increased in the stress test scenario

Figure 5-17 shows the location of the walkways.

Figure 5-17 North-south movement corridor

An assessment of walkways across the deck against the Fruin LOS criteria identified that all but one connections operate at Fruin LOS A. The area near building A1 operates at LOS B. In the PM peak hour, the OSD performed similar to the AM peak hour, with all tested walkways across the deck operating at Fruin LOS A.

The Fruin density maps of the walkways on the OSD for the AM and PM peak hours are presented in Figure 5-18 and Figure 5-19, and a summary of the results is presented in Table 5-16.

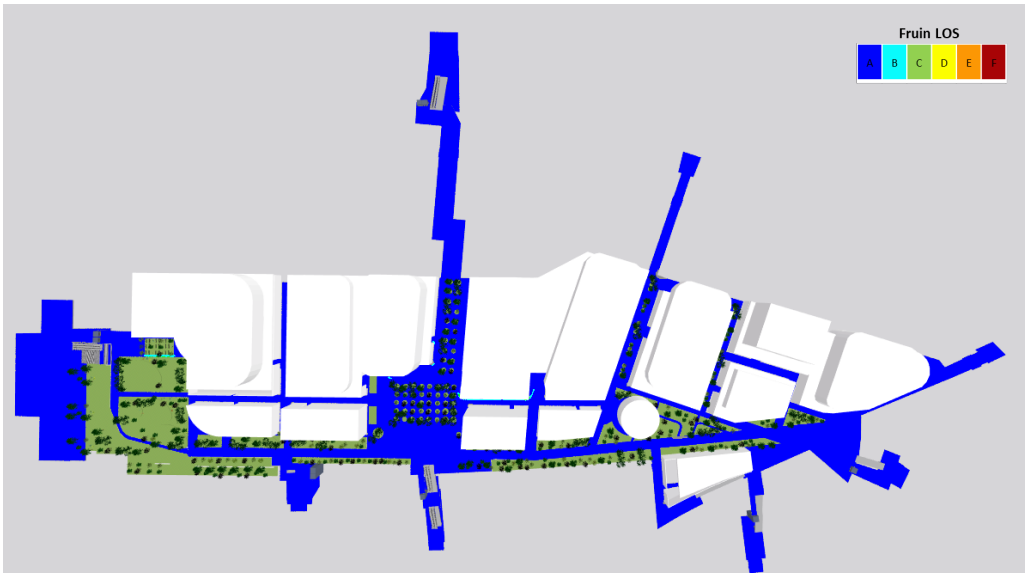


Figure 5-18 OSD AM peak hour Fruin LOS

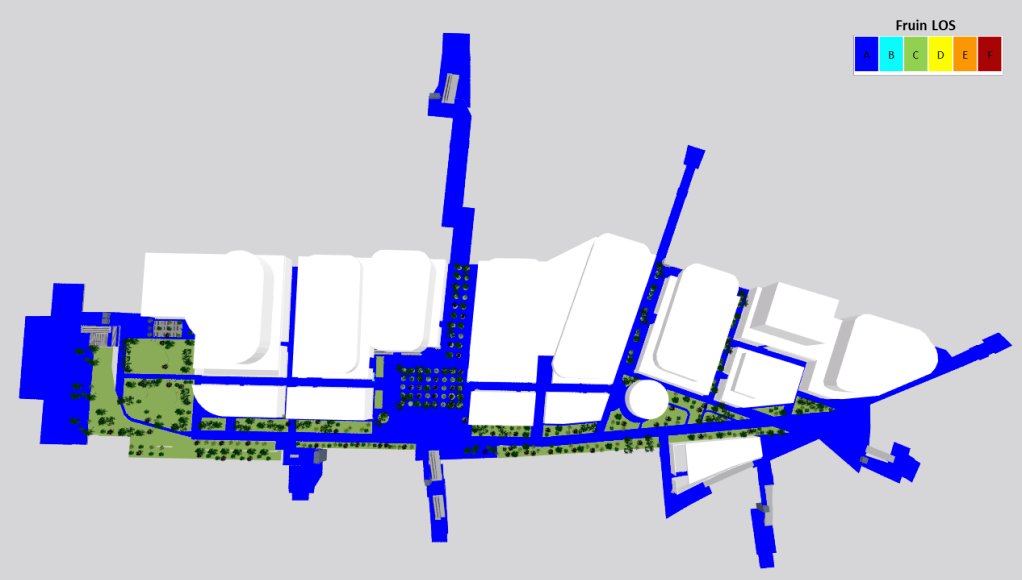


Figure 5-19 OSD PM peak hour Fruin LOS

Fruin LOS A is observed across the majority of the deck, indicating free circulation and high-quality service for pedestrians. The areas where the highest density of pedestrian flow is located near the access to the Central Walk escalators, as well as along Walkway 3 south of the Devonshire Street walkway and leading into buildings B1 and B2.

Model findings indicate that the performance of the majority of stairs and ramps connecting to the OSD would operate at LOS A during commuter peak periods, with the critical connection being the escalators to Central Walk, which would operate at LOS C in the morning peak hour and LOS B in the afternoon peak hour.

Table 5-16 OSD AM and PM peak hour modelling summary

Location	AM Peak hour Fruin LOS	PM Peak hour Fruin LOS	Compliance
Walkway 1	A	A	Yes
Walkway 2	A	A	Yes
Walkway 3	A	A	Yes
Grand Concourse	A	A	Yes
E-W walkway at A1	A	A	Yes
Central Walk (south)	A	A	Yes
Central Walk (west)	A	A	Yes
Mortuary Station	A	A	Yes
Prince Alfred Sidings	A	A	Yes
Devonshire Street	A	A	Yes
Staircases	A	A	Yes
Escalators	C*	B*	Yes

Note: * Observed worst LOS recorded for all escalators in model.

The results of pedestrian modelling for the footpath network across the Precinct Transport Model for the AM and PM peak hour have been reported in Table 5-17. Performance was measured against the following LOS criteria:

- The Walking Space LOS criteria for footpaths – to understand overall level of comfort on footpaths and other non-transport interchange areas. A LOS C or better is required for satisfactory performance.

Table 5-17 OSD AM and PM peak hour Walking Space Guide assessment summary

Location	Available width	AM Peak hour		PM Peak hour	
		Pedestrian flow rate	LOS	Pedestrian flow rate	LOS
OSD north-south Walkway 1	6.0m	240	A	100	A
OSD north-south Walkway 2	4.0m	240	A	70	A
OSD north-south Walkway 3, adjacent to Building B1	5.0m	3510	D	2160	C
OSD north-south Walkway 3, adjacent to Building B4	5.0m	1560	C	1310	B
OSD Walkway Devonshire Street	11.8m	1400	A	810	A

The analysis shows that the design of the walkways across the OSD is generally sufficient and achieves a Walking Space Guide LOS C, however some congestion was identified on Walkway 3 between Building B1 and B3, where a LOS D was recorded in the AM Peak hour. This is due to the location of the building entrances along this walkway within the model environment, and could be resolved through detailed design at a later DA stage.

The analysis shows that the design of the walkways across the OSD and the associated vertical transport connections is generally sufficient, and will safely accommodate the forecasted pedestrian demands for the Precinct. It is recommended the future design of the OSD target an LOS C in accordance with the Walking Space Guide, to ensure sufficient space is produced to provide a comfortable walking experience.

Detailed modelling results are reported in *Appendix D – Over station model results.*

5.5 Cyclist assessment

The urban design and renewal of Central Precinct looks to provide a sustainable, connected and customer friendly environment. Because of this, the development at Central Precinct will look to promote and support cycling as much as possible.

At the Precinct level, the changes to cycling infrastructure to support activity at Central Station and Central Precinct is significant and would improve the safety and efficiency of trips for all cyclists travelling through the Precinct. The overall impact of cycling trips generated by the proposed Central Precinct is considered minimal in comparison to the induced demand across the network. Demand for bicycle parking within Central Precinct is expected to be largely driven by the proposed development, with most spaces allocated to future development rather than for commuter use.

Based on current information, the anticipated cycling trips to and from Central Precinct are summarised in Table 5-18.

Table 5-18: Future cycling trips – AM and PM peak periods

Future cyclist demand forecast	AM peak hour		PM peak hour	
	Trips to precinct	Trips from Precinct	Trips to precinct	Trips from Precinct
Station cyclist demand	506	126	253	379
Future development cyclist demand	706	118	130	543
TOTAL	**1,212**	**244**	**383**	**922**

The CPRP proposes several cycling connections around Central Precinct, formalising north-south cycling corridors either side of the precinct, as well as providing opportunities for an east-west connection along Eddy Avenue corridors. Local cycling access is provided directly into the precinct via Prince Alfred Park, along the Railway Colonnade from Hayes Street to the north, and via the Goods Line extension from the west into Mortuary station.

The new and updated cycling links introduced by CPRP, and their connection to the broader cycling network, is shown in Figure 5-20.

The cycling and active transport network across Central Precinct have been planned to provide a mix of through-routes around the precinct, and local connections to the station and the OSD. While through-site cycling connection would be ideal in linking across the rail corridor, the technical complexity of building over the tracks, traversing significant level change and integrating with existing heritage poses challenges to providing cycle access across the site at deck level.

The use of the Goods Line extension and Devonshire Tunnel were contemplated as commuter-level cycling links, however it was found that the interface with the plazas and spaces at the end of these connections impacted on the suitability of the use of these links as a high-speed cycling corridor.

The Goods Line extension, with its potential for a bicycle parking hub to be located along its length, has been identified as a local access route, that will provide cycling connections to development and local activity within the precinct.

At the Precinct level, the changes to cycling infrastructure to support activity at Central Station and Central Precinct is significant and would improve the safety and efficiency of trips for all cyclists travelling through the Precinct. The overall impact of cycling trips generated by the proposed Central Precinct is considered minimal in comparison to the induced demand across the network. Demand for bicycle parking within Central Precinct is expected to be largely driven by the proposed development, with most spaces allocated to future development rather than for commuter use.

Due to the expected increase in pedestrian demands, existing pinch points along the Chamber Street/ Elizabeth Street cycleway may see an increased potential of conflict between pedestrians and cyclists. Increased pedestrian demands across the intersection of Elizabeth Street and Foveaux Street impact on the north-south cycleway at this location, with pedestrians waiting on the footpath where the

separated cycleway intersects. While this is an existing issue, it is recommended that the issue be further investigated to identify a solution.

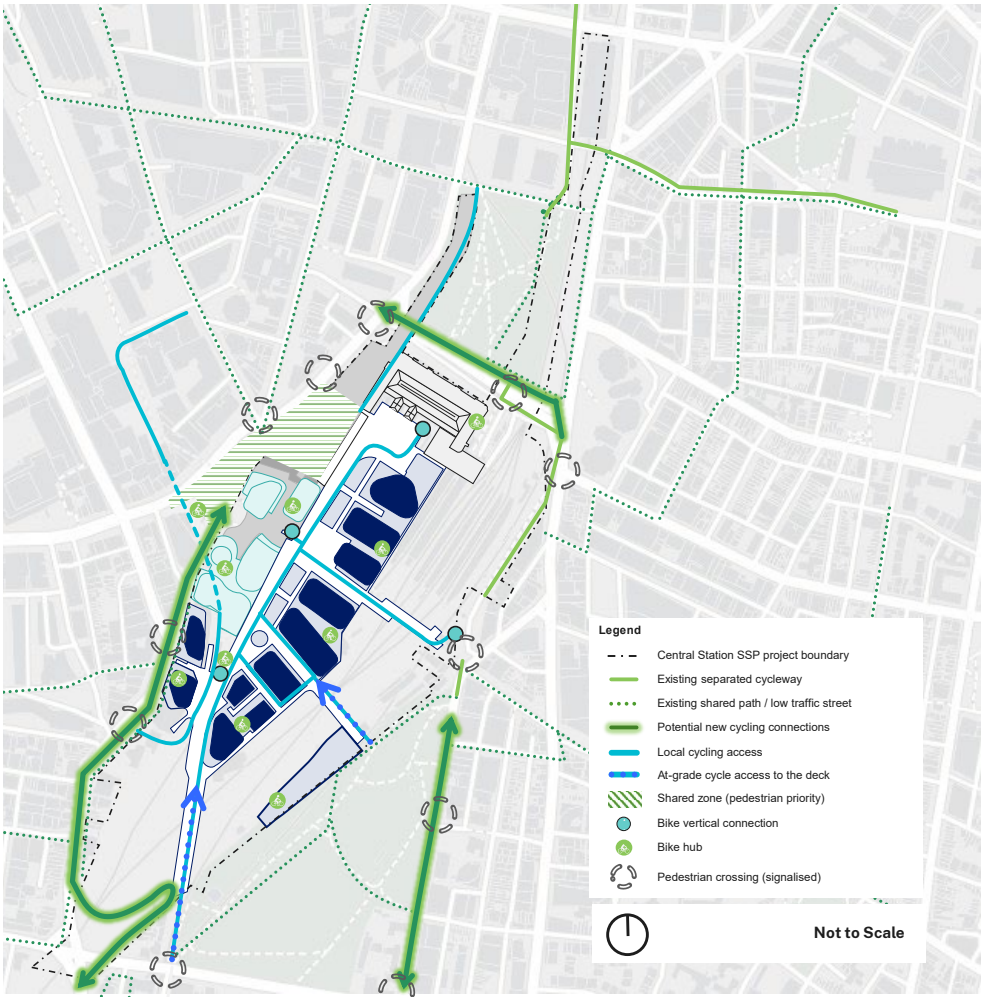


Figure 5-20: Future Cycling network around Central Precinct

The City of Sydney Development Control Plan (DCP) 2012 specifies minimum parking rates and standards for bicycle facilities, for new development within the CBD. Assuming these rates were adopted for Central Precinct , the scale of cycle parking facilities required for the assumed Precinct mix of land use, is presented in Table 5-19.

Table 5-20 summarises the required number of long-term and short-term bicycle parking spaces for Central Precinct by adopting the of Sydney DCP 2012 bicycle parking rates.

The assessment identifies that the adoption of the bicycle parking rates of the Sydney DCP would require the concept master plan to provide approximately 3,338 long-term (staff, student and residential) bicycle parking spaces and 1,062 short-term (visitor) bicycle parking spaces.

Table 5-19: City of Sydney DCP 2012 bicycle parking rates

Land Use	Residents/ Employees (long-term)	Customers/ visitors (short-term)
Residential	1 per dwelling	1 per 10 dwellings
Student accommodation[1]	1 per dwelling	1 per 10 dwellings
Hotel	1 per 4 staff	1 per 20 rooms
Commercial	1 per 150 m^2	1 per 400 m^2
Retail	1 per 250 m^2	1 per 400 m^2
Education	1 per 10 staff + 1 per 10 students	
Community[2]	1 per 1000 m^2	1 per 200 m^2

1 The Residential bicycle parking rate has been adopted to understand the likely bicycle parking requirements of Student Accommodation within the SSP

2 The Residential bicycle parking rate has been adopted to understand the likely bicycle parking requirements of community within the SSP.

Table 5-20: Central Precinct Development bicycle space requirement

Land use	Quantity	Measure	Bicycle parking requirement	
			Long-term	Short-term
Residential	508	dwellings	508	51
Student accommodation	266	rooms	266	27
Hotel[1]	578	staff	144	-
	481	rooms	-	24
Commercial	257,464	m^2	1,716	644
Retail	22,921	m^2	92	229
Education	5,952	m^2	595	-
Community	17,356	m^2	17	87
		Total	**3,338**	**1,062**

1 Hotel staff rate assumes 12 staff for every 10 rooms (4 Star hotel standard, World Tourist Organization)

Comparing the of Sydney DCP 2012 bicycle parking rate to the proposed mode share, bicycle parking for long-term users falls slightly short of the 7.5 per cent target of 3,560 trips for residents and workers to the Precinct. A higher bicycle parking rate for long-term users within the proposed Planning Framework for Central Precinct would support the adoption of the target mode share.

The Reference Master Plan identifies six locations for future long-term bicycle parking:

- Within Eddy Plaza adjacent to the Terminal building,
- On the deck above Central Station, within:
  - Block A

  - Block B
  - Block C, near the access cross the railway corridor to Prince Alfred Park
- At street level within Block D, near Regent Street
- Underneath Railway Square, adjacent to the Goods Line (outside of the SSP boundary).

Spatial assessments are currently being completed to determine the area required at each of these locations to provide the right quantum of long-term bicycle parking for Central Precinct. End of trip facilities, including showers and lockers, would also be provided at each location consistent with the requirements of the of Sydney DCP 2012.

Further identification of short-term bicycle parking areas across the Precinct at convenient locations for visitors will be determined as the Precinct master plan is further refined.

5.6 Public transport assessment

5.6.1 Trains and metro

The Central Station modelling has been updated to reflect the revised station layout, with this section of the assessment updated with the results of the updated pedestrian modelling outputs.

As Sydney's busiest railway station, demand through Central Station is expected to grow, both in passengers on the suburban and regional rail services, and with the opening of the Sydney Metro platforms.

The location and proximity of the proposed Central Precinct to Central Station is expected to generate high demands, with the direct connection from Central Walk West up to the OSD. Based on the trip generation assessment, the future development of Central Precinct would add 6,580 additional train and/ or metro passenger trips into Central Station during the morning peak hour, and 5,360 additional trips during the evening peak hour.

Table 5-21 provides a summary of train and metro commuter trips within the study area.

The proposed Central Precinct is anticipated to comprise eight per cent of all train and metro trips through Central Station in 2036, with many of these movements directed into new vertical connections up to the proposed OSD. Overall, passenger trips through Central Station are expected to increase by 95 per cent on 2019 demands, in part due to overall growth across the network and due to the opening of the Sydney Metro platforms.

Table 5-21: Train and Metro trip generation (2036 AM and PM peak hours)

	AM peak hour		PM peak hour	
	Trips	Percentage	Trips	Percentage
Central Precinct development	6,580	10%	5,360	9%
Non-development trips (including transfers between train services)	57,900	90%	55,500	91%
Total	**64,500**	**100%**	**58.900**	**100%**

A summary of the key movements within Central Station and its connections to Central Precinct in the 2036 AM peak hour are provided in Figure 5-21.

Dynamic pedestrian modelling was completed within the internal station model (as outlined in Section 5.1.1) to understand the increased passenger demands due to background growth and the expected demand associated with the development of Central Precinct. Fruin density maps of Central Station for the peak 15 minutes recorded within the AM peak hour for Central Walk East, Central Walk West, the southern entrance and the suburban platforms Figure 5-22 to Figure 5-25 with a summary of the results presented in Table 5-22.

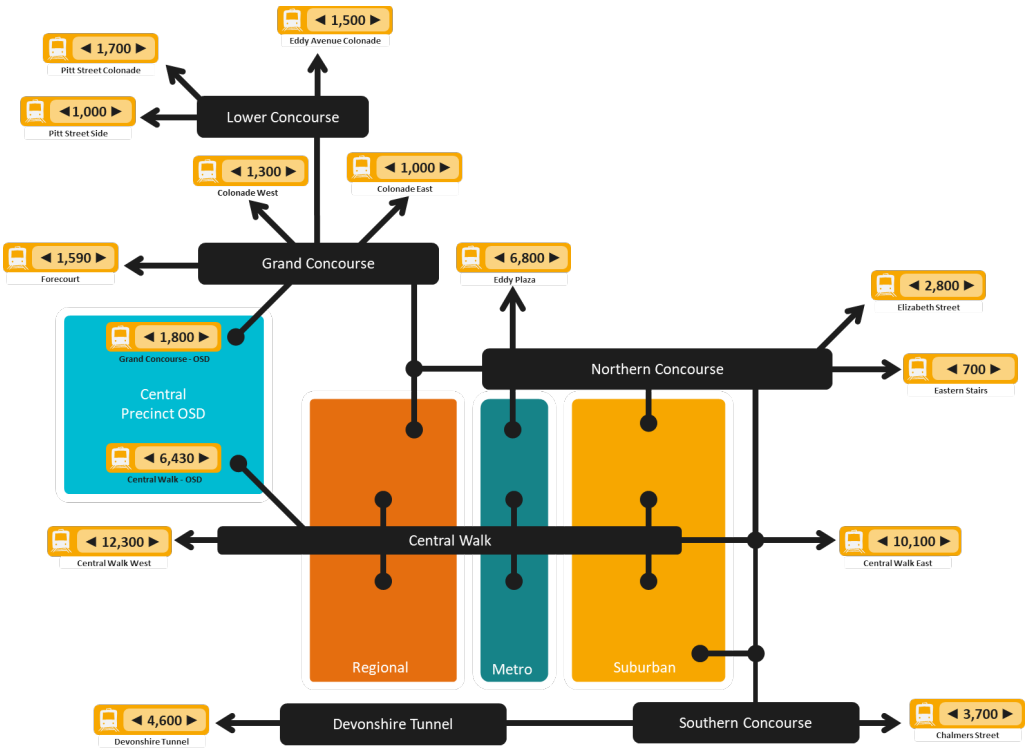


Figure 5-21: 2036 Central Station 2036 AM peak hour passenger movement summary

Detailed results are provided in Appendix E – Internal Station model results.

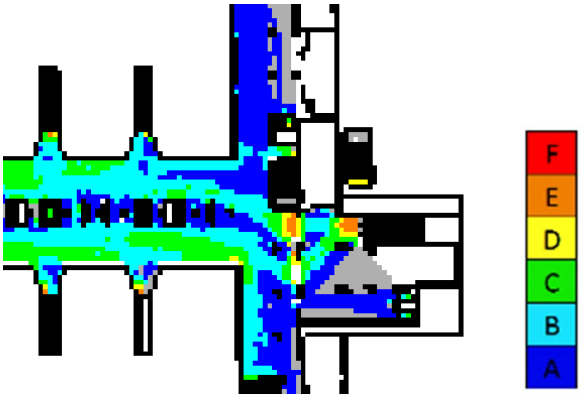


Figure 5-22 Central Walk East, Fruin LOS diagram (8:30-8:45am)

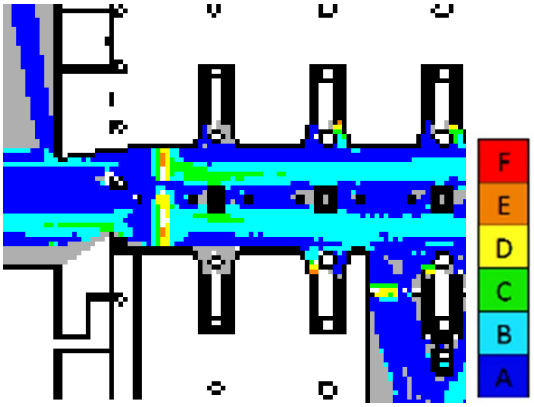


Figure 5-23 Central Walk West, Fruin LOS diagram (8:30-8:45am)

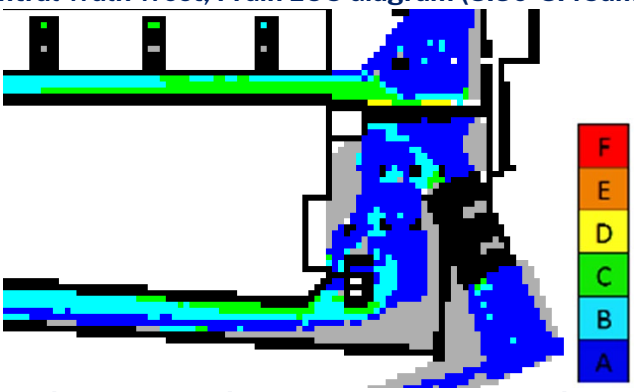


Figure 5-24 Central Station Southern Entrance, Fruin LOS diagram (8:30-8:45am)

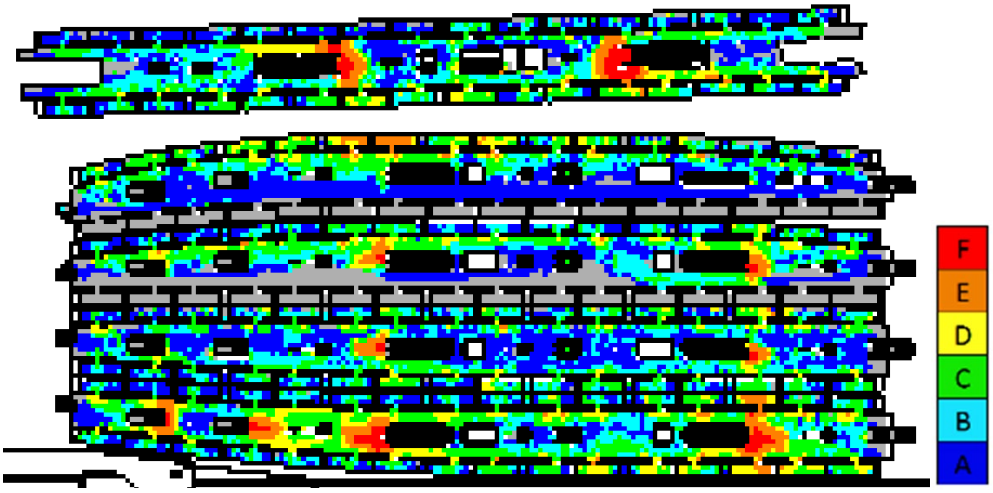


Figure 5-25 Central Station suburban platforms AM peak hour Fruin LOS diagram

Table 5-22 Central Station AM and PM peak hour modelling summary

Area		AM Peak hour LOS	PM Peak hour LOS	Compliance
Gatelines	All locations	A/C	A/B	Yes
Concourse areas	All locations	B/C	A/C	Yes
Platforms	Platform 16/17 Platform 18/19 Platform 20/21 Platform 22/23 Platform 24/25	D/E/F	D/E	No Significant queueing forms when exiting platforms following arrival of peak services No worse than 2019 conditions
	Platform 4/5 Metro Platforms	E	A/C	No Significant queueing forms when exiting platforms following arrival of peak services
	All other platforms	B/C	A/B	Yes
Vertical connections	VT to Platform 24/25	D/E	D/E	No Analysis identified platforms will clear before next train
	All other vertical transport	A/C/D	A/B/C/D	No Analysis identified vertical transport capacity is sufficient to meet the required platform clearance

The modelling identified that all concourse circulation areas and gatelines are compliant with Network Rail Station Capacity Planning Design Manual by achieving a LOS C or better and would be able to accommodate the expected growth anticipated in 2036. The addition of new platform access points to Central Walk, as well as the extension of Central Walk to the western edge of the Precinct will provide improved access and circulation within Central Station for commuters.

Central Station's gatelines are set to provide fluid access to and from all the access points of the train station in 2036.

The assessment of platform performance identified several suburban platforms operating at or worse than 'Walkways' LoS D, which exceeds the Network Rail Station Capacity Planning Design Manual threshold. Substantial queueing forms at vertical circulation following the arrival of peak services, indicating congestion, preventing other passengers from circulating along the platform. Figure 5-26 presents an example of this issue.

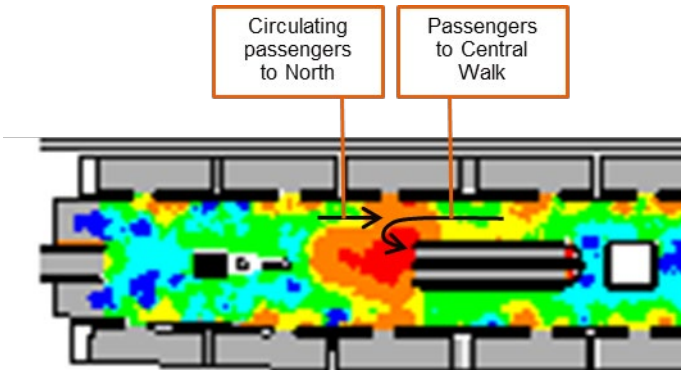


Figure 5-26: Example of Platform Circulation Issues, Platform 16/17, Southern Escalators, 2036 AM

It is noted that the observed congestion on the platforms is comparable to the congestion observed within the existing station conditions, as outlined in Section 3.5. The planned upgrades to Central Station as part of Central Precinct increases the vertical transport capacity of platforms, ensuring that overall performance of the platforms is no worse than existing conditions. Furthermore, all platform waiting areas are compliant with the Network Rail Station Capacity Planning Design Manual threshold of 'Queuing' LoS B.

With regards to vertical connections within Central Station, the analysis shows that the vertical transport capacity is sufficient to meet the required platform clearance times across all platforms except from Platform 24/25. Further analysis of the vertical connections and clearance times for Platform 24/25 identified that all passengers can clear the platforms before the arrival of the next train, based on a future service headway of 180s. As such, the vertical transport capacity is considered appropriate.

The analysis shows that the design of the walkways across the OSD and the associated vertical transport connections is sufficient and will safely accommodate the forecasted pedestrian demands for the Precinct. In areas where congestion may occur, the forecasted passenger levels will not result in conditions worse than observed in 2019.

The additional train and metro passenger demand created by the proposed Central Precinct development does not any significant detrimental impact on the performance of the station platforms or concourses within a scenario where Central Walk West has been built.

5.6.2 Light rail

The opening of the CSELR line from the Sydney CBD to Kingsford and Randwick in 2020 has expanded the availability of light rail services to Central Precinct. It has

also changed travel patterns along the south-east corridor to Central Station, with those travelling towards Moore Park and the University of NSW able to use the direct light rail services.

Central Precinct will also increase light rail trips through the Precinct, with passengers able to choose different stops based on their ultimate destination above the station or within new development at street level. Based on the trip generation assessment, the future development of Central Precinct would add 880 additional light rail trips to the network during the morning peak hour, and 380 additional trips during the evening peak hour.

Table 5-23 provides a summary of light rail trips within the study area in the 2036 AM and PM peak hours. Table 5-24 provides a comparison of the 2036 AM peak hour demand for light rail across the five stops within the study area and the expected capacity.

Table 5-23: Light rail trip generation (2036 AM and PM peak hours)

	AM peak hour		PM peak hour	
	Trips	Percentage	Trips	Percentage
Central Precinct development	880	17%	380	7%
Non-development light rail trips (including transfers between services)	4,370	83%	4,950	93%
Total	5,250	100%	5,330	100%

Table 5-24 Future Light Rail Demand against capacity, AM Peak

Route / Stop	Boards	Alights	Net change of occupancy	Total Capacity	% of Capacity
Dulwich L1 – Central Station	690	430	260	3,000	9%
CSELR (L2/3) – Chalmers Street Southbound	1760	440	1320	4,500	29%
CSELR (L2/3) – Chalmers Street Northbound	410	670	260	4,500	6%
CSELR (L2/3) – Haymarket Southbound	280	80	200	4,500	4%
CSELR (L2/3) – Haymarket Northbound	350	140	210	4,500	5%

Overall, demand for light rail services in 2036 is expected to increase 256 per cent on 2019 demands, with the demand generated by Central Precinct creating 23 per cent of the growth. The increase is largely due to the opening of the CSELR services in 2020 which diverted existing bus demand from the south-east onto light rail services.

When considering the potential capacity across the light rail network around Central Precinct, the three routes have the combined potential of accommodating over 21,500 trips during the peak hour (assuming a four-minute service frequency). This suggests that there is sufficient capacity on the existing light rail network to

accommodate the anticipated uplift in demand associated with Central Precinct and background growth.

Light rail passengers travelling to and from the OSD within Central Precinct will be able to access vertical connections from Devonshire Street for CSELR services to and from the southeast. Passengers travelling to and from the Sydney CBD on CSELR services will be able to access the OSD from the Rawson Place stop, passing through the Terminal Building to use the internal vertical connections. IWLR passengers will have direct access from the light rail stop to the Grand Concourse, and up to the OSD.

The additional light rail passenger demand created by the proposed Central Precinct development does not any significant detrimental impact on the performance of the light rail stops or connections to the OSD above.

5.6.3 Buses and coaches

In 2036, Central Precinct will continue to function as a major bus interchange, facilitating connections between bus, train, metro and light rail services as well as providing direct access to the area. The introduction of the CSELR and Sydney Metro services are expected to change travel patterns and bus demand, as trips migrate to new routes away from existing bus services. Overall, background bus demand is expected to experience moderate growth to 2036.

The future development of Central Precinct will increase bus trips through the Precinct. Based on the trip generation assessment, the future development of Central Precinct would add 1,030 additional bus trips to the network during the morning peak hour, and 1,160 additional trips during the evening peak hour.

Table 5-25 provides a summary of bus trips within the study area in the 2036 AM and PM peak hours. Table 5-24 provides a comparison of the 2036 AM peak hour demand for bus services across the 12 bus stands within the study area and the expected capacity.

Table 5-25: Bus trip generation (2036 AM and PM peak hours)

	AM peak hour		PM peak hour	
	Trips	Percentage	Trips	Percentage
Central Precinct development	1,030	10%	1,160	14%
Non-development bus trips (including transfers between services)	8,800	90%	7,200	86%
Total	9,830	100%	8,360	100%

Table 5-26: Bus trip generation (2036 AM and PM peak hours)

Route / Stop	Boards	Alights	Net change of occupancy	Total Capacity	% of Capacity
Bus Stand A - Eddy Avenue	20	190	20	490	35%
Bus Stand B - Eddy Avenue	360	110	360	700	36%

Route / Stop	Boards	Alights	Net change of occupancy	Total Capacity	% of Capacity
Bus Stand C - Eddy Avenue	510	30	510	1400	34%
Bus Stand D - Eddy Avenue	360	20	360	1050	32%
Bus Stand E - Elizabeth Street	440	40	440	1470	27%
Bus Stand G - Chalmers Street	110	1040	110	2520	37%
Bus Stand J - George Street	530	2740	530	9100	24%
Bus Stand K - Lee Street/ Railway Square	10	10	10	350	0%
Bus Stand L - George Street/Railway Square	410	140	410	1400	19%
Bus Stand M - George Street/Railway Square	1080	330	1080	3710	20%
Bus Stand N - Lee Street	100	60	100	700	6%
Rawson Pl Bus Stand	710	210	710	1050	48%

Overall, demand for bus services in 2036 is expected to decrease by two per cent on 2019 demands, which is attributed to the shift in travel from bus services to light rail to the southeast of Central precinct. The demand generated by Central Precinct can be accommodated in existing service patterns. However, given the expected scale of change across the bus network to 2036 as a result of the CSELR and Sydney Metro services, bus capacity will need to be further evaluated as information becomes available.

Review of the external precinct model indicates there will be some pedestrian congestion at some bus stands around Railway Square and on Eddy Avenue. Bus stands in these locations are located within key pedestrian movement corridors, with alighting, waiting and boarding activities at times conflicting with through pedestrian movement. However, comparison of activity observed in 2019 demonstrates congestion will remain at similar levels in 2036.

The future high pedestrian demands across the Precinct is also expected to impact on bus service frequency and reliability. Competing demands of bus journeys and pedestrians crossing at key road intersections will likely lead to delays for on-road public transport services. Further modelling is currently being undertaken to understand the degree of impact, with the results and assessment to be incorporated into a future revision of this report.

The redevelopment of the Lee Street bus layover site as part of CPRP incorporates an upgraded bus-layover facility that will cater for future changes to bus services and operations. The upgraded facility will provide a minimum of 13 bus bays to accommodate layover activities, as well as provide amenities for bus drivers and support the adoption and integration of a future electric bus fleet.

Access into the redeveloped bus layover site will one-way, with the entry point currently proposed to be located north of the Regent Street and Lee Street intersection, and the exit point to the south of the intersection. In the event Lee Street is closed to through traffic, it is recommended that consideration is given to the entry and exit points be switched over. This would allow buses travelling southbound along Regent Street to turn left into the site after the intersection and allow buses leaving the layover the opportunity to turn north at the signalised intersection of Lee Street and Regent Street. This removes the need for northbound buses to travel around the site to reconnect with bus routes at Railway Square.

The development of Central Precinct is not forecasted to generate a demand for coach services. Coach services and facilities will be improved as part of the CPRP, with an upgraded managed and dynamic coach layover pick-up, and drop-off facility in the revitalised Western Forecourt. This facility will have direct access for customers transferring from coach services to the suburban, metro and regional rail lines.

5.7 Road network assessment

5.7.1 Central Precinct road network

The road network in 2036 is expected to be similar to traffic conditions in 2019, with heavy traffic conditions through the study area during commuter peaks. In the AM peak, there is a strong west to east traffic movement through Central Precinct via Eddy Avenue, with the intersections surrounding Central Station impacted by turn movement capacity and efficiency. Traffic queues are expected to form along Eddy Avenue, Pitt Street, George Street and Lee Street for northbound and eastbound traffic.

The PM peak is also expected to experience high levels of congestion in key locations on the periphery of Central Precinct. The intersections of Regent Street and Cleveland Street to the south of the Precinct, and Elizabeth Street and Eddy Avenue, experiences the most significant queueing on the north approaches.

Recognising the limitations of the surrounding road network, Central Precinct has been designed to control the access and desirability of vehicles travelling to the site. This will be achieved through:

- A target mode share (as outlined in Section 5.2) that prioritises active and sustainable transport modes, with supporting measures to ensure the mode share is achieved
- Reduced car parking requirements for new development within Central Precinct (as outlined in Section 5.8.1)
- Integrated loading facilities to consolidate deliveries and servicing demand, with arrival demand management to control when vehicles access the site (as outlined in Section 5.8.2)
- Increasing the number of designated point-to-point locations around Central Precinct to align with key movement corridors and providing an autonomous vehicle route on the deck to cater for last-mile drop-off and pick up activities (as outlined in Section 5.8.3).

Table 5-27 summarises the AM and PM peak hour traffic demand generated by Central Precinct. The resultant traffic demand from the above introduces 460

traffic movements (comprising of point to point, deliveries and service vehicles, and parked vehicles) in the AM peak hour, and 420 movements in the PM peak hour travelling to and from Central Precinct. These trips will be distributed across the site, distributing the impact from the slight increase in vehicle traffic associated with the new development around the Precinct.

Table 5-27: AM and PM Vehicle demand and type summary

Vehicle access point	AM peak demand			PM peak demand		
			Total			Total
Western Forecourt	63	0	**63**	53	0	**53**
Western Forecourt and Terminal Building dock access (off Pitt Street)	32	14	**46**	41	15	**56**
Regent Street Sidings access	261	36	**297**	218	41	**259**
Prince Alfred Sidings (off Chalmers Street)	15	3	**18**	15	2	**17**
Cleveland Street	40	0	**40**	37	0	**37**
Sub-total	411	53	**464**	364	58	**422**

Figure 5-27 shows the traffic volume during the two hour AM peak on the road network with the future development in Central Precinct, using output data from the Strategic Traffic Forecasting Model (STFM). There are minimal differences in traffic volumes without the development in 2036 as shown in Figure 5-28.

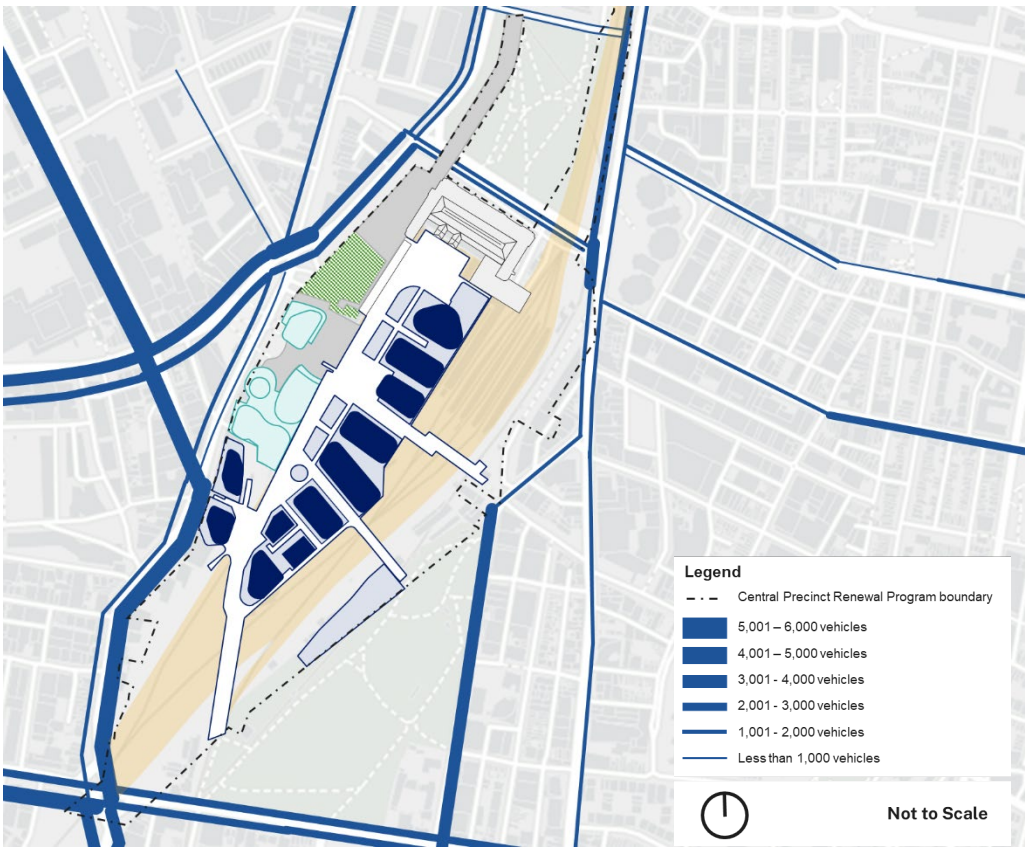


Figure 5-27 Two hour AM peak hour traffic volumes with CPRP in 2036

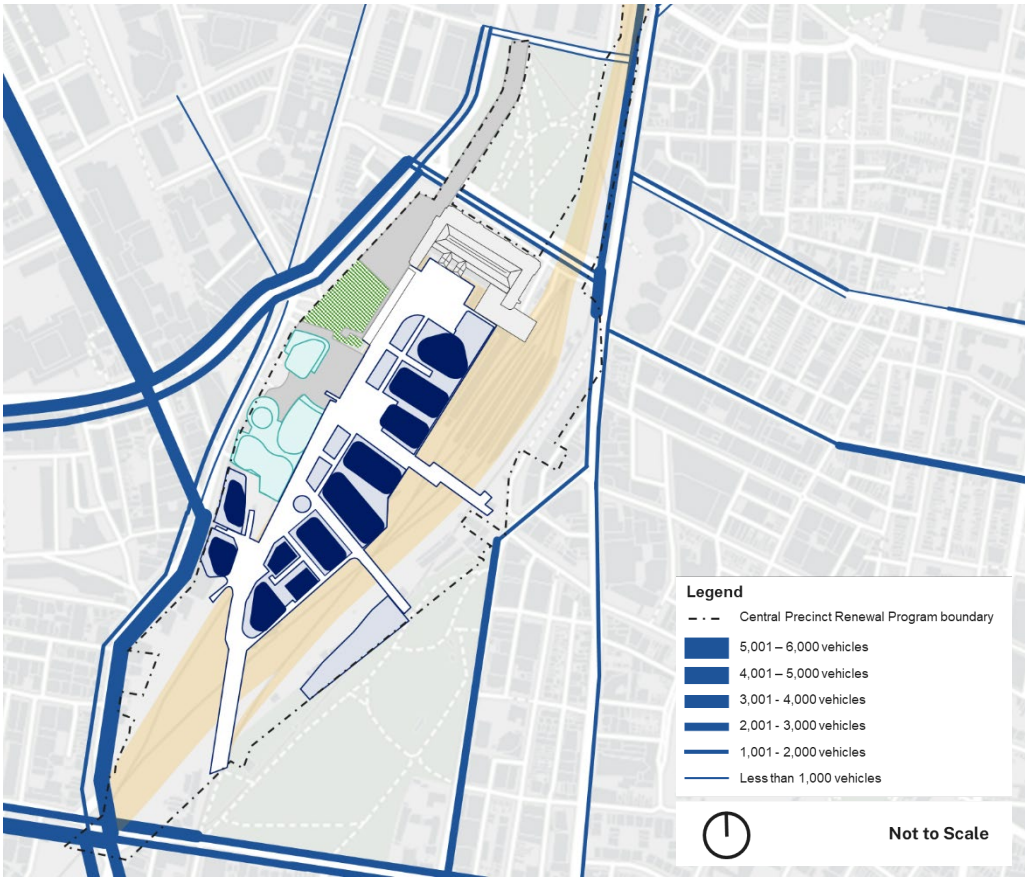


Figure 5-28 Two hour AM peak hour traffic volumes without CPRP in 2036

A summary of the generated traffic movements and key external traffic patterns around Central Precinct in the 2036 AM peak hour are provided in Figure 5-30.

While the resulting traffic generation is expected to be able to be absorbed in future traffic patterns, key traffic bottlenecks are expected to remain. As identified in Section 5.4, external precinct modelling shows that the expected pedestrian activity will increase, creating competing demands for signal time between pedestrians and road traffic. Effective planning and management of these demands should prioritise walking and cycling to support mode shift and reduce congestion, as outlined in Section 4.1.

Localised improvements may be possible through the completion of projects external to CPRP, including WestConnex and other road projects that provide alternative traffic routes through the Precinct.

Lee Street Closure

The reference masterplan identified an opportunity to close Lee Street between Regent and Pitt Streets to bus and general traffic to create a pedestrian zone and expand the public square outside Central Station.

To test the impact of the Lee Street closure, an additional scenario was tested in the Precinct Transport Model where the space on Lee Street was converted to pedestrian only space. This required configuration of the road network to allow for two-way movement along Regent Street, south of Harris Street, with existing traffic movements along Lee Street were assumed to be redistributed to the Regent Street / George Street / Harris Street intersection.

Figure 5-29 provides a comparison of the pedestrian LOS (Fruin Walkways) for Lee Street open and closed.

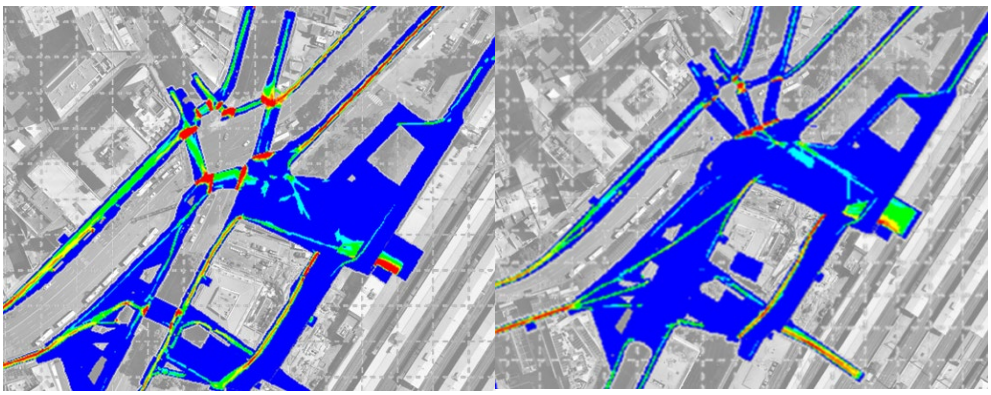


Figure 5-29 Precinct Model LOS Diagrams 2036 AM Peak Hour – Lee Street Open (Left) and Lee Street closed (Right)

Analysis of the model identified that the closure of Lee Street improves pedestrian congestion, and as an isolated site, improves traffic flow in comparison to existing conditions.

However, when considering the overall network, significant northbound queueing is expected along Regent Street (extending to the south of Cleveland Street). Substantial queuing is also expected for southbound traffic on Harris Street. In reality, Lee Street traffic (i.e. impacted by the closure) would be expected to redistribute through the wider road network, rather than all use Regent Street. This wider redistribution has not been assessed, and would require further evaluation and investigation.

As part of the Lee Street closure option, there is an opportunity to reduce the George Street and Pitt Street cross section by one lane (between Harris Street and Eddy Avenue). This road space could be reallocated to improve the overall network performance and operation (e.g. to create a separate bus lane and bus stop on the north side of George Street, reallocate to traffic, redesign intersections). Further investigation and stakeholder engagement on this approach is required should the Lee Street closure be considered further.

A summary of the key conflict points in the surrounding road network are identified in Figure 5-30.

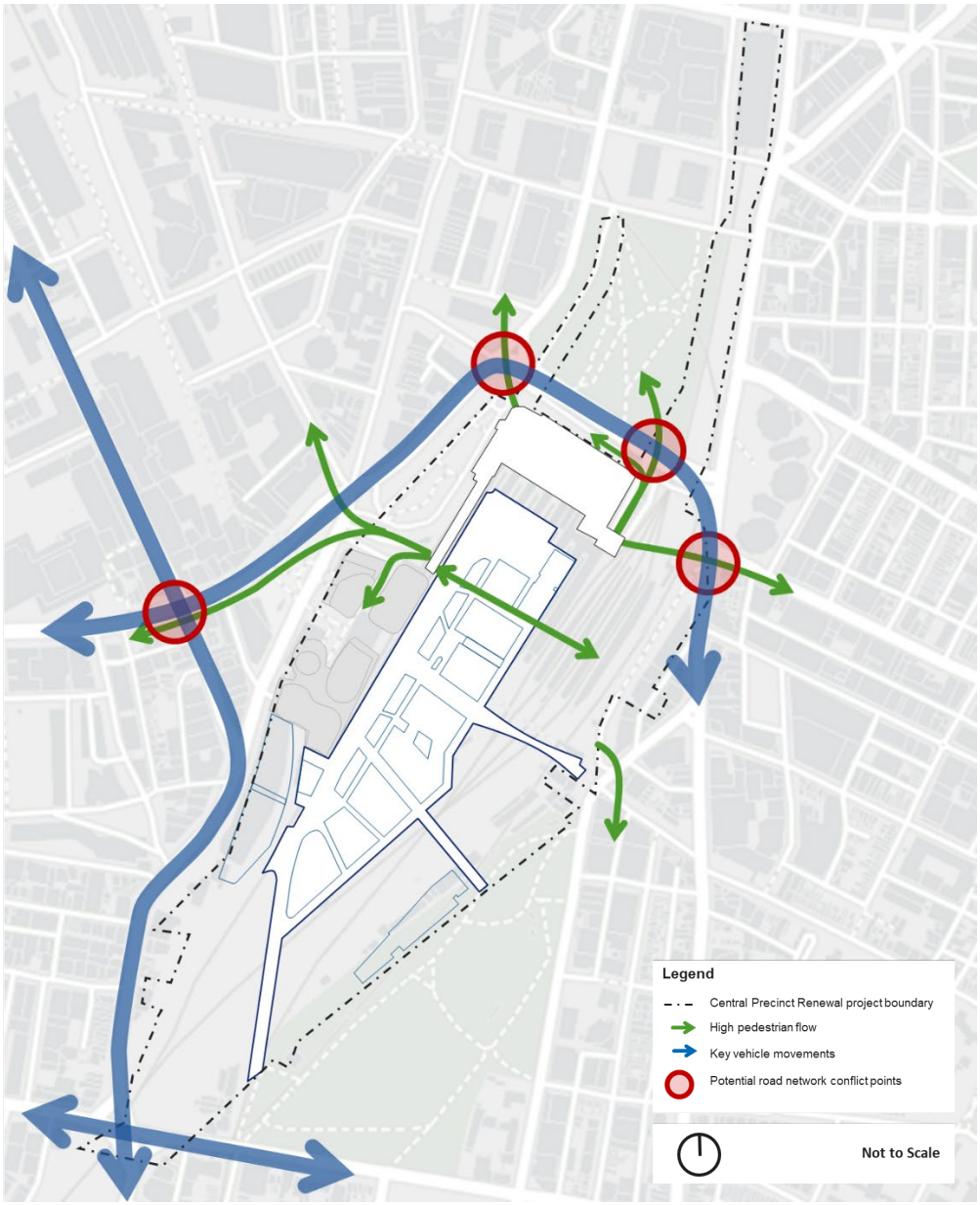


Figure 5-30: 2036 Road network conflict

5.7.2 Site access

Vehicle access points are constrained by the locations of heritage infrastructure at Central Precinct. The proposed vehicle access locations, as well as existing access points to be retained, are shown in Figure 5-31. Central Precinct is expected to accommodate a range of vehicle sizes, including light vehicles, small trucks and large vans (SRVs), medium sized trucks (MRVs), buses and coaches, as well as larger service and emergency vehicles.

Access to Central Precinct has, where possible, been positioned away from key pedestrian movement corridors to reduce delays and the potential of conflict between vehicles and pedestrians. They are also positioned around site boundary to further redistribute demand, and all access points are generally proposed as left-in/ left-out to minimise impacts to the road network.

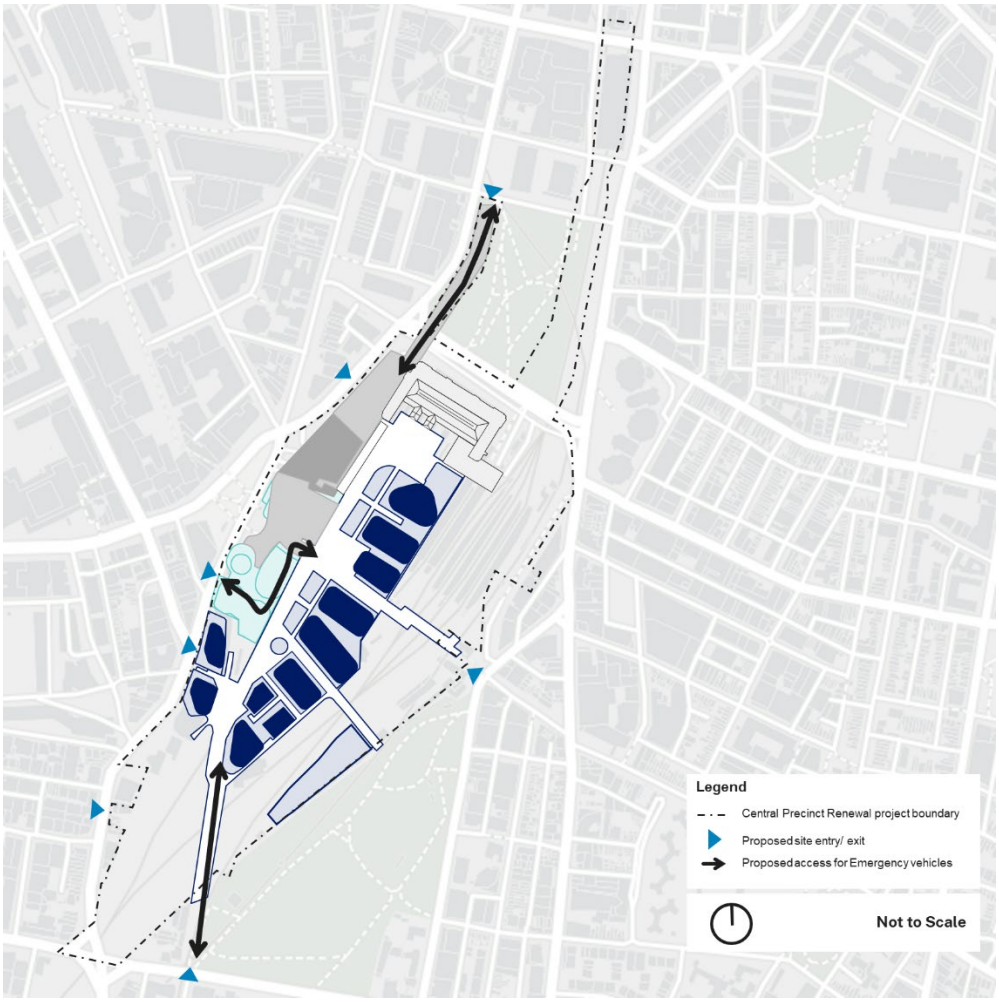


Figure 5-31: Proposed vehicle access to Central Precinct

Western Forecourt and Terminal Building dock access (off Pitt Street)

Vehicle access to the Western Forecourt and Terminal Building dock is provided via a ramp on Pitt Street through left-in left out arrangement. A combined total of 46 vehicle movements are expected to occur in the AM peak hour from this access, and 56 movements in the PM Peak hour.

Access is expected to be limited to MRV vehicles or smaller, due to heritage and other infrastructure constraints in the immediate area. No issues were identified during the modelling and swept path analysis, with preliminary swept paths analysis was undertaken to confirm vehicles are able to enter and exit the site safely.

Regent Street Sidings access

The Regent Stret Sidings site provides separated entry and exit points, which accommodate bus, servicing and Vehicle access to Regent Street Sidings dock is provided via a left turn only entry and exit. A combined total of 297 vehicle movements are expected to occur in the AM peak hour from this access, and 259 movements in the PM Peak hour.

The Regent Street access has been designed to accommodate HRV vehicles. No issues were identified during the modelling and swept path analysis, with

preliminary swept paths analysis was undertaken to confirm vehicles are able to enter and exit the site safely.

The revised Masterplan identified the potential for a combined access point for the loading dock, bus layover site and basement parking area that is integrated with a signalised intersection. Further work will be completed during the detailed design phases to look at approaches in improving site access efficiency, and the impact of this revised access design on the broader network.

Sydney Yards Access Bridge (SYAB)

The Sydney Yards Access Bridge (SYAB) currently provides access to the Sydney Trains yard at Central Station, from Regent Street to the south west of the precinct. No changes to the SYAB are proposed as part of CPRP.

Cleveland Street (through Prince Alfred Park)

Emergency vehicle access to the OSD will be provided via an at-grade connection through Prince Alfred Park, allowing emergency vehicles to travel over the rail corridor as required. The access will be designed to prevent non-authorised vehicles from accessing Prince Alfred Park or the OSD.

Prince Alfred Sidings (off Chalmers Street)

The Prince Alfred Street Sidings site is proposed to be accessed off the Chalmers Street and Devonshire Street intersection. The development is expected to add nine additional vehicle movements in the AM Peak hour, and ten vehicle movements in the PM Peak hour.

Dynamic modelling of the access, intersection and pedestrian activity identified that the intersection is expected to perform adequately, with minimal access on station access or broader vehicle movement. Detailed intersection modelling would be completed at a later DA stage to reconfirm future performance of this location.

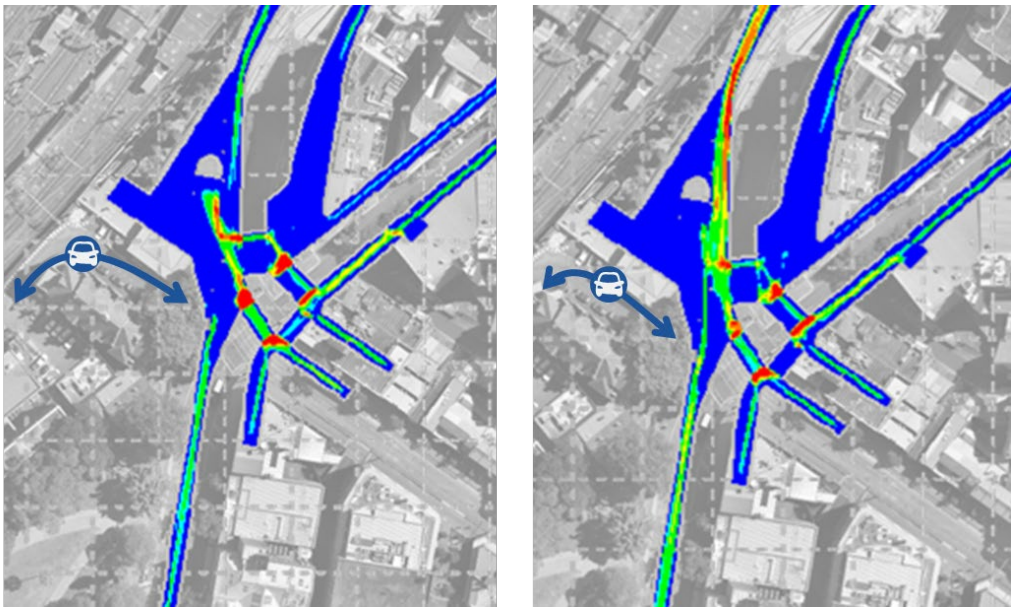


Figure 5-32 Precinct Model LOS Diagrams 2036 AM Peak Hour – Lee Street Open (Left) and Lee Street closed (Right)

In consideration of the assessment above and those outlined in previous sections, the proposed site access points are anticipated to have a negligible impact on

surrounding transport operations, provided all are designed ensure sufficient sight lines and widths for all expected vehicle types. Accesses would be designed in accordance with relevant Australian Standards , as well as Transport for NSW and City of Sydney guidelines, and undergo further investigation and design reiteration as part of any future Development Application process.

5.8 Parking and servicing requirements

5.8.1 Car parking

Car parking demand for the Central Precinct was assessed using the following two approaches:

- By applying the maximum parking rates outlined in the City of Sydney LEP 2012 and adopting a Category A classification for residential land uses and Category D for non-residential land uses. The rates used in this assessment are outlined in Table 5-28.
- From first principles, using the preferred car mode share targets for the CPRP as outlined in Section 6.2. Table 5-29 compares the maximum parking demand identified using the identified approaches.

Table 5-28: Maximum car parking requirements – City of Sydney LEP 2012

Land use		Rate[1]
Residential	1 bed dwelling	0.3 spaces / dwelling
	2 bed dwelling	0.7 spaces / dwelling
	3 bed dwelling	1 spaces / dwelling
Student accommodation		0.2 spaces per room
Hotel		0.2 spaces per room
Commercial		0.65 spaces per 100/ m^2
Retail		0.65 spaces per 100/ m^2
Education		1 space / 200 m^2 GFA
Community2		1 space / 30 m^2 GFA

1 The City of Sydney LEP uses a calculation method to determine the number of parking spaces for commercial and retail land uses that considers the Gross and Total site area. For this assessment, these calculations have been translated into an equivalent parking rate per 100 m^2 of GFA.

2 The Entertainment rate has been adopted to understand the likely parking requirements of community uses within the SSP

Table 5-29: Central Precinct car parking requirement comparison.

Land use	Quantity	Measure	Car parking maximum	
			LEP	Target mode share
Residential	152	1 bed dwelling	46	68
	279	2 bed dwelling	195	
	76	3 bed dwelling	77	
Student accommodation	266	rooms	53	141
Hotel	481	rooms	96	0
Commercial	473,800	m^2	1,674	
Retail	36,830	m^2	149	
Education	53,780	m^2	236	
Community	6,460	m^2	579	
Maximum total parking spaces			**3,105**	**208**

The assessment identifies that that the adoption of the maximum car parking rates of LEP 2012 would require a maximum of 3,105 spaces for the CPRP. If parking were to be supplied in line with the target mode share for the Precinct, a total of 208 parking spaces would be required for residential uses.

The Reference Master Plan currently proposes 377 parking spaces across the Precinct, located within the Regent Street Sidings site on the western boundary, and the Prince Alfred Sidings site on the eastern boundary. This includes spaces allocated to the future land uses of CPRP, as well as providing for operational parking for Central Station and associated EV and autonomous vehicle fleet associated with CPRP.

The provision of a sufficient quantum of parking spaces for station operations is crucial. Parking required for station operation needs will be considered separate to the future development parking requirements Further refinement on the quantum of parking spaces provided to maintain and operate the station will be undertaken in any future Development Application process.

It is recognised that the City of Sydney LEP 2012 parking rates represent the maximum number of parking spaces that could be provided across the site, the adoption of a similar quantum of parking would potentially introduce over 3,000 vehicle trips to and from the Precinct during the peak hour. Noting the current constraints across the road network, it is unlikely surrounding streets would be able to accommodate an increase to this scale.

When considering mechanisms to promote sustainable transport behaviour, restrictions on private vehicle parking reduce the likelihood of trips by car. Mechanisms such as introducing paid parking, time-restricted parking, and reducing the available parking supply, all have been proven as a deterrent in choosing private vehicles for travel. However, the use of any mechanism must be balanced to ensure the broad range of mobility needs are considered and provided for.

An adoption of lower maximum rates beyond the City of Sydney LEP 2012 requirements, would support a shift away from private vehicles, whilst allowing for and providing access for those who need it. Given the Precinct's location on top of Sydney's largest transport hub, lower parking rates would reduce reliance of future residents and employees on private vehicles while alternative means of travel are available.

It is recommended that the proposed planning framework for Central Precinct include maximum parking requirements that are in closer alignment with the target mode share. Recommended parking rates are provided in Table 5-30.

Table 5-30: Proposed maximum car parking rates for Central Precinct SSP

Land use		Maximum parking rate
Residential	1 bed dwelling	0.3 spaces/ dwelling
	2 bed dwelling	0.7 spaces/ dwelling
	3 bed dwelling	1 spaces/ dwelling
Student accommodation		0.1 spaces per room
Hotel		0.1 spaces per room
Commercial		1 space per 2000 m^2 GFA
Retail		1 space per 2000 m^2 GFA
Education		1 space per 2000 m^2 GFA
Community		1 space per 2000 m^2 GFA

Car share

The provision of car share spaces would support broader precinct push for reduced reliance on private vehicles. Car share spaces contribute to reducing the reliance on car ownership, allowing trips that require the use of a vehicle to occur as needed. There is also potential for car-sharing parking provisions to be included onsite or on off-street spaces in another location managed by the City of Sydney. This would enable wider access to the service by residents of Central Precinct and the broader community.

The City of Sydney DCP 2012 requires a minimum of one car share space per 50 off-street car spaces. Adoption of this rate for the reference master plan, eight car share spaces would be required across the Precinct.

Noting the potential to reduce the maximum parking rates and the scale of trips associated with the Precinct, it is recommended that the proposed planning framework for Central Precinct include a minimum requirement of one car share space per 25 off-street car spaces to be provided.

Motorcycle parking spaces

The City of Sydney DCP requires a minimum of one motorcycle space per 12 off-street car spaces. Based on the preferred master plan, the provision of 377 off-street car spaces would result in a requirement for 34 motorcycle parking spaces.

It is recommended that the proposed planning framework for Central Precinct include the City of Sydney DCP rate of one motorcycle space for every 12 car parking spaces.

Electric vehicle parking spaces

As mobility trends change, the uptake of Electric Vehicles (EVs) will require provisions for EV charging infrastructure to support and encourage the uptake of alternative vehicle fuel types.

It is recommended that the proposed planning framework for Central Precinct include the requirement of providing up to one EV charging space for 10 car parking spaces.

5.8.2 Service vehicle requirements

Service vehicle requirements for Central Precinct have been assessed using two approaches:

- By applying the maximum parking rates outlined in the City of Sydney DCP. The rates used in this assessment are outlined in Table 5-31.
- Using a logistics spreadsheet model to determine the daily freight and servicing trips associated with the Precinct with a consolidated basement arrangement (including station operations).

The logistics spreadsheet model was developed with support and direction from the Transport for NSW Freight Branch to evaluate key parameters of vehicles entering, accessing, and exiting the loading and servicing areas within a managed dock system. It provides an assessment of potential queue lengths when entering the dock access point, potential delays in accessing a dock for unloading and loading of goods, and the storage requirements needed to support a last-mile delivery service when Central Precinct from the loading dock.

Key parameters integrated within the model include:

- The master plan floor area and land use breakdown
- Daily delivery trip rates for each land use, including servicing demands associated with station activities
- The distribution of trips per vehicle type for each land use (light vehicles, medium rigid vehicles and heavy rigid vehicles)
- Vehicle arrival temporal profiles
- The distribution of time spent on site by trip type (freight and servicing) and type of vehicle
- Access requirements into the loading facility (such as control gates and other mechanisms that might delay vehicles arriving to the loading dock).

The adoption of the logistics spreadsheet model as an assessment tool for the loading and servicing areas allowed for a holistic analysis of potential impacts on accesses points, recognising the variability of arrival times and delivery activities throughout the day. It also enabled the demands associated operations of Central Station to be evaluated alongside future development demands, to ensure long-term station operations are provided for.

Table 5-31: Service vehicle requirements – City of Sydney LEP 2012

Land Use	Rate
Residential	• 1 space for the first 50 dwellings or serviced apartments; plus • 0.5 spaces for every 50 dwellings/ serviced apartments or part thereafter.
Commercial	• 1 space per 3,300 m^2 GFA, or part thereof, for the first 50,000 m^2; plus • 1 space per 6,600 m^2, or part thereof, for additional floor area over 50,000sqm and under 100,000 m^2; plus • 1 space per 13,200 m^2, or part thereof, for additional floor area over 100,000 m^2.
Hotel	• 1 space per 50 hotel bedrooms, or part thereof, up to 100 bedrooms; then • 1 space per 100 hotel bedrooms; plus • 1 space per 400 m^2 of reception, lounge, bar and restaurant area GFA, or part thereof, for the first 2,000 m^2; then • 1 space per 8000 m^2 of reception, lounge, bar and restaurant area GFA thereafter.
Retail	• 1 space per 350 m^2 GFA, or part thereof, up to 2,000 m^2; then • 1 space per 800 m^2 GFA thereafter.

The assessment identifies that that the adoption of the service vehicle rates of the City of Sydney DCP 2012 would require at least 120 spaces for loading to be provided for CPRP as shown in Table 5-32. The logistics model identified 106 spaces would be required as a minimum to support the Precinct.

Table 5-32: Central Precinct service vehicle requirements comparison

Land use	Quantity (m^2)	Measure	Service vehicle requirements	
			DCP	Logistics model
Residential	2,082	Dwellings or student apartments	22	106
Commercial[1]	534,040	m^2 GFA	13	
Hotel	2,280	rooms	57	
Retail	36,830	m^2 GFA	28	
Station operations	16,000	m^2 GFA	-	
Total spaces required			**120**	**106**

1 For the purposes of this assessment, the Commercial GFA floor area calculation includes Education and Community floor areas.

The Reference Master Plan currently proposes 197 loading and service vehicles across the Precinct, with the breakdown of vehicle types for each dock presented in Table 5-33. This includes approximately 80 of the 149 spaces within the Western Forecourt dock to accommodate freight and servicing demands associated with the operation of Central Station and the rail corridor.

The logistics model was developed to evaluate how an integrated loading dock facility would operate in the context of Central Precinct , identify the likely

demand for vehicles over a typical day, and the resulting spatial requirements to support freight and service vehicles.

Table 5-33: Central Precinct loading facility space allocation

	Light vehicles	Small rigid vehicles (SRV)	Medium rigid vehicles (MRV)	Total
Terminal Building dock		5	4	**9**
Western Forecourt dock	124	13	12	**149**
Regent Street Sidings dock	22	8	9	**39**
Prince Alfred Sidings	-	-	-	**0**
Total	**146**	**26**	**25**	**197**

The freight and servicing task associated with the future development is expected to require nearly 2,000 vehicles to visit the Precinct on a typical day, with 1,200 movements associated with Central Precinct (as derived from the logistics model, shown in Figure 5-33). The additional 800 movements are associated with freight and servicing for the Western Gateway. The peak arrival period for Central Precinct is between 9am and 10am, in which a total of 126 vehicles accessing the Precinct. It should be noted that an increased use of cargo and food delivery bikes can be expected across the Precinct in the future, which would facilitate last-mile movement of foods. They should be considered as part of any future freight strategy.

Comparing the results of the loading facility assessment, the logistics model highlights a slightly lower requirement for the total number of spaces across Central Precinct. This suggests that a lower quantum of loading spaces could be provided onsite without comprising operations of Central Precinct, and there are opportunities through the adoption of an integrated loading dock management system to optimise and smooth out loading demand and reduce the frequency of vehicles crossing over footpaths around Central Station during peak periods.

To ensure the frequent servicing of developments above the station has minimal impact on pedestrian amenity, Central Precinct proposes the adoption of integrated loading and distribution facilities as opposed to traditional loading docks. In addition to the provision of vehicle loading and distribution, consideration should be made to enable the adoption of cargo bikes for last-mile movement of goods from distribution facilities. These facilities would accommodate deliveries, service vehicles and waste collection away from the public realm and allow for the consolidation of goods for delivery across the Precinct to their destination. This approach allows for the security screening of goods and the consolidation of goods movement in a centralised location, and improved street and deck amenity through the minimisation of the unloading of vehicles in the public realm.

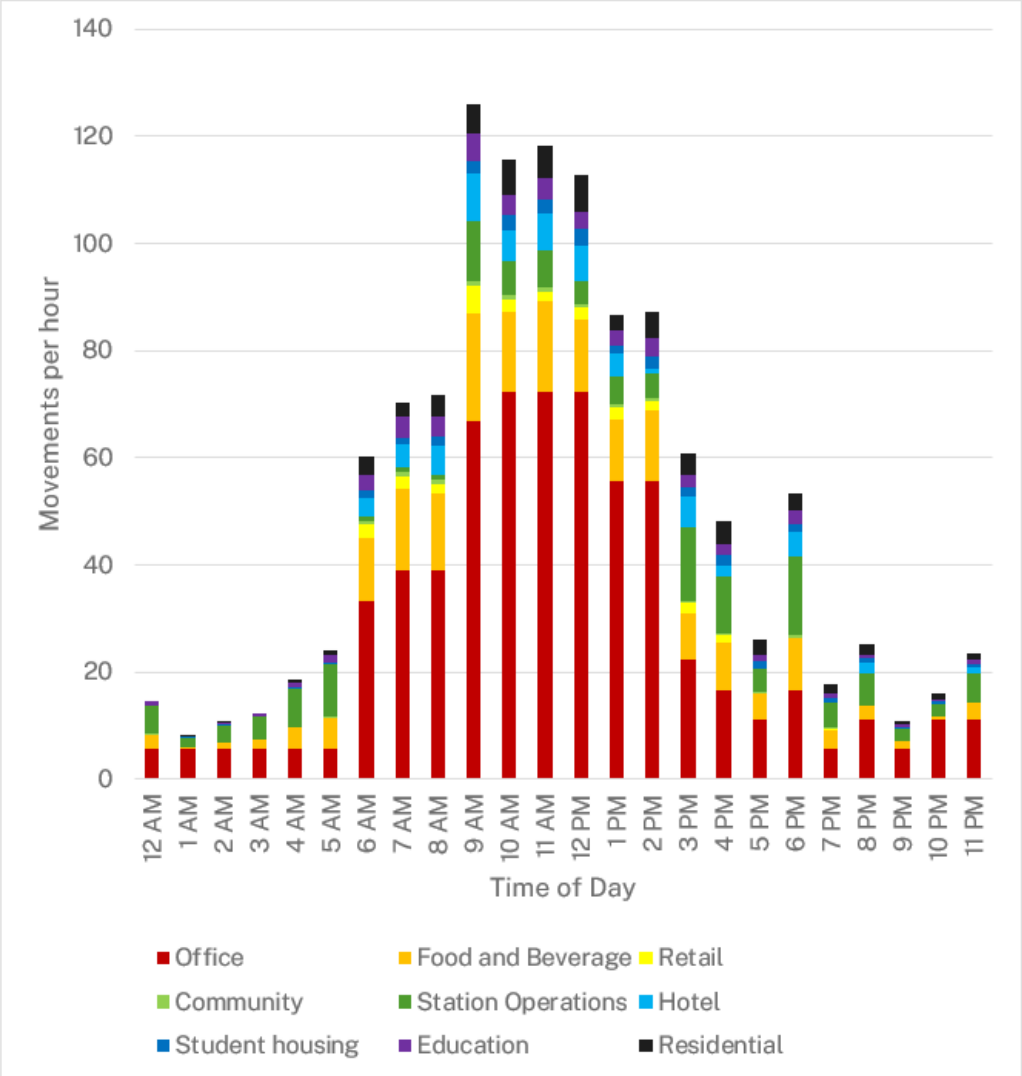


Figure 5-33: Daily service vehicle arrival profile (land use)

The loading docks and distribution facilities would be further supported through a dock and logistics management system. This would incorporate an online booking system, which requires drivers to book timeslots to access the site and loading bays, and an internal logistics distribution system, which would allow for incoming goods to be processed and distributed to tenants within Central Precinct.

A managed approach improves the efficiency of loading and servicing, levelling the peak periods expected throughout the day. This reduces the potential for queuing into the docks, the need for on-street parking, and reduction unsafe conditions within the loading dock during these peak periods. A managed system may also allow for the reduction in the number of loading bays throughout the Precinct, where overflow deliveries from the peak period could be accommodated during other time periods.

Alternative and innovative approaches to servicing the Precinct should be investigated, including adoption of other modes of transporting goods. This includes the potential for using the rail network to accommodate freight tasks associated with Central Precinct and the adoption of cargo bikes for last-mile movement of goods, which would reduce the impact of servicing on the public realm and road network.

Provisions will also need to be made onsite to accommodate parking and charging locations for the EV fleet associated with the servicing the CPRP. Furthermore, space will be required to store the autonomous vehicle fleet onsite, as well as provide for maintenance and backup fleet vehicles in case of breakdowns. Further detail on these provisions would be identified at a later DA stage.

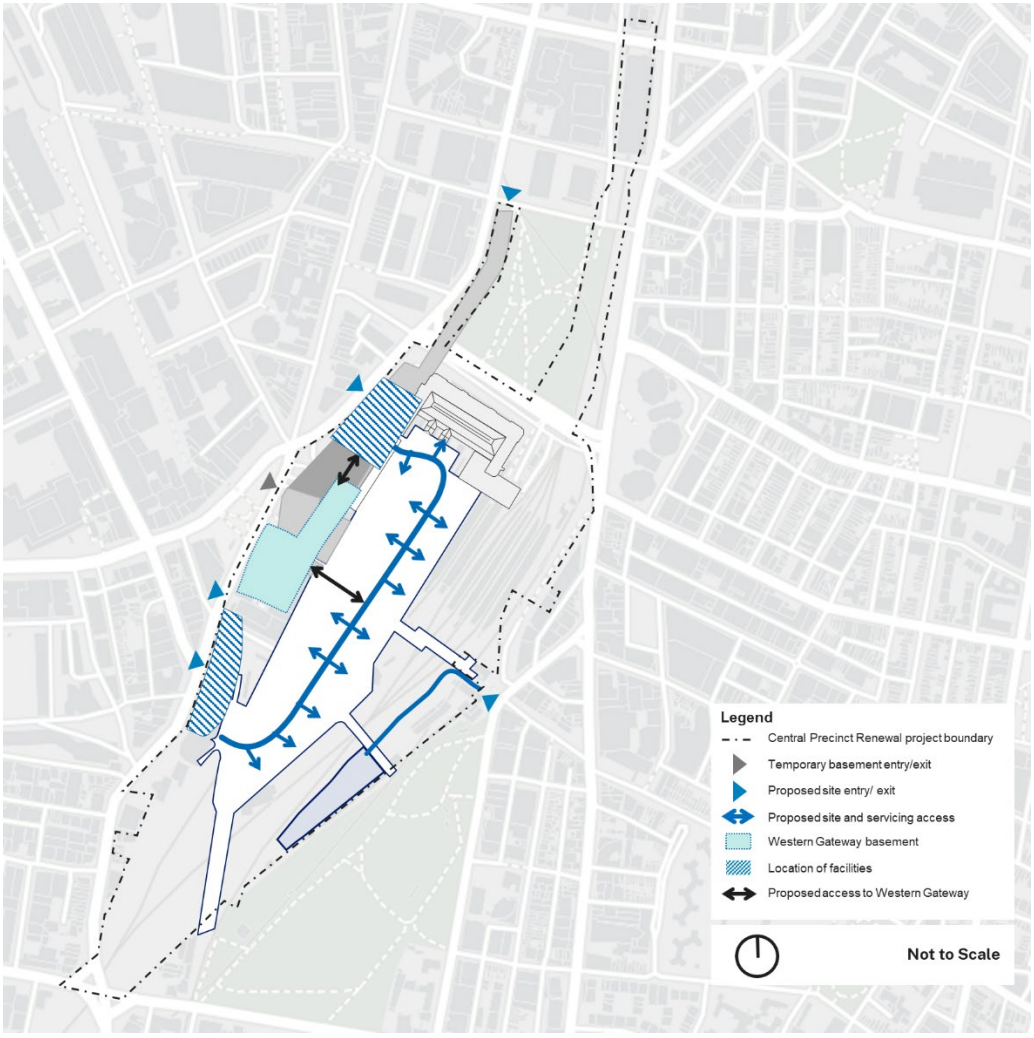


Figure 5-34: Proposed servicing and freight access

5.8.3 Point-to-point

Point to point activity around Central Precinct is expected to increase as travel demands and land uses across the study area intensifies. Central Precinct proposes to expand the provision of point-to-point facilities across the Precinct, with the Reference Master Plan identifying the following locations for drop-off and pick up areas:

- Within the revitalised Western Forecourt precinct,
- On Lee Street adjacent to the Western Gateway Precinct
- On Regent Street around Mortuary Station
- On Chalmers Street to the east of Central Station
- Within Prince Alfred Park, with a new vehicle access point from the intersection of Cleveland Street and George Street. This will be supported by

an autonomous vehicle service onto the deck above the station, providing a last mile connection for point-to-point users.

A summary of the locations of the proposed point-to-point facilities and their proximity to Central Station is provided in Figure 5-35.

Based on the trip generation assessment, the future development of Central Precinct would add 260 traffic movements in the AM peak hour, and 220 movements in the PM peak hour travelling to and from Central Precinct. These trips will be distributed across the point-to-point facilities around Central Precinct, distributing the impact from the minimal increase in vehicle traffic associated with the new development around the Precinct.

The increased provision of point-to-point facilities around Central Precinct is expected to accommodate future demand associated with the proposed development. These facilities will also support growth in passenger drop-off and pick-up activities for the surrounding area.

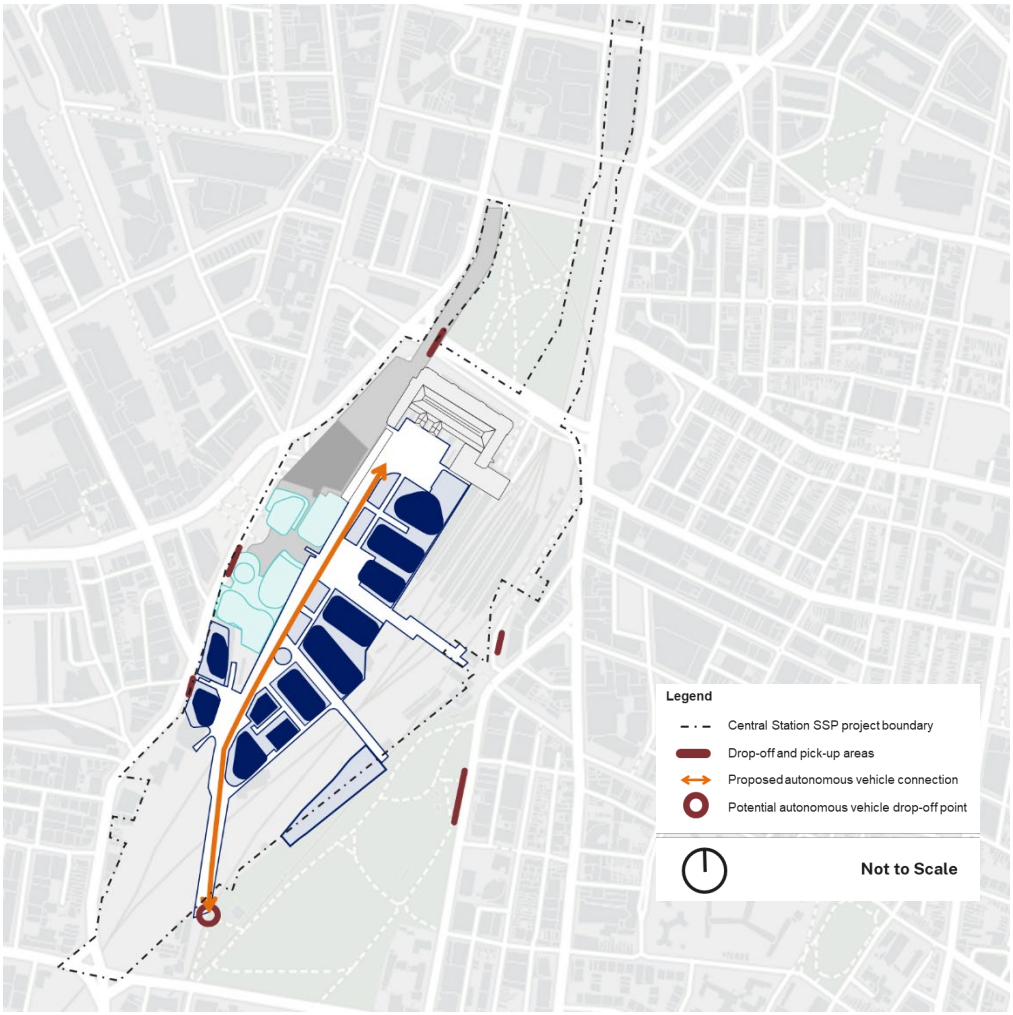


Figure 5-35: Proposed point-to-point facilities around Central Precinct

5.9 Safety assessment

5.9.1 Crash severity

This safety assessment of the road network within Central Precinct is informed by analysis of crash data supplied by Transport for NSW for the purpose of this study, which includes all crashes recorded within a five-year period between 1 January 2015 and 31 December 2019.

During this period, a total of 187 crashes occurred within the Precinct, of which 84 per cent resulted in some degree of injury to at least one of the parties involved.

The degrees of injury are defined as follows:

- Fatal injury – resulting in at least one person dying within 30 days from injuries sustained in the crash
- Serious injury – resulting in at least one person being admitted for a hospital stay
- Moderate injury – resulting in attendance of at least one person to an emergency department of a hospital, but not subsequently admitted for a hospital stay
- Minor/ other injury – resulting in injury for at least one person, without any record of hospital stay or emergency department attendance
- Non-casualty (towaway) – not resulting in injury to any parties.

Table 5-34 provides a summary of injury crashes and numbers of people injured.

Table 5-34: Crashes by severity

Crash severity	Number of crashes	Percentage of crashes	Number of people injured
Fatal injury	0	0%	0
Serious injury	30	16%	30
Moderate injury	63	34%	72
Minor/ other injury	64	34%	76
Total injury crashes	**157**	**84%**	**178**
Non-casualty (towaway)	30	16%	0
Total crashes	**187**	**100%**	**178**

5.9.2 Crash locations

The road network around Central Precinct services a mix of movement types, including vehicles, cyclists and pedestrians travelling in all directions. With intersections being the point of conflict for differing desire lines, most of the crashes recorded around Central Precinct occurred at intersections, accounting for 70 per cent of all crashes. Non-intersections crashes account for 30 per cent of all crashes.

Table 5-35 shows the physical location of all crashes recorded around Central Precinct during the five-year period. It is evident that crashes are primarily concentrated along high pedestrian activity areas, such as on Eddy Avenue, along

Chalmers Street near the station access in the east, and along Regent and Lee Streets. Most of the 19 total crashes recorded along the Great Western Highway within the crash data boundary are attributed to the Pitt Street/ Lee Street/ Great Western Highway intersection, where very high incidences of accidents have been recorded.

Table 5-35: Crashes by location type

Crash location type	Number of crashes	Percentage of crashes
Non-intersection crashes	56	30%
One-way street	9	5%
Two-way undivided	36	19%
Divided road	11	6%
Intersection crashes	130	70%
T-intersection	60	32%
X-intersection	47	25%
Y-intersection	1	<1%
Multiple intersections	22	12%
Other crash location	1	<1%
Total	**187**	**100%**

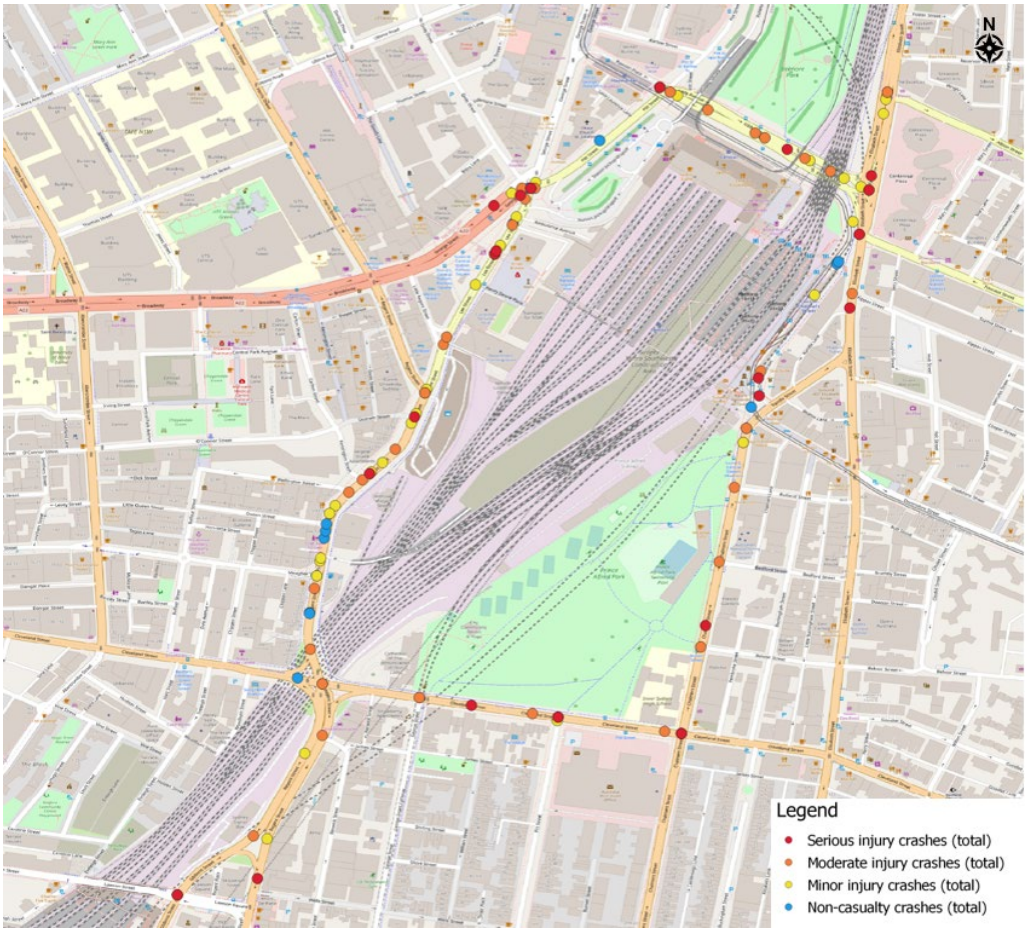


Figure 5-36: Crash locations around Central Precinct

Table 5-36 provides a summary of the streets on which crashes have occurred. An analysis of crash locations around Central Precinct indicates that 42 per cent of crashes occurred to roads directly adjoining the station to the west of the Precinct, primarily along Regent Street and Lee Street. Of the recorded crashes, 22 per cent occurred directly east of the Precinct, primarily on Elizabeth Street and Chalmers Street. 17 per cent of crashes occurred on Cleveland Street, and 13 per cent occurred on Eddy Avenue. Overall, 84 per cent of crashes that occurred around Central Precinct resulted in injury.

Table 5-37 provides an overview of the severity of crashes recorded for pedestrians and cyclists.

Of the 187 crashes recorded arod the Precinct, 52 crashes involved pedestrians and 25 crashed involved cyclists.

Compared to crashes involving only vehicles, the incidence of serious or moderate injuries are higher when vulnerable road users such as pedestrians or cyclists are involved, with 27 per cent of all crashes involving pedestrians resulting in serious injury that required hospital admission, and 48 per cent resulting in moderate injury that required attendance to a hospital's emergency department. When considering crashes involving cyclists, 15 per cent resulted in serious injury, and 52 per cent resulted in moderate injury.

Table 5-36: Crashes by location

Street name	Number of crashes	Percentage of crashes	Casualty crashes	Percentage of crashes resulting in injury
West				
Regent Street	41	22%	30	73%
Lee Street	21	11%	19	90%
Great Western Highway at Pitt/ Lee Street	19	10%	16	84%
Pitt Street	3	2%	2	67%
East				
Elizabeth Street	21	11%	19	90%
Chalmers Street	17	9%	14	82%
Randle Street	1	1%	1	100%
South				
Cleveland Street	31	17%	27	87%
North				
Eddy Avenue	23	12%	21	91%
Other				
Gibbons Street	7	4%	6	86%
Rawson Place	2	1%	1	50%
George Street	1	1%	1	100%
Total	**187**	**100%**	**157**	**84%**

Table 5-37: Pedestrian and cyclist crashes by severity

Crash severity	Pedestrian crashes	Pedestrian crash proportion	Cyclist crashes	Cyclist crash proportion
Fatal injury	0	0%	0	0%
Serious injury	14	27%	4	15%
Moderate injury	25	48%	13	52%
Minor/ other injury	13	25%	8	32%
Total crashes	**52**	**100%**	**25**	**100%**

During the five-year period, two crashes were recorded between a pedestrian and a cyclist, both of which resulted in moderate injury. However, it should be noted that there is a potential gap in the data, as any minor injury crashes that didn't result in emergency department or hospital admission would not have been reported.

Figure 5-36 and Figure 5-37 show the physical locations of pedestrian and cyclist crashes, respectively.

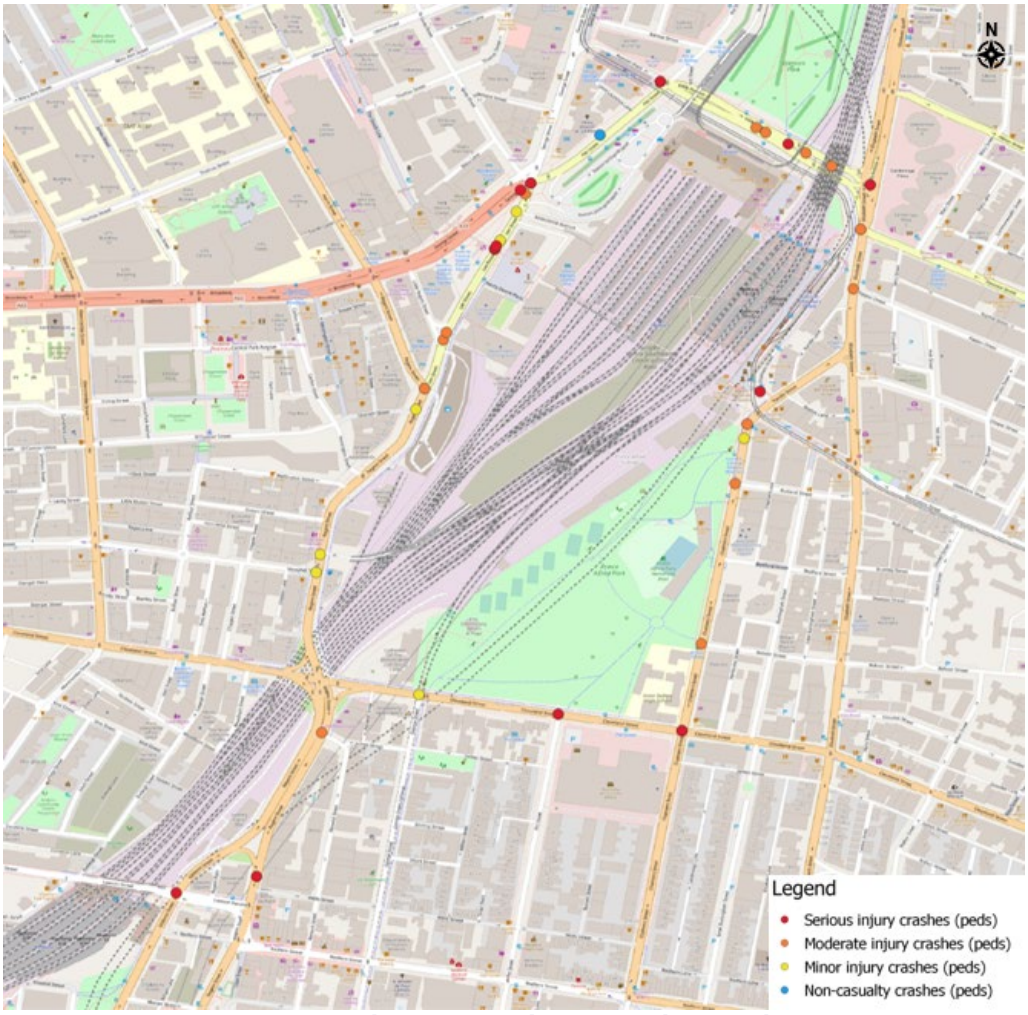


Figure 5-37: Locations of pedestrian crashes around Central Precinct

Pedestrian crashes are concentrated primarily around the station accesses on Eddy Avenue, Chalmers Street and Lee Street, with a greater concentration of incidents at the traffic signals at the intersection between Lee Street and Pitt Street. Cyclist crashes have been recorded primarily along movement corridors such as Lee Street, Regent Street, Cleveland Street and Chalmers Street near the station access.

Figure 5-38: Locations of cyclist crashes around Central Precinct

5.9.3 Road safety performance

The road safety performance for the road network surrounding Central Station were assessed by estimating the crash rates that would occur per 100 million vehicle kilometres travelled (MVKT) on various road sections. This is an industry-accepted measure of crash exposure that is used to compare the frequency of crashes across different roads with varying levels of traffic demand.

The following data was used as input to perform crash data analysis by MVKT:

- Number of crashes recorded over a five-year period (1 January 2015 and 31 December 2019)
- As there are no permanent midblock count stations located along the network, traffic surveys (classified intersection counts) conducted on Tuesday 30 March 2021 were used to perform a high-level estimate of annual daily traffic expected on various road sections.

As the crash data extends back to 2015, it includes incidents recorded on roads that have undergone significant upgrade works to enable the implementation of the light rail. This includes but is not limited to the closure of Chalmers Street and changes to Eddy Avenue and Rawson Place.

Table 5-38 provides an overview of estimated crashes that would occur per 100 MVKT travelled on the road network surrounding Central Station, providing a platform for comparison of the relative incident rate on the road sections.

Table 5-38: Estimated crashes per 100 MVKT

ID	Road section	Crashes per 100 MVKT	Casualty crashes per 100 MVKT
1	Regent Street	501	367
2	Lee Street	340	307
3	Great Western Highway	335	282
4	Pitt Street	21	14
5	Eddy Avenue	189	173
6	Elizabeth Street	96	86
7	Randle Street	32	32
8	Chalmers Street	100	83
9	Cleveland Street	97	85

Figure 5-38 and Figure 5-39 present a visualisation of the estimated crashes along the road network per 100 MVKT.

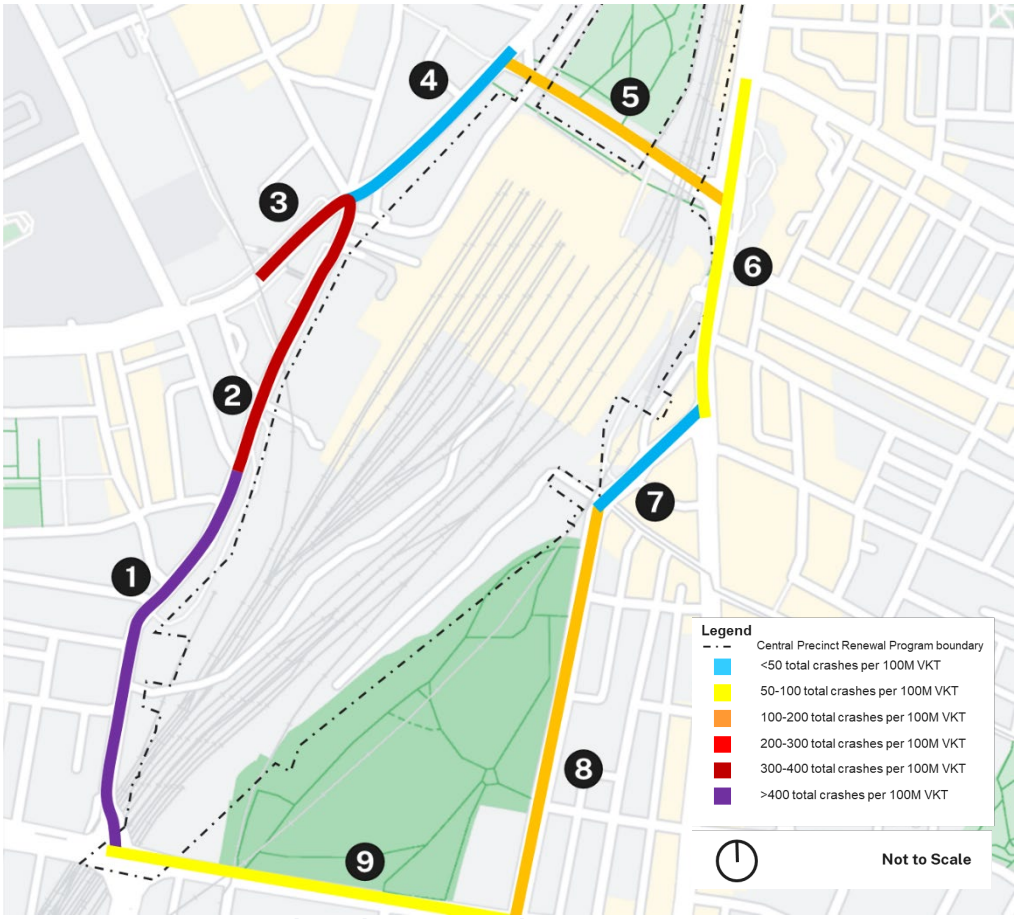


Figure 5-39: Estimated crash frequency by 100 MVKT

Figure 5-40: Estimated casualty crash frequency by 100 MVKT

5.9.4 Road safety benchmarking

Road safety benchmarking was undertaken to assess the crash severity around Central Precinct. Areas used to validate the target mode share in Section 5.2.1 were used to for the crash data benchmarking due to the similar urban form and public transport infrastructure services. These locations were taken at an SA2 level and align with the areas identified in Section 5.2.2.

Publicly available crash data was sourced from TfNSW Open Data and the Victorian Department of Transport. Five-year crash data between January 2017 and December 2021 was analysed for Sydney based locations whilst five-year crash data between July 2015 and June 2019 was sourced for Melbourne based locations.

The crashes per 100 million vehicle kilometres travelled (VKT) metric was not calculated as the annual average daily traffic varies for different street types and is not provided for all streets within the locations. Crashes per kilometre was taken to compare the areas.

A total of 119 crashes occurred within the Precinct, with 30.43 crashes occurring per kilometre. It is evident that the Precinct's crash rate per kilometre is higher than all the other areas, double Melbourne's total crashes per kilometre and thrice Sydney CBD's crash per kilometre. The total length of the road network and number of crashes within the areas are detailed in Table 5-39.

Table 5-39 Overall number of crashes

Locations	Total length of road network (km)	Total number of crashes	Total crashes per km
CPRP	3.91	119	30.43
Sydney CBD	86.63	886	10.23
Pyrmont - Ultimo	27.61	263	9.53
Redfern - Chippendale	41.39	344	8.31
Melbourne	51.96	808	15.55
Docklands	27.15	168	6.19

Due to the differences in data between states, the following categories were used to classify the severity of injuries.

- Fatal injury – resulting in at least one person dying within 30 days from injuries sustained in the crash
- Serious injury – resulting in at least one person being admitted for a hospital stay
- Other – requires either some medical attention or no person injured

Table 5-40 provides a summary of the severity of the crashes within each area. The Precinct has a higher crash rate per kilometre for all categories (fatal, serious, and other) in comparison to the other areas. Melbourne's serious crash rate is comparative to the Precinct's serious crash rate.

Table 5-40 Crashes by severity of injury

Locations	Fatal crashes volume	Fatal crashes per km	Serious crashes	Serious crashes per km	Other crashes	Other crashes per km
CPRP	1	0.26	19	4.86	99	25.32
Sydney CBD	9	0.1	170	1.96	707	8.16
Pyrmont - Ultimo	1	0.04	50	1.81	212	7.68
Redfern - Chippendale	3	0.07	65	1.57	276	6.67
Melbourne	3	0.06	233	4.48	572	11.01
Docklands	0	0	57	2.1	111	4.09

The fatal and serious injury (FSI) crash rate is specified in Table 5-41. The Precinct's FSI rate is the highest, with Melbourne's FSI rate being somewhat similar at 0.91.

Table 5-41 FSI crash rate

Locations	Sum of fatal or serious crashes	FSI crash rate
CPRP	20	1.02
Sydney CBD	179	0.41
Pyrmont - Ultimo	51	0.37
Redfern - Chippendale	68	0.33
Melbourne	236	0.91
Docklands	57	0.42

The precinct's crash rate in comparison to the other areas can be attributed to the smaller total road length, causing the Precinct's crash rate to be perceived higher than the other areas. Benchmarking the crashes by other metrics such as the number of residents, employees and station patronage can provide a multi-faceted understanding of the precinct's crashes.

Table 5-42 and Table 5-43 benchmark the volume of crashes per 1000-residents and 1000 employees respectively. For every 1000 residents, there is a total of 37.19 crashes within the Precinct, the highest in comparison to the other benchmarked areas. However, when benchmarking the volume of crashes per 1000 employees, the Precinct only had 8.93 crashes per 1000 employees. In comparison, Sydney CBD had nearly double the total crashes at 15.61 crashes per 1000 employees.

Table 5-42 Severity of crashes benchmarked against every 1000 residents

Locations	Fatal crashes per 1000 residents	Serious crashes per 1000 residents	Other crashes 1000 residents	Total crashes per residents
CPRP	0	5.94	30.94	37.19
Sydney CBD	0.27	5.11	21.27	26.66
Pyrmont - Ultimo	0.04	2.03	8.6	10.66
Redfern - Chippendale	0.11	2.38	10.09	12.57
Melbourne	0.06	4.38	10.76	15.19
Docklands	0	3.61	7.02	10.63

Table 5-43 Severity of crashes benchmarked against every 1000 employees

Locations	Fatal crashes per 1000 employees	Serious crashes per 1000 employees	Other crashes 1000 employees	Total crashes per 1000 employees
CPRP	0.08	1.43	7.43	8.93
Sydney CBD	0.16	3	12.46	15.61
Pyrmont - Ultimo	0.04	1.87	7.92	9.83
Redfern - Chippendale	0.12	2.5	10.6	13.21
Melbourne	0.06	4.9	12.02	16.99
Docklands	0	3.85	7.5	11.35

Table 5-44 benchmarks the total crashes for every 100 million journeys that involve all train stations within the study area. Redfern-Chippendale is proposed to have the highest volume of crashes, with a total of 5798 crashes per 100 million journeys. The Precinct has the lowest number of crashes, at 471 crashes per 100 million journeys.

Table 5-44 Total crashes per for every 100 million trips within the location.

Locations	Annual average patronage for train stations within location	Total number of crashes	Total crashes per 100million trips
CPRP	25,265,576	119	471
Sydney CBD	86,969,505	886	1019
Pyrmont - Ultimo	n/a	263	n/a
Redfern - Chippendale	5,932,726	344	5798
Melbourne	26,109,600	808	3095
Docklands	11,297,613	168	1487

5.10 Movement and place analysis

Movement and Place is a place-based approach to the planning, design, delivery, and operation of transport networks. It provides a framework to understand the function of streets in the context of their value to the community and recognises the impact between streets and the spaces they adjoin. The framework is a tool that enables the balancing of the movement of people and goods with maintaining and enhancing the amenity and quality of places.

5.10.1 Understanding place

To understand places around Central Precinct, the *Practitioner's Guide* to *Movement and Place* (GANSW, 2020) outlines the framework for what qualifies places and future placemaking in the Precinct. The Guide offers three lenses through which places can be defined, consisting of physical form, the activities

that happen within them and their shared meaning to people. The combination of these three factors contributes to creating place intensity.

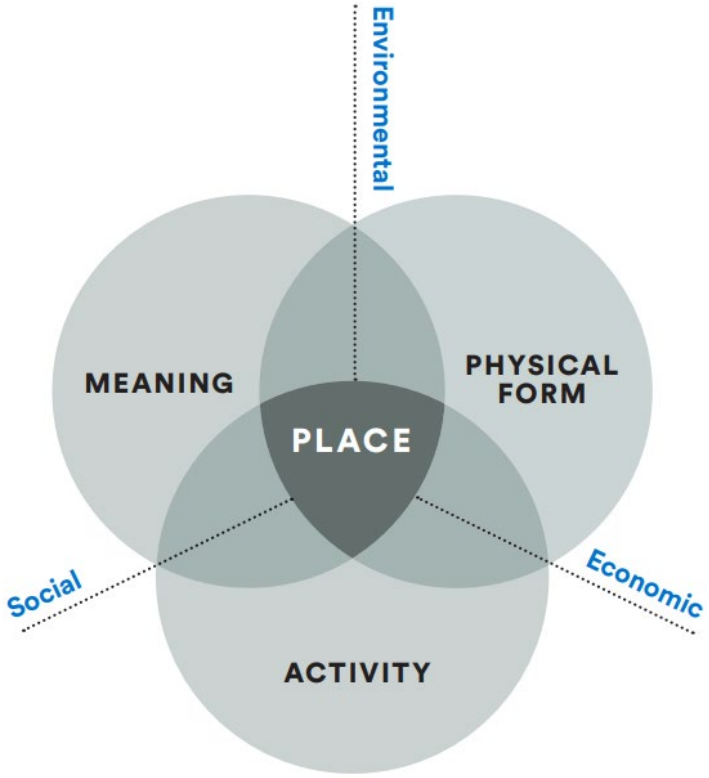


Figure 5-41: The synthesis of place through meaning, physical form, and activity

Physical form is a combination of the layout of buildings, movement networks and open spaces; the way in which the land is subdivided and configured to form lots; and the type, function and use of the built form.

Activity is the type, diversity or intensity of the ways a place is used or enjoyed.

The meaning of a place reflects how they are commonly valued by the local people and communities. It is an aspect of the place that is typically built over time and usage.

5.10.2 Current places

Sydney's Central Station is Australia's busiest transport interchange, located at the southern edge of Central Sydney. The Precinct extends to the suburbs of Haymarket, Chippendale and Surry Hills.

The station provides transport services for a wide cross-section of customers, including residents and employees of the CBD, students commuting to schools and universities located near the station or connected to it through the transport interchange, visitors to the food and retail businesses nearby as well as travellers arriving in Sydney via the Sydney Kingsford Smith Airport.

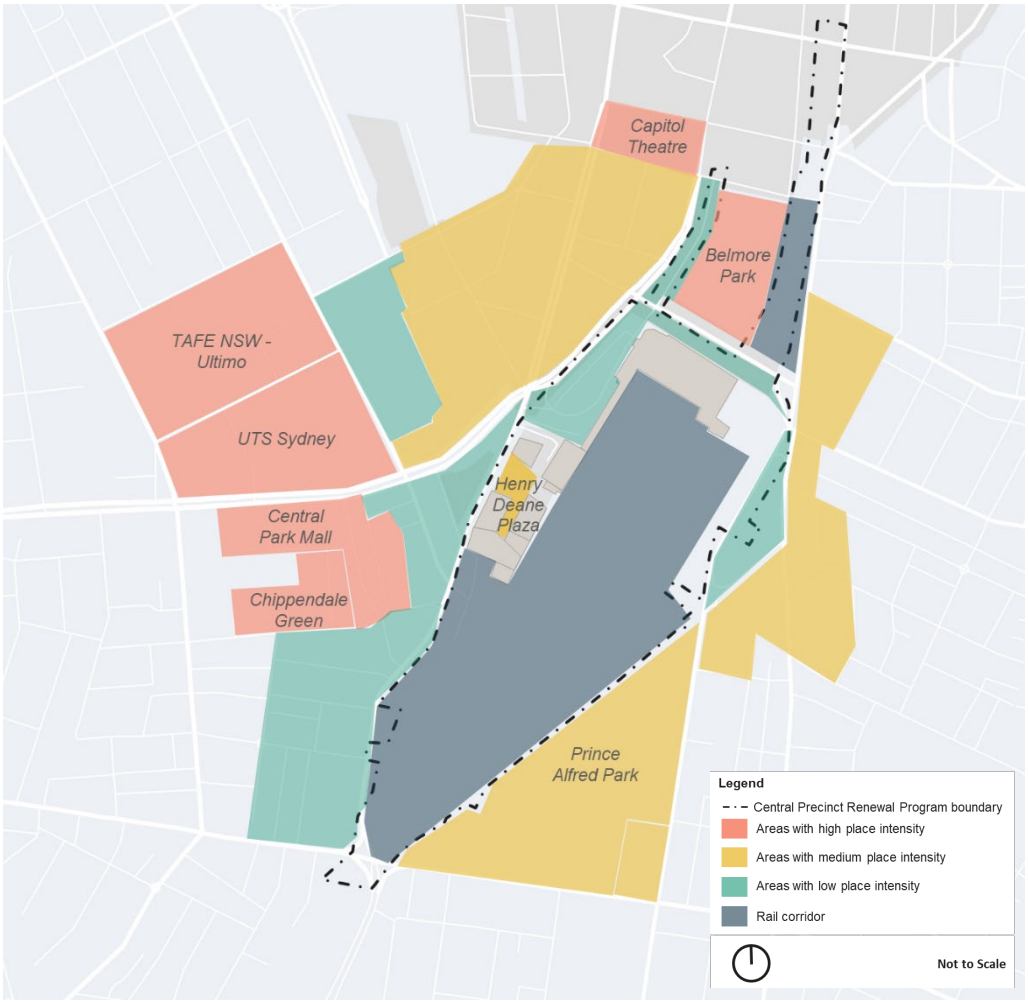


Figure 5-42: Current place intensity around Central Station

The following represent locations of medium to high place intensity in the Precinct:

- educational facilities:
    - University of Technology Sydney
    - TAFE NSW, Ultimo campus
    - Inner Sydney High School
- parks:
    - Belmore Park
    - Prince Alfred Park
    - Chippendale Green (Central Park)
- food and retail areas:
    - Central Park Mall and surrounds
    - Capitol Theatre
    - Restaurants located in Surry Hills to the east
    - Restaurants and retail located in Haymarket to the north-west.

Despite the concentration of land uses and areas with high place value around the station, Central Station itself currently functions as a place for transit, with few areas that attract visits or invite people to dwell.

While there exists the physical form for store fronts located along the southern side of Eddy Avenue underneath the sandstone arches, they receive little activity, and many of the lots are currently unoccupied. Similarly, while there are some food retail businesses located within the Central Food Market at the north-east corner of the unpaid area of the Grand Concourse for station commuters, the area does not hold sufficient meaning to the community for it to be considered high place value.

5.10.3 Future places

With the initiatives the Central Precinct Renewal Program proposes in revitalising the station and surrounds as well as developments currently underway in adjoining areas, many new open spaces and future places are planned.

The future Central Precinct offers a new deck over the railway tracks that would be home to commercial buildings, retail, hotels and community-serving facilities.

Figure 5-42 shows the indicative locations of place intensity proposed in the renewal of the Precinct. All existing place intensity will be maintained at the same level with additional place intensity located on the deck.

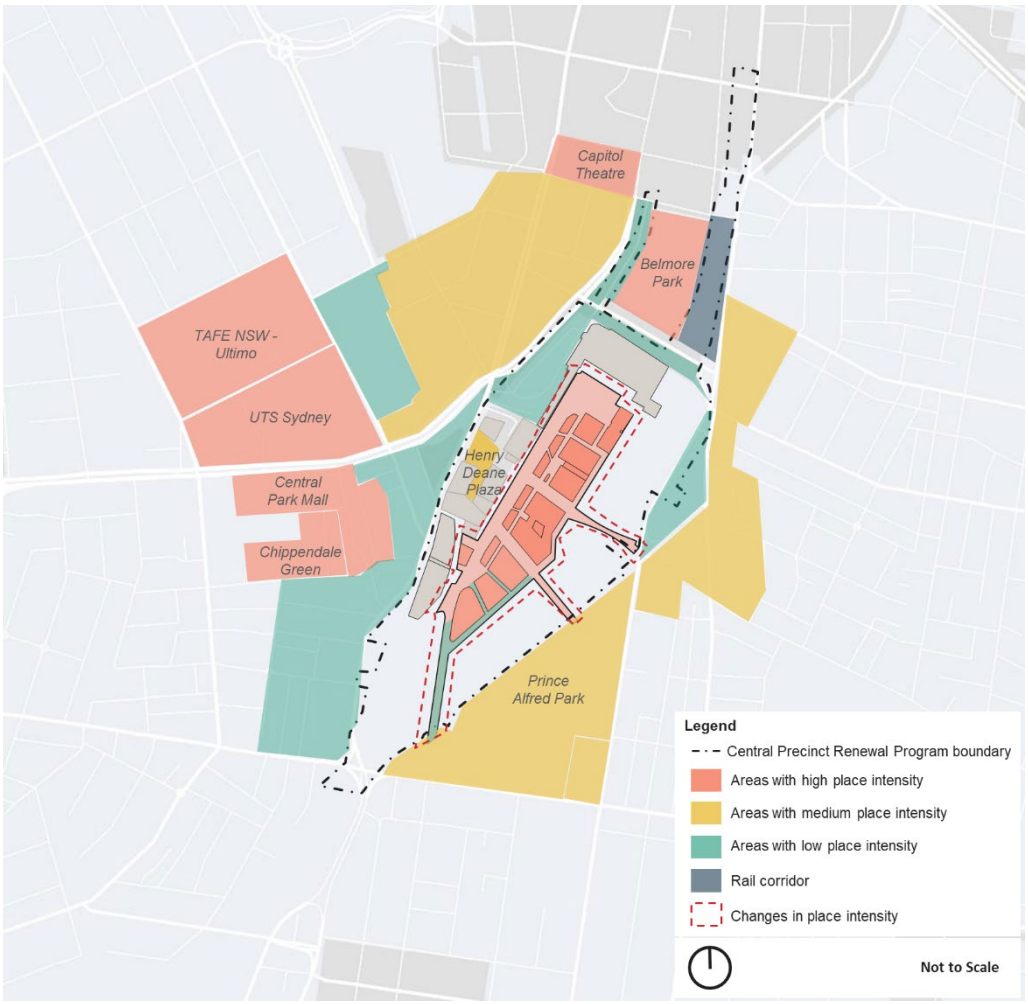


Figure 5-43: Future place intensity around Central Station

The value of a place is synthesised through the interactions between physical form, activity and meaning, which are intrinsically linked to the functionality of areas and the interactions visitors have with them.

The proposed developments on the deck would contribute the physical form and activity of a commercial area, with retail and hotels supporting employees, business visitors and tourists. With proposed community facilities and retail that would attract local Sydney residents, the revitalisation of the Precinct and development of the deck presents an opportunity to greatly enhance the value of the place to both visitors and residents of Sydney.

The Precinct will leverage off the intensity of activity that will be provided by commercial developments both on the deck and by Tech Central, which will be an ecosystem of universities, start-ups and tech. Multiple new open areas and green spaces to be located both on the deck and at the street level near these developments will become meeting points that invite activity from employees, retail visitors and the general public.

5.10.4 Understanding movement

The *Practitioner's Guide* to *Movement and Place* (Government Architect NSW, 2020) additionally outlines the framework for understanding movement in relation to and from, within and through a place, and classifies it into three distinct groups.

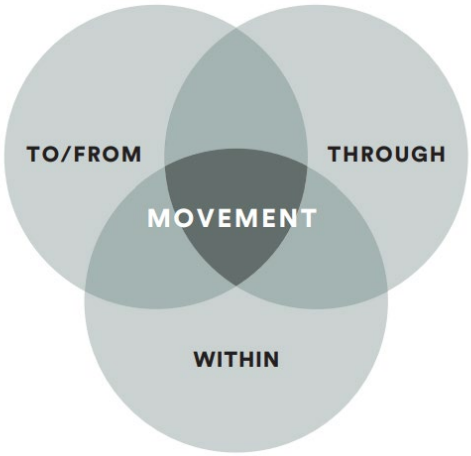


Figure 5-44: Three types of movement in relation to a place

Movement through a place does not engage with the area but can impact on it such as in contributing to through vehicle traffic, congestion, noise and pollution reducing amenity. Movement to and from a place interacts with it and connects it to other destinations, and movement within a place is contained within the Precinct.

Viewing the concept of movement through this lens enables an understanding of the complementary relationship between movement and place. The connections within, to and from the Precinct are critical to enabling the intensity of activity that is required to create a high-quality place.

5.10.5 Existing movement

Existing movements that travel through Central Precinct consists primarily of vehicular traffic on major roads that do not have a destination in the Precinct. These movements contribute to congestion on the surrounding road network and compete with active and public transport modes for priority at traffic signals. High pedestrian and cyclist movements also travel through the Precinct, crossing

between the eastern and western sides of the station via Eddy Avenue and Devonshire Tunnel.

As a major multi-modal transport interchange, movements to and from the Precinct make up the greatest proportion of travel demand. Existing train and bus services connect Central Station to the suburban and intercity network, with frequent all stops and limited services in all directions. Light rail provides a connection to both inner west suburbs and

Movements within the Precinct consist primarily of transfers between modes, such as between heavy rail, light rail and buses.

5.10.6 Future movement

Future movements in Central Precinct will include new links to the OSD, as well as through the station. New major connections will include:

- Central Walk, linking the metro and suburban rail platforms, and will extend from Railway Square in the west to Chalmers Street and the light rail stop in the east
- Connections to the OSD, including:
    - Stairs and escalators to the Grand Concourse
    - Stairs and escalators to Central Walk
    - Stairs to City Square
    - Escalators to Henry Deane Plaza
    - Stairs to the Goods Line
    - Stairs to Mortuary Station
    - Walkway to Prince Alfred Sidings
    - Stairs and escalators to Devonshire Street.

These new links will provide more direct connections over and under the railway tracks, that will enable people to travel across the Precinct more easily in all directions. With a greater number of attractors within the Precinct, higher off-peak movements within the Precinct can be expected, contributed by employees of the OSD.

5.10.7 Existing movement and place classification

The designation of corridor classifications was initially undertaken based on speed limits, public transport services, and placemaking elements on every road.

Based on the classification highlighted in the legend, Figure 5-44 exhibits the current street environment/ corridor classification for roads and streets within and surrounding the Central Precinct.

Of the roads surrounding the Precinct, sections of Elizabeth Street, George Street and Broadway are considered main streets. In addition to facilitating high movements of pedestrians, public transport and private vehicles, these streets reflect high place value contributed by food and retail businesses, commercial buildings, educational institutions.

Other major streets adjoining the Precinct include Eddy Avenue and Chalmers Street, which are important transport interchanges and movements corridors

located at the station accesses, and function as meeting places for customers of the station.

Roads such as Lee Street, Chalmers Street south of Randle Street and sections of Elizabeth Street function primarily as movement corridors for private vehicles and buses.

Figure 5-45: Existing street environments

5.10.8 Future movement and place classification

Due to the extent of the Central Precinct SSP works, few changes are expected to the streets surrounding the station. Both Eddy Avenue and Chalmers Street will experience a higher place intensity. Quay Street will experience more movement due to the closure of Lee Street.

The addition of the OSD provides new areas of high place value through the addition of restaurants and retail, and buildings with commercial, educational and community uses on the deck. Figure 5-45 provides an overview of future street classifications under the SSP.

The OSD would be structured so the primary movement corridor would run through the middle of the development, allowing the most direct movements to and from buildings and connecting to Central Walk below the deck. Open green space with seating will be provided around the northern section and western corridor of the deck, and will function primarily as meeting and leisure areas for visitors and employees of the OSD, and as a secondary walkway across the deck.

Outcomes of Central Precinct will enable the activation of existing storefronts along Eddy Avenue, of which many are currently vacant. This can be expected to

help improve the place value of the street by attracting visitors under the historic sandstone arches.

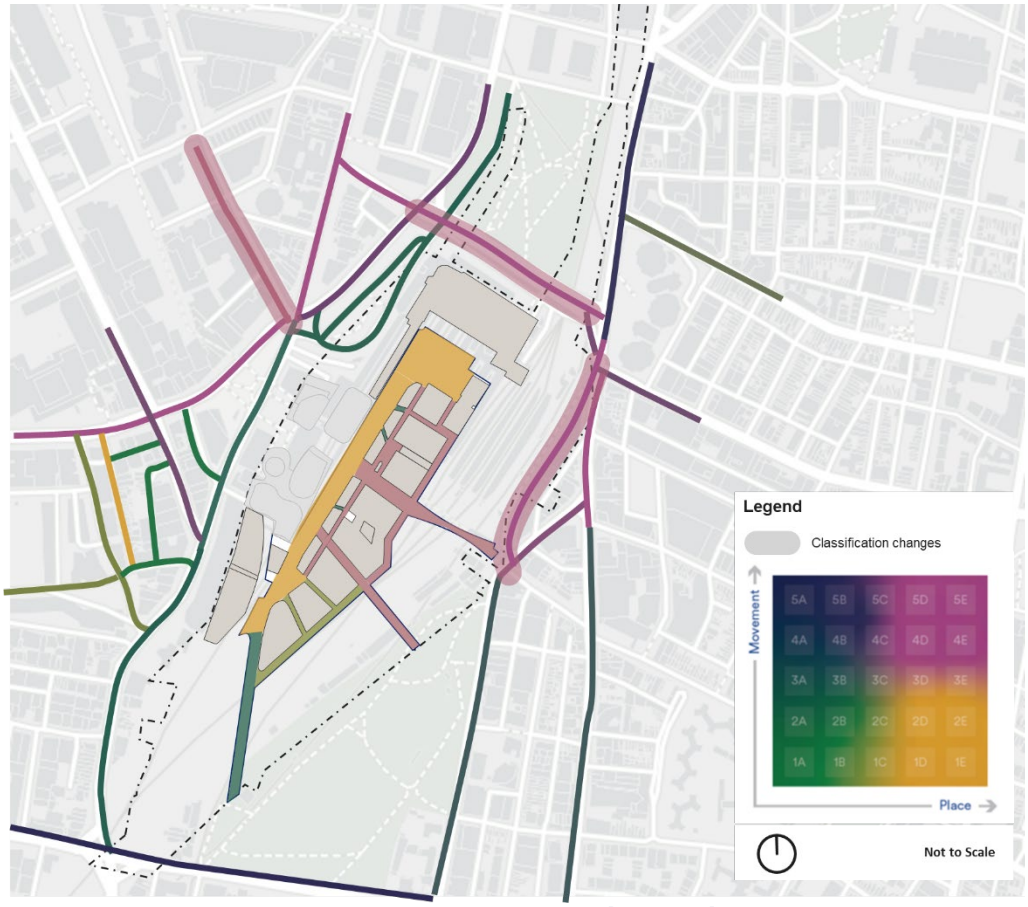


Figure 5-46: Future street environments around Central Precinct

5.11 Cumulative impact assessment

There is the potential for cumulative transport impacts from the project and other proposed developments surrounding the project. Section 2.4 identified key infrastructure, service and development projects that have the potential to have a cumulative impact with Central Precinct. These projects include:

- Sydney Metro and Metro West
- Fast Rail
- More Trains More Services
- Sydney's Bus Future
- WestConnex
- Tech Central
- Pyrmont urban renewal.

A qualitative assessment of associated potential cumulative impacts during operation is provided below. This is based on the most current publicly available information at the time of this assessment.

5.11.1 Sydney Metro and Metro West

Sydney Metro will introduce a new Metro Station within Central Precinct. Opening in 2024, the new link will connect Chatswood in the north to Bankstown in the south-west, including access to other new stations at Crow's Nest, Victoria Cross (North Sydney), Barangaroo, Martin Place and Pitt Street.

Within Central Precinct, Sydney Metro is expected to add 11,600 additional movements through Central Station in the AM peak hour in 2036, either through transferring to suburban or regional rail services, or entering/ exiting the station to the surrounding precinct. Travel patterns beyond study area are also expected to occur, with reduced patronage on North Shore line, as well as reduce demand for buses travelling from North Sydney.

The assessment for Central Precinct has considered both the increase in passenger movements, and the likely changes to travel patterns and how journeys to Central Station may change over the next 20 years. Demand forecasts have included demands associated with the new Metro platforms, as well as demands to bus stands within the Precinct.

Preliminary demand forecasting and modelling of pedestrian movements through the station suggest Sydney Metro will reduce passengers using Platforms 16 and 18 and increase demand through Central Walk East. External to the station, there is no clear change in pedestrian movements attributed to Sydney Metro, due to the quantum of activity across the study area.

Sydney Metro West stations located west of the inner-western suburbs may attract passengers from existing train lines, especially at stations in Parramatta, Homebush and Strathfield. Additionally, passengers whose journeys begin or end in Pyrmont/Ultimo or the northern areas of the CBD may transfer from train services that are serviced by Central Station. However, these are likely to number less than 200 during peak hours and their impact will be mainly on transfers within the station.

Some passengers whose journeys begin or end west of Central Station and who either walk or take the light rail services may also transfer to Metro West, using Pyrmont Station instead of Central. These would reduce demand on Grand Concourse and the Colonnades at the light rail stop by fewer than 100 persons during the peak hours. There is also the potential for a reduction in pedestrian traffic leaving and arriving at the western station accesses, but these volumes would be minimal.

Overall, Sydney Metro is a positive contributor to the vision of Central Precinct, with the project acting as a driver for improved pedestrian connections within Central Station and in the surrounding area. While new Metro services will add additional movements into the station, the expanded catchment enabled by the new network will support the adopted mode share targets.

5.11.2 Fast Rail

Fast rail looks to deliver faster rail corridors within regional NSW, improving the capacity, frequency of journey times to and from regional centres. Due to existing network constraints, the main interface hub with the regional fast rail network is expected to be outside of the Sydney CBD, with Central Station likely to play a key role in facilitating transfers between the fast rail hub and the broader suburban and regional rail network.

With the Fast Rail initiative in early stages of planning, the assessment of Central Precinct has not included adjustments to demands or travel patterns linked specifically to Fast Rail. However, changes introduced by the Central Precinct project, including track and signal upgrades, have been included in future forecasts of services to both regional and suburban platforms, and in the subsequent modelling of Central Station and surrounding precinct.

5.11.3 More Trains More Services

The More Trains More Services program will provide additional capacity on Sydney's railway lines through new systems, infrastructure upgrades and additional trains. At Central Station, this includes additional services in the AM and PM peak hours along the T2, T4 and South Coast, and T8 lines.

The increase in service reliability and frequency resulting from the More Trains More Services program is expected to see reduced wait times and a leveling of demand across peak and non-peak services. The assessment for Central Precinct has considered the increased frequency of services, with future service capacity and frequency aligning with the assumptions of the More Trains More Services.

Preliminary demand forecasting and modelling of pedestrian movements through the station indicate the More Trains More Services will have a positive impact on passenger activity within Central Precinct. Increasing capacity and frequency of train services reduces waiting time on platforms, allowing for increased passenger capacity through the rail network. The extension of Central Walk West as part of Central Precinct ensures Central Station can accommodate the increased demand attributed to the cumulative impact of More Trains More Services and the proposed development of Central Precinct.

Overall, More Trains More Services is a positive contributor to the vision of Central Precinct, enabling a higher frequency and reliability of train services across the suburban network. This supports the future growth of the network, and ensures demand associated with the proposed Central Precinct development can be accommodated within the rail network.

5.11.4 Sydney's Bus Future

Sydney's Bus Future is a long-term plan to introduce new rapid bus routes across the Greater Sydney area, as well as simplify the existing bus network through rationalisation of bus stops and creating more direct bus routes. Around Central Precinct, Eddy Avenue and Railway Square will remain key interchange locations for buses, with Broadway, Regent Street, Eddy Avenue, Elizabeth Street and Chalmers Street all forming part of the planned city centre key bus corridors.

Given the interchange role Central Precinct plays in connecting bus services with multiple modes of transport and the high demand for bus services, there are no current plans to remove bus stands. The assessment for considered both the increase in demand within the bus network, how future occupants of Central Precinct may travel via bus to the Precinct, and accessibility from each bus stand to the OSD and other key developments.

As noted in Section 5.6.3, preliminary precinct modelling identified that there is likely to be increased congestion around bus stands throughout the Precinct, due to the position of key bus interchanges within high activity pedestrian movement corridors. While Sydney's Bus Future is a positive contributor to the vision of

Central Precinct, the increased activity around bus stands will require further mitigation, when considering the background activity of both pedestrians and bus users, and the demand attributed to the development of Central Precinct.

There are opportunities in conjunction with the CPRP program to improve access to bus stands within Central Precinct, including along Eddy Avenue and Railway Square. This may include priority bus spines, with continuous bus lanes second from the kerb and dedicated off-line stopping bays.

5.11.5 WestConnex

WestConnex is a staged upgrade of the motorway network west and south of Sydney, connecting western Sydney, Sydney Airport and Port Botany and south and south-western Sydney. Once complete, WestConnex will act as the western CBD bypass, improving east-west connectivity to the south of the Sydney CBD and reducing vehicle demands on the arterial road network.

The STFM model used in the assessment includes Future road and network upgrades committed and proposed within and beyond the study area, including WestConnex. A review of outputs from the STFM for the study area identify that, in comparison to 2019 volumes, WestConnex is expected to reduce through traffic around Central Precinct, with traffic volumes decreasing to the west along Regent Street and to the south along Cleveland Street. Noting the expected increase in pedestrian traffic around Central Precinct in the future, the forecasted decrease in through traffic around the study area may support opportunities to rebalance road space to support non-private vehicle travel across Central Precinct and the broader Sydney CBD.

5.11.6 Tech Central

Tech Central is the future focal point of Sydney's innovation and technology community. Extending from Central Precinct at its northern point, to Ultimo in the west, Surry Hills in the east and Eveleigh in the south, the area is expected to undergo significant transformation with new commercial and education development.

Given Central Precinct’s location, the assessment of the proposed future development has considered and included the expected demand associated with Tech Central. The Western Gateway precinct, which forms a part of Central Precinct and Tech Central but not directly included in the SSP, has been included in the demand forecasting, pedestrian modelling and other transport mode assessments for Central Precinct.

Beyond the study area, Tech Central has also influenced travel patterns and movements to and from Central Station. Population and employment projections for Tech Central, together with the areas to the east, north and west of Central Station, have been used to identify how pedestrian movements may change over time, and then integrated into the demand forecast calculations and subsequent modelling of the Precinct.

The preliminary modelling identifies the Western Gateway as a key destination for pedestrians, accounting for 7,300 trips within the Precinct during the AM peak hour, with 4,700 of those to and from Central Station. The broader Tech Central area increases trips to the southwest, with high pedestrian demands travelling along the George Street/ Broadway corridor.

When considered in conjunction with Central Precinct, the key movement corridors and pedestrian activity for both the Western Gateway and Tech Precinct are generally located away from activity associated with Central Precinct during peak periods. In off-peak periods, the complementary land-uses across Central Precinct, the Western Gateway and the broader Tech Precinct will create trips between destinations across the three zones. The pedestrian network for Central Precinct and the Western Gateway have been design with this in mind, allowing pedestrians to move efficiently between the two without moving onto the external network.

The inclusion of Central Precinct within Tech Central is both reflective and supportive of Central Precinct's vision. The proposed development of Central Precinct, alongside the Western Gateway, form part of Tech Centrals northern anchor. While the trip generation for both Central Precinct and the Western Gateway is significant, the directionality of movement during peak periods ensures the cumulative demands associated with both planned and proposed development can be safely accommodated.

5.11.7 Pyrmont urban renewal

The Pyrmont urban renewal area, located west of Central Precinct extending from Broadway to Johnstons Bay, will grow to accommodate 8,500 additional residents and 23,000 jobs over the next 20 years. The Ultimo Precinct, located adjacent to Central Precinct, will account for a significant portion of this growth.

The urban renewal of Pyrmont has had a direct influence into demand generation and trip distribution across Central Precinct. The introduction of Pyrmont metro station will significantly change how the community accesses Pyrmont, with more trips undertaken via metro services rather than walking from Central. Similar to Tech Central, future population, employment and student data for Pyrmont and Ultimo have been used to understand likely changes in movements to and from Central Precinct, and the key corridors and connections between the two areas. This has been used as inputs into the pedestrian trip generation forecasts, with the Precinct model allowing for a detailed analysis of pedestrian connections across Lee Street and George Street towards Ultimo.

As identified in Section 5.4, there are significant pedestrian demands crossing both Lee Street and George Street towards Ultimo. The introduction of Central Walk West is likely to encourage more pedestrian movement at street level, bypassing the existing Devonshire Tunnel alignment and extension underneath George Street towards the Goods Line. Improving pedestrian connectivity across this corridor will be key in providing a clear link between the Pyrmont urban renewal area, and the future development at Central Precinct.

5.12 Summary of impacts

5.12.1 Overall

The overall assessment of transport impacts due to the Central Precinct proposal has shown that:

- The additional pedestrian and broader transport demand generated by Central Precinct is high, in recognition of the Precinct's scale. However, majority of growth in demand and activity is attributed to trips through Central Station, rather than the proposed development.

- The adopted mode share for Central Precinct is ambitious, however, it is both reflective of the vision and aspirations of the Central Precinct project, and the characteristics of the Precinct and expected infrastructure investment.
- Travel plans will be required to support the adopted mode share. These should include information programs for sustainable transport, active transport initiatives, flexible working hours and proactive cooperation between agencies should be delivered and monitored by future developers of Central Precinct to encourage workers, visitors and residents to choose alternatives to driving.
- Broader capacity enhancements realised through the More Trains More Services program, Sydney's Bus Futures and other infrastructure investment initiatives are necessary to accommodate the growth in transport demand, both with and without the development of Central Precinct.
- Noting the importance of Central Station as a major transport interchange, there is potential for Central Precinct to impact on transport operations. The planning and implementation of Central Precinct should minimise any negative impact on operations created by the development of Central Precinct and enhance safety and operational efficiency of the interchange where possible.

5.12.2 Walking and cycling

The assessment of walking and cycling impacts due to the Central Precinct proposal has shown:

- The majority of pedestrian and cyclist demand generated within Central Precinct would be due to Central Station, and not the proposed development.
- The growth in pedestrian demand will place increased pressure on footpaths and intersections, which over time may lead to undesirable amenity outcomes for pedestrians.
- Dynamic modelling of pedestrian movements across the study area identified three intersections as not meeting the LOS criteria for pedestrians in the AM or PM peak periods:
    - north-east from the station travelling to Surrey Hills, crossing at the intersection of Elizabeth Street and Foveaux Street.
    - north of the station travelling to Belmore Park and the Eddy Avenue bus interchange, crossing at the pedestrian signals on Eddy Avenue
    - north-west of the station travelling towards Haymarket, across the intersection of Pitt Street and Eddy Avenue

  Comparison of the performance of these intersections against a 'no development' scenario highlighted that these intersections are expected to perform poorly without CPRP, with demands associated with the development having minimal impact. Infrastructure upgrades are required at the above locations to support the expected increase in pedestrian movement.
- The Walking Space Guide assessment identified the following areas as not achieving a LOS C.
    - On the southern side of George Street, midblock between Harris Street and Quay Street
    - Along the western side of Pitt Street, north of Eddy Avenue
    - On the southern side of Eddy Avenue along the station colonnade
    - On the northern side of Eddy Avenue, adjacent to Bus Stand B

  - On the western side of Elizabeth Street, south of the T5 bus stop
  - On the western side Chalmers Street, midblock between Randle Street and Elizabeth Street adjacent to the Light Rail stop

  For each of these locations, the observed LOS was similar for both the CPRP and 'No Development' scenarios. Each of the locations identified should be considered for road space reallocation in line with the TfNSW Road Space Allocation Policy and Procedure.

  Infrastructure works to support the above pedestrian desire lines should consider the reallocation of road space in line with the road user hierarchy identified in Section 4.1.

- The expansion of Central Walk towards Lee Street safely accommodates east-west movement across Central Station and is further supported by new connections over the station and the existing Devonshire Tunnel.
- Dynamic modelling of pedestrian movements and activity on the proposed deck above the station identified that the reference master plan design can safely accommodate pedestrian demands up to and across the deck. The future design of the OSD target an LOS C in accordance with the Walking Space Guide, to ensure sufficient space is produced to provide a comfortable walking experience.
- Cycling infrastructure to support Central Station would significantly improve access to Central Precinct.
- An existing conflict point between cyclists and pedestrians at the intersection of Elizabeth Street and Foveaux Street has not yet been resolved, with further mitigation required.
- The proposed planning framework for Central Precinct should include bicycle parking rates that are in closer alignment with the 7.5 per cent cyclist target mode share for the Central Precinct.

5.12.3 Public transport

The assessment of public transport impacts due to the Central Precinct have identified:

- the additional passenger generated by the development of Central Precinct through Central Station is expected to account for nine per cent of all future movement through the station.
- dynamic modelling of pedestrian movements within Central Station identified that the suburban platforms perform no worse than 2019 conditions with the increased passenger demand
- the increase in services due to More Trains More Services, together with the introduction of Sydney Metro services into Central Precinct is considered sufficient to cater for the forecast demand associated with Central Precinct, as well as the cumulative demand from future developments across Tech Central and the Ultimo-Pyrmont area.
- the additional light rail demand generated by Central Precinct, together with the anticipated background growth, can be accommodated by existing light rail services.
- the additional bus trip demand generated by Central Precinct, together with the anticipated background growth, can be accommodated by the future bus network and servicing levels.

- increased pedestrian congestion at some bus stands around Railway Square and on Eddy Avenue may conflict with traversing pedestrian movements. Additional space for both waiting passengers and moving pedestrians should be considered in these locations.

5.12.4 Road network and site access

The assessment of road network impacts due to the Central Precinct proposal have identified:

- the road network is constrained and congested and hence future car mode share for Central Precinct should be restricted.
- the anticipated traffic impact of a limited private vehicle scenario (including delivery and service vehicle demand) would have a negligible impact to the wider road network.
- the need to improve safety, especially for pedestrians and cyclists, to reduce the risk of crashes and align with the Towards Zero vision
- pedestrian activity associated with Central Precinct and Central Station is likely to create additional strain on the road network around Central Precinct due to pedestrian crossings competing against road traffic for signal time.
- there may be opportunities to reallocate road space to support the growth in pedestrian activity around Central Precinct, including along Eddy Avenue to the north, and on Lee and George Streets to the west.
- vehicular access to Central Precinct has been positioned away from key pedestrian movement corridors to reduce delays and the potential of conflict between vehicles and pedestrians.
- various services and vehicle movements will be generated by the public domain, which will be supported by the introduction of integrated distribution facilities. This would accommodate deliveries, service vehicles and waste collection away from the public realm and allow for the consolidation of goods for delivery across the Precinct to their destination, while managing the challenges posed by the unique access requirements of a multi-modal precinct with heritage infrastructure.

5.12.5 Parking and servicing requirements

The assessment of access, parking and loading impacts due to the Central Precinct proposal have identified:

- high levels of accessibility and non-car options available to future residents, workers and visitors to Central Precinct minimises the need for parking provision.
- the proposed planning framework for Central Precinct include maximum parking requirements that are in closer alignment with the target mode share.
- the proposed planning framework for Central Precinct include a minimum requirement of one car share space per 25 off-street car spaces to be provided.
- the proposed planning framework for Central Precinct include a minimum requirement of one motorcycle space for every 12 car parking spaces to be provided.

- the proposed planning framework for Central Precinct include a minimum requirement of one EV charging space per 15 off-street car spaces to be provided.
- access onto the deck over the station could be provided via an autonomous shuttle from a connection through Prince Alfred Park from Cleveland Street. This would provide 'last mile' access to the Central Avenue, ensuring the public realm and developments within Central Precinct are accessible for all ages and abilities, while also maintaining security provisions above the rail corridor.
- various services and vehicle movements will be generated by the public domain, which will be supported by the introduction of integrated distribution facilities. This would accommodate deliveries, service vehicles and waste collection away from the public realm and allow for the consolidation of goods for delivery across the Precinct to their destination, while managing the challenges posed by the unique access requirements of a multi-modal precinct with heritage infrastructure.
- the adoption of integrated loading management system to manage loading and servicing activities across Central Precinct will smoothen vehicle demand peaks and reduce the frequency of vehicles crossing over footpaths around Central Station during peak periods.
- a Delivery and Servicing Management Plan should be prepared for the Precinct and each dock as appropriate to identify and confirm the servicing strategy for the Precinct (including the station and rail infrastructure as appropriate). This plan should make additional considerations of infrastructure to be provided within the site, policies around vehicle entry and enable adoption of innovative servicing arrangements.
- provision of point-to-point locations surrounding the Precinct would minimise traffic and amenity impacts around the station precinct.
- vehicular access to Central Precinct has been positioned away from key pedestrian movement corridors to reduce delays and the potential of conflict between vehicles and pedestrians.

6. Preliminary construction approach and staging

6.1 Overview

There is currently no formal construction program for Central Precinct. However, potential construction activities and key stages have been identified that allow for the identification of likely transport impacts and mitigation measures.

- **Stage 0 – Preliminary and independent works** comprise of elements of Central Precinct that can either be completed independently of the OSD, or are required as part of the early works and construction staging process.
    - **Part A Enablement Works** – would include the redevelopment of the Terminal building and Regent Street sidings site (including the Lee Street bus layover). The southern loading dock is expected to be constructed as part of the sidings site development.
    - **Part B - Central Walk West and Platform enabling works** includes the construction of Central Walk West, and alterations to the regional platforms of Central Station to enable the future construction of the OSD. The northern loading docks, located under the Western Forecourt, is expected to be constructed during this phase.
    - **Part C - Redevelopment of Goulburn Street and Prince Alfred Sidings** includes the redevelopment of the Goulburn Street and Prince Alfred Sidings sites, including associated loading facilities.
- **Stage 1 – Over Station Development Block A buildings** is the first stage of the OSD and includes the buildings on the northern section of the site. This will also include the connection from Central Walk up to the OSD, a portion of the OSD public domain, and the connection over the suburban rail lines to Chalmers Street.
- **Stage 2 Over Station Development Block B and partial Block C buildings** is the second stage of the OSD construction and includes buildings and public domain in the central section of the OSD, including the land bridge connection to Prince Alfred Sidings.
- **Phase 3 Over Station Development buildings C1-5** is the final stage of OSD construction and includes all buildings in Block C to the south of the Precinct. This stage will also likely include the construction of the remaining land bridge connecting to Prince Alfred Park to the south.

These impacts would likely be experienced at various times throughout the construction phase, as works progress and depending on the activity being undertaken.

6.2 Construction traffic routes

Access to Central Precinct for construction vehicles will be dependent on the location of the works.

Site hoarding will be established to separate work zones from adjacent footpaths and pedestrian pathways to maintain the safety of pedestrians in the area. Traffic controllers will be present at the vehicle crossover points to manage interactions with pedestrians and other road users.

Construction vehicles will travel to and from the site via the arterial road network including the Western Distributor, Victoria Road and the City West Link before arriving at the site via Pitt Street, Regent Street and/ or Chalmers Street. Construction vehicles are expected to depart via Regent Street and Broadway when accessing the site from the west, and Chalmers Street when accessing the site from the east.

The potential construction traffic routes are shown in Figure 6-2.

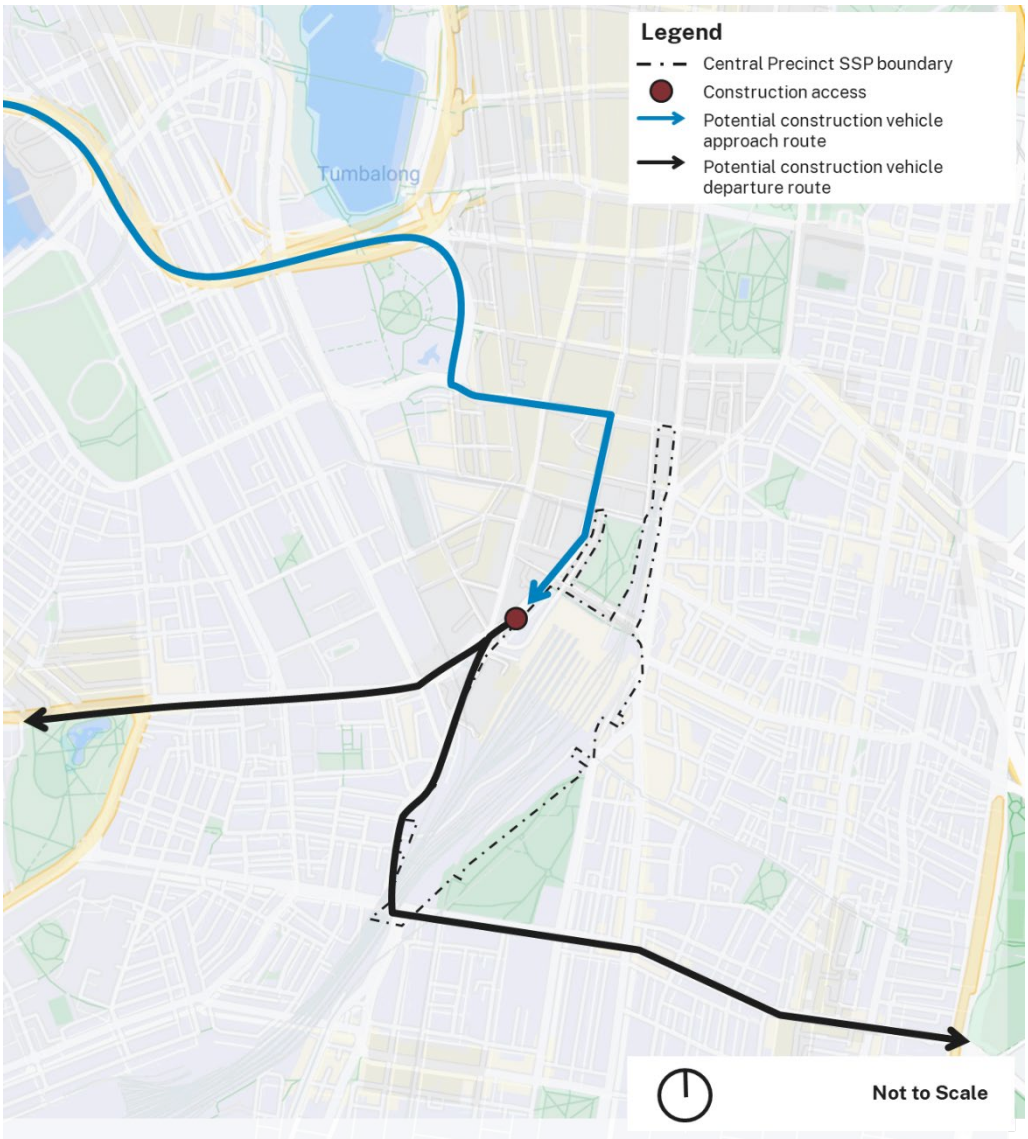


Figure 6-1: Likely construction traffic access routes

6.3 Construction traffic impacts

The following provides an overview of the likely construction traffic impacts on different road users. They are not indicative of the final impact of construction on access and movement. The Construction Traffic Management Plan, which is to be developed at a later stage of the design, should consider innovative and wide-ranging approaches to minimise the impact of construction vehicles on the public domain and operation of the Precinct.

6.3.1 Pedestrians and cyclists

Construction and related vehicle activity is expected to have a high impact pedestrian and cyclist movements surrounding the site. The movement of construction traffic (including heavy vehicles and worker vehicles) may cause interruptions, particularly when entering and exiting the site during construction.

Where practical, construction site access should be located away from key pedestrian movement corridors (including across the intersection of Elizabeth and Foveaux Streets and adjacent to the Eddy Avenue pedestrian crossing). Where this cannot be achieved, delivery activities and other vehicle movements should be limited to occur outside of peak station activity (outside 7am to 9am, and 4pm to 6pm). Alternative temporary cycling routes to the east or west of the Precinct may be required as construction progresses, to reduce any negative impact from construction traffic on cyclists.

6.3.2 Commuters and rail users

During construction, some existing pedestrian paths and station access points may need to be closed to facilitate construction. Alternative routes through and out of Central Station would need to be provided with appropriate wayfinding. Sufficient width along these routes would need to be provided to accommodate forecasted pedestrian flows, with timing of closures to be outside peak travel periods.

6.3.3 On-road public transport

As outlined in Section 4.5, there are over 50 bus and three light rail services that operate in the vicinity of Central Precinct. Depending on the location of works, there are several services that may pass adjacent or through potential construction zones. This includes along Chalmers Street to the east, Eddy Avenue to the north, and Pitt Street, George Street, Regent Street and Lee Street along the western boundary. Eddy Avenue, George Street and Lee Street carry a sizable number of buses each day, especially during the morning and afternoon peak periods. Construction vehicle arrival and departure times from sites within Central Precinct will need to be adequately managed to avoid increased congestion for the public transport network in the surrounding area and reduce flow on impacts to services across the Sydney CBD.

6.3.4 Station operations

During construction of Central Precinct, servicing, deliveries, and maintenance activities will need to occur to ensure Central Station continues to operate at appropriate levels. Temporary loading dock facilities will be required to support ongoing operational activities, with sufficient vehicle spaces to align with vehicle demand. A logistics demand management system may be required to balance available space across the loading areas during construction of the Precinct.

Emergency vehicles will travel along the arterial road network around Central Precinct as their route of choice so that they reach their destination as soon as possible. Construction traffic management across the Precinct must ensure emergency vehicles have priority when passing through and around the construction site.

6.4 Construction traffic management principles

A Construction Traffic Management Plan (CTMP) would be prepared for each stage of construction for Central Precinct and be submitted to the appropriate authorities for approval ahead of adoption and implementation. The CTMP would outline the guidelines, general requirements and specific procedures to be used for any works that may have an impact on traffic operation and be prepared in accordance with City of Sydney's requirements.

The primary objectives of the CTMPs will be to:

- Maximise public safety
- Minimise disruption to pedestrians, cyclists and motorists
- Ensure construction traffic accesses the arterial network as soon as practicable on route to, and immediately after leaving, the construction site
- Ensure buses and light rail services run on time with no disruption to routes and stops, where possible
- Minimise changes to traffic operation and kerbside access
- Minimise construction traffic generation during network peak periods
- Maintain access to properties and businesses
- Work collaboratively with other stakeholders and other major projects to mitigate traffic and transport impacts
- Incorporate innovative and improved approaches to minimise the impact of construction traffic.

6.5 Mitigation measures

The adoption of mitigation measures during construction of Central Precinct will ensure construction activities have limited impact on road users, station and public transport operations and the broader road network in general. The traffic, transport and access-related mitigation measures during the construction phase include the following:

- Deliveries will be pre-booked and planned to ensure a consistent and minimal number of trucks arriving at site at any one time
- Vehicles entering, exiting, and driving around the site should be required to give way to pedestrians and vehicles already on the road
- Where possible, vehicles will enter and exit the site in a forward direction. They must wait until a suitable gap in traffic allows them to assist trucks to enter or exit the site
- Neighbouring properties will be notified of construction works and timing
- Materials will be delivered, and spoil removed outside of peak public transport activity within the standard construction hours

- No on-site parking will be provided to encourage the use of public transport to the construction site.
- Traffic controllers will be used to manage traffic on the public street(s) to allow trucks to enter or leave construction sites throughout Central Precinct.
- Investigation and consideration of vehicle technologies and safety features, such as side under run protection and blind spot monitoring, to maximise the safety of interactions between heavy vehicles and vulnerable road users

One or more CTMPs would need to be prepared as part of the detailed design stage for each phase of Central Precinct's development. These CTMPs would investigate in greater detail specific impacts of construction activities, and outline specific mitigation measures for approval by the relevant road and/or planning authority.

7. Implementation plan and strategy

7.1 Approach to management and mitigation

This section provides an overview of the proposed measures to mitigate the impacts of the proposed development of Central Precinct, both during operation and construction.

Some of the issues identified in this transport assessment are expected to occur without the development of Central Precinct. While these may not be directly attributed to the proposed development, the success of the CPRP is intertwined with delivering on the broader capacity and infrastructure projects. In considering and identifying mitigation initiatives, a holistic view of the transport network has been adopted to delivering on the vision of a fully integrated transport network to support the CPRP.

A suite of initiatives has been proposed to support the development of the site and mitigate the impacts on the transport network. These include:

- Mitigation measures and actions that can be addressed through changes to the Planning Framework
- Updates to the Central Precinct master plan
- Supporting infrastructure projects that could be delivered as part of the renewal of Central Precinct (but outside the scope/ boundary of the SSP)
- Infrastructure projects that fall outside the scope of Central Precinct.

Critical to the success of all the identified initiatives, and the corresponding success of Central Precinct, will be the ongoing engagement with stakeholders and transport authorities as the project progresses.

7.2 Proposed mitigation measures and provisions

Table 7-1 provides a summary of the proposed mitigation measured identified in response to this transport assessment of the development of Central Precinct, including:

- Identifying the impact or issue as identified in the Transport Assessment
- Outlining the proposed mitigation measure required to address the issue
- Recommending the relevant mechanism to be used for the identified mitigation measure, and the timing and/or trigger for the mitigation measure to occur

The mitigation measures have been developed in alignment with the overall Central Precinct vision and objectives outlined in Section 1.2. Further detail on specific initiatives and solutions to address issues and impacts arising from Central Precinct will be included in these report following the completion of the revised pedestrian and transport modelling.

The following approach has been adopted in she identification of mitigation triggers:

- For existing issues and constraints identified in the assessment, the mitigation measure should be in place prior to 2026 (prior to the first stage of development being operational)

- For issues and constraints influenced by Central Precinct as part of the assessment, the mitigation measure should be in place prior to 2034 (prior to the first stage of OSD being operational)
- For mitigation measures on construction impacts or involving ongoing monitoring, the mitigation measure should be in place prior to the relevant works commencing

Table 7-1: Central Precinct proposed mitigation measures and mechanisms

Ref	Impact/ issue	Action	Mechanism	Trigger
Overall				
A1	Broader public transport capacity improvements are required to ensure Central Station can accommodate future growth	Broader capacity enhancements realised through the More Trains More Services program, Sydney's Bus Futures and other infrastructure investment initiatives	Support and implement existing/ planned initiatives These infrastructure projects fall outside the scope of Central Precinct SSP	By 2034
A2	There is potential for Central Precinct to impact on transport operations, both during standard operations and under unplanned/ planned disruption	Include objectives within the SSP Framework to ensure that the planning and implementation of CPRP minimises any negative impact on operations created by the development of Central Precinct and enhances safety and operational efficiency of the interchange where possible	Include objectives in the design guide of the SSP Framework	Prior to construction commencing
Walking and Cycling				
B1	The growth in pedestrian demand will place increased pressure on footpaths and intersections, which over time may lead to undesirable amenity outcomes for pedestrians	Enable ongoing monitoring of pedestrian activity around Central Precinct by installing pedestrian movement sensors at key locations, such as: • On the footpaths either side of George Street, on the approach to the intersection of Broadway and Harris Street • On the footpaths either side of George Street and Lee Street, on the approach to the intersection of George Street and Lee Street • On footpaths on the approach to the intersection of Pitt Street and Eddy Avenue • On footpaths on the approach to the intersection of intersection of Elizabeth Street and Foveaux Street • Within Prince Alfred Park	Work with the City of Sydney and identify locations where monitoring is required and seek funding through transport funding initiatives as part of CPRP	Prior to construction commencing and as soon as practicable
B2	Pedestrian congestion impacting pedestrian comfort and performance of the footpath on George Street, midblock between Harris Street and Quay Street	Monitor pedestrian congestion on George Street and work with key stakeholders on the potential solutions	Support and consider future investigations as required through existing Transport for NSW processes and programs	Ongoing
B3	Pedestrian congestion impacting performance of the intersection of Pitt Street and Eddy Avenue	Monitor pedestrian congestion at the intersection of Pitt Street and Eddy Avenue and work with key stakeholders on the potential solutions	Support and consider future investigations as required through existing Transport for NSW processes and programs	Ongoing

Ref	Impact/ issue	Action	Mechanism	Trigger
B4	Pedestrian congestion impacting performance of the midblock pedestrian crossing on Eddy Avenue, adjacent to Eddy Plaza	Monitor pedestrian congestion at the pedestrian signals on Eddy Avenue and work with key stakeholders on potential solutions	Support and consider future investigations as required through existing Transport for NSW processes and programs	Ongoing
B5	Pedestrian congestion impacting pedestrian comfort and performance of the footpath on both sides of Eddy Avenue	Monitor pedestrian congestion on Eddy Avenue and work with key stakeholders on improvements that balance the operations of the CBD network to meet the needs of all users	Support and consider future investigations as required through existing Transport for NSW processes and programs	Ongoing
B6	Pedestrian congestion impacting performance of the intersection of Elizabeth Street and Foveaux Street	Monitor pedestrian congestion intersection of Elizabeth Street and Foveaux Street and work with key stakeholders on improvements that balance the operations of the CBD network to meet the needs of all users	Support and consider future investigations as required through existing Transport for NSW processes and programs	Ongoing
B7	A localised point of conflict is yet to be resolved at the intersection of Elizabeth Street and Foveaux Street, where pedestrian demands intersect with the cycling corridor	Investigate potential improvements to remove and/or reduce conflict between pedestrians and cyclists	Support and consider future investigations as required through existing Transport for NSW processes and programs	Ongoing
B8	The bicycle parking rates specified in City of Sydney DCP 2012 may not achieve target mode share	Enhance bicycle parking rates support adoption of a 7.5 per cent cyclist mode for Central Precinct	Include enhanced bicycle parking rates within the design guide of the SSP Framework	Prior to construction commencing
B9	A minimum of 1,062 visitor cycling spaces across Central Precinct are required to achieve the target mode share	Provide visible and secure bicycle parking in the public domain for visitors to Central Precinct	Include visitor bicycle parking rates and nominate high level preferred locations within the design guide of the SSP Framework	Prior to construction commencing
Public Transport				
C1	Congestion on suburban platforms forming when exiting platforms following arrival of peak services	To be monitored and managed as part of Station operations	Support and implement future investigations. This falls outside the scope of Central Precinct	Ongoing
C2	Increased pedestrian congestion at some bus stands around Railway Square and on Eddy Avenue may conflict with traversing pedestrian movements	Monitor pedestrian and bus passenger demand and work with key external stakeholders on improvements that balances the operations of the CBD network to meet the needs of all users.	Support and consider future investigations as required through existing processes and programs	Ongoing

Ref	Impact/ issue	Action	Mechanism	Trigger
C3	High pedestrian demands moving through the Precinct create delays and impacts service frequency and reliability of road-based public transport	Review intersection performance around the Precinct and work with stakeholders on improvements that balances the operations of the CBD network to meet the needs of all users.	Support and consider future investigations as required through existing processes and programs	Ongoing
C4	Ensuring regional connectivity for customers accessing Sydney CBD	Support potential investigations by others into opportunities for a coach terminal facility outside of the Precinct to a location that provides transfer to the public transport network and direct access to the freeway network	Support and implement future investigations. This falls outside the scope of Central Precinct	Ongoing
Road Network				
D1	The road network around Central Precinct is congested, with limited capacity for additional vehicle demands	Review intersection performance around the Precinct and work with stakeholders on improvements that balances the operations of the CBD network to meet the needs of all users.	Support and implement future investigations. This falls outside the scope of Central Precinct	Ongoing
D2	High pedestrian demands moving through the Precinct create delays and impacts the efficiency of the road network	Work with stakeholders on improvements that balances the operations of the CBD network to meet the needs of all users.	Support and consider future investigations as required through existing processes and programs	Ongoing
D3	Road safety issues and road crashes in the Precinct with an over representation of pedestrians and cyclists in crash data and high fatal and serious injury crashes	Work with stakeholders on improvements that improves safety of vulnerable road users.	Support and consider future investigations as required through existing processes and programs	Ongoing
Access, Parking and Loading				
E1	The car parking rates specified in City of Sydney LEP 2012 may not support the reduced private vehicle mode share	Reduce car parking rates support the adoption of a ‘car-free precinct’ for Central Precinct	Updated car parking rates have been included within the statutory instrument of the SSP Framework	Prior to construction commencing
E2	The car share rates specified in City of Sydney DCP 2012 may not support the reduced private vehicle mode share	Enhance car share rates support the adoption of a ‘car-free precinct’ for Central Precinct	Enhanced car share rates have been included within the design guide of the SSP Framework	Prior to construction commencing

Ref	Impact/ issue	Action	Mechanism	Trigger
E3	Loading and servicing of the Precinct will require innovative management approaches to limit the impact on the surrounding network	Adoption of integrated loading management system to manage loading and servicing activities across Central Precinct	Loading and servicing requirements have been included within the design guide of the SSP Framework	Prior to construction commencing
		Adoption of one or more integrated distribution facilities for Central Precinct accommodate deliveries, service vehicles and waste collection away from the public realm and allow for the consolidation of goods for delivery across the Precinct to their destination		Prior to construction commencing
		Preparation of a Delivery and Servicing Management Plan for the Precinct and each dock as appropriate to identify and confirm the servicing strategy for the Precinct (including the station and rail infrastructure as appropriate)		Prior to construction commencing
		Investigate the usage of alternate and innovative approaches to servicing the Precinct, including but not limited to the adoption of the rail network to accommodate freight tasks, and the usage of cargo bikes for last-mile movement of goods.	Support and implement future investigations as part of preparation and adoption of the Delivery and Servicing Management Plan/s	Prior to construction commencing
Construction Traffic Management				
F1	Potential for Central Precinct construction activities to impact on the operations of Central Station, the surrounding transport interface and pedestrian movement through the Precinct	Preparation of a Construction Traffic Management plan for the Precinct and each stage as appropriate to identify and confirm the interim servicing strategy for the station and outline how pedestrian access will be maintained throughout construction activities	Construction traffic management requirements have been included within the design guide of the SSP Framework	Prior to construction commencing
		Considering and incorporating innovative and wide-ranging approaches to minimise the impact of construction traffic within the Construction Traffic Management Plan	Support and implement future investigations as part of preparation and adoption of the Delivery and Servicing Management Plan/s	Prior to construction commencing

8. Consultation

As part of the preliminary CPRP works, key stakeholders have been engaged to share information, understand needs and aspirations, and seek feedback for the project.

The stakeholder engagement methodology generally undertaken is summarised as follows:

- Providing an overview of the Central Precinct project, and the key transport elements proposed as part of the works
- Enabling a discussion of the overarching principles used to develop the transport elements of Central Precinct project, and how they align and interact with broader strategic direction both the State Government and City of Sydney
- Outlining the approach of the transport assessment, how pedestrian and transport modelling will be used to assess impacts of the development, and how future trip generation was calculated
- Identification of key assumptions used to inform travel patterns, growth, transport network changes and mode share development
- Discussions on supporting projects and initiatives that either support or could be supported by Central Precinct, and what elements should be included in the transport assessment.

Table 8-1 provides an overview of the outcomes of the consultation with key stakeholders.

Table 8-1: Stakeholder engagement summary

Stakeholder	Date of consultation	Outcomes
Transport for NSW	2019-2022	Multiple sessions with internal TfNSW stakeholders and SMEs
City of Sydney	25 October 2021	• TfNSW to ensure linkages are clearly defined. • TfNSW to provide clarity in documentation around criteria of need for precinct development. Documentation should be clear on what is included within SSP works and what is a supporting project/ opportunity.
	4 May 2022	Discussed preferred pathway to SSP release / feedback period for the Transport technical workstream.

Stakeholder	Date of consultation	Outcomes
NSW Department of Planning, Industry and Environment	9 March 2022 23 May 2022	• TfNSW provided a short update and presentation on the Transport Impact Assessment being prepared to address the Study Requirements. • TfNSW noted the report forecasting requires updating to include implications of COVID. Key implication is that while transport usage will continue to grow, it is at a decreased rate compared to before COVID. Research shows changed working behaviors and altered trip patterns. Due to this, final Transport Report is delayed to May to allow for the changed forecasting to be incorporated. • CoS asked about the study boundaries selected, including pedestrian study boundary and GSC asked about discussing Active Transport, especially post COVID uptake in cycling and ease of east-west movements.
Greater Sydney Commission	31 January 2022	• No issues raised

9. Conclusion and recommendations

The following recommendations are provided to support the advancement of the CPRP. Recommendations are provided for the ongoing master plan and design development of the CPRP and the development of planning controls. In addition to these recommendations, a line-of-sight table has also been provided as **Appendix A.**

The recommendations were determined through consultation with service providers and suitably qualified professionals to achieve CPRP design outcomes and further address the Study Requirements. Recommendations are derived by a detailed assessment of the CPRP transport demands, the supporting initiatives required and the impact to surrounding transport network this shall have.

The transport environment around the Precinct is in flux, subject to various changing factors across the city that will impact on demand. Continual monitoring and surveying of the network is required to ensure proposed initiatives and upgrades are adequate and implemented at the right time to support the development.

9.1 Design and master plan recommendations

Future work and recommendations for the CPRP design development include:

- Continue engagement with stakeholders and transport authorities across the development, planning and implementation of CPRP

9.2 Planning framework recommendations

In addition to the above, further recommendations for the support and development of planning controls, DCPs or guidelines for the CPRP include:

- include objectives within the SSP Framework to ensure that the planning and implementation of CPRP minimise any negative impact on operations created by the development of Central Precinct and enhance safety and operational efficiency of the interchange where possible.
- enhance bicycle parking rates to support the adoption of a 7.5 per cent cyclist mode for Central Precinct as suggested in Table 9-1.

Table 9-1: Proposed bicycle parking rates for Central Precinct SSP

Land Use	Residents/ employees (long-term)	Customers/ visitors (short-term)
Residential	1 per dwelling	1 per 10 dwellings
Student accommodation	1 per dwelling	1 per 10 dwellings
Hotel	1 per 4 staff	1 per 20 rooms
Commercial	1 per 150 m^2	1 per 400 m^2
Retail	1 per 150 m^2	1 per 400 m^2
Education	1 per 10 staff plus 1 per 10 students	N/A
Community	1 per 150 m^2	1 per 200 m^2

- reduce car parking rates for the non-OSD development to support the adoption of a ‘car-free precinct’ for Central Precinct as suggested in Table 9-2.

Table 9-2 Proposed maximum car parking rates for Central Precinct SSP

Land use		Rate
Residential	1 bed dwelling	0.3 spaces/ dwelling
	2 bed dwelling	0.7 spaces/ dwelling
	3 bed dwelling	1 spaces/ dwelling
Student accommodation		0.1 spaces per room
Hotel		0.1 spaces per room
Commercial		1 space per 2000 m^2 GFA
Retail		1 space per 2000 m^2 GFA
Education		1 space per 2000 m^2 GFA
Community		1 space per 2000 m^2 GFA

- restrict car parking associated with future development from being located on the OSD'
- enhance car share rates to support the adoption of a 'car-free precinct' for Central Precinct by requiring a minimum of one car share space per 25 off-street car spaces.
- adoption of a minimum rate for motorcycle spaces of one space for every 12 car parking spaces.
- adoption of a minimum rate of one EV charging space for 10 car parking spaces.
- adopt the proposed rates identified in Table 9-3 for loading provisions for Central Precinct, unless otherwise supported by the adoption and implementation of a loading management system as part of a precinct wide Delivery and Servicing Management Plan

Table 9-3 Proposed loading space rates for Central Precinct SSP

Land Use	Rate
Residential	• 1 space for the first 50 dwellings or serviced apartments; plus • 0.5 spaces for every 50 dwellings/ serviced apartments or part thereafter.
Commercial	• 1 space per 3,300 m^2 GFA, or part thereof, for the first 50,000 m^2; plus • 1 space per 6,600 m^2, or part thereof, for additional floor area over 50,000sqm and under 100,000 m^2; plus • 1 space per 13,200 m^2, or part thereof, for additional floor area over 100,000 m^2.
Hotel	• 1 space per 50 hotel bedrooms, or part thereof, up to 100 bedrooms; then • 1 space per 100 hotel bedrooms; plus • 1 space per 400 m^2 of reception, lounge, bar and restaurant area GFA, or part thereof, for the first 2,000 m^2; then • 1 space per 8000 m^2 of reception, lounge, bar and restaurant area GFA thereafter.
Retail	• 1 space per 350 m^2 GFA, or part thereof, up to 2,000 m^2; then • 1 space per 800 m^2 GFA thereafter.

- preparation of a Delivery and Servicing Management Plan for the Precinct and each dock as appropriate to identify and confirm the servicing strategy for the Precinct (including the station and rail infrastructure as appropriate).
- adoption of one or more integrated distribution facilities for Central Precinct accommodate deliveries, service vehicles and waste collection away from the public realm and allow for the consolidation of goods for delivery across the Precinct to their destination.
- preparation of a Construction Traffic Management plan for the Precinct and each stage as appropriate to identify and confirm the interim servicing strategy for the station and outline how pedestrian access will be maintained throughout construction activities.

9.3 Supporting initiatives outside the scope of CPRP

The following initiatives are recommended for support and further development, however, fall outside the scope of CPRP and may require alternative funding mechanisms and delivery approaches:

- broader capacity enhancements realised through the More Trains More Services program, Sydney's Bus Futures and other infrastructure investment initiatives
- work with stakeholders in identifying opportunities to:
  - address pedestrian congestion on George Street
  - improve pedestrian capacity across the intersection of Pitt Street and Eddy Avenue
  - improve pedestrian capacity along and across Eddy Avenue
  - improve pedestrian capacity across the intersection of Elizabeth Street and Foveaux Street
  - provide wider footpaths along George Street, Eddy Avenue, Broadway, Pitt Street and Quay Streets
  - Investigate opportunities to reduce pedestrian and cyclist conflict at the intersection of Elizabeth Street and Foveaux Street
  - accommodate both waiting passengers and moving pedestrians on Eddy Avenue and at Railway Square
- prioritise bus and light rail movements at intersections around the Precinct ahead of through traffic to support and maintain service frequency and reliability of public transport services
- support potential investigations by others into opportunities for a coach terminal facility outside of the Precinct to a location that provides transfer to the public transport network and direct access to the freeway network
- reallocate road space in accordance with modal hierarchy.

In conclusion, the proposed master plan has been reviewed and assessed by suitably qualified professionals and consider that the proposed outcomes satisfy the above recommendations.

Appendix A – Line of sight

Appendix A – Line of sight

Table A-1 Summary of Issue, Aspirations and solutions identified in this Transport Assessment

Issue	Aspirations	Solutions
Broader public transport capacity improvements are required to ensure Central Station can accommodate future growth.	Provide a world-class transport interchange with turn-up and go services	Broader capacity enhancements realised through the MTMS program, Sydney's Bus Futures and other infrastructure investment initiatives Support and advocacy – falls outside scope of CPRP
There is potential for Central Precinct to impact of transport operations, both during standard operations and under unplanned/planed distributions	Ensuring that during operation (including degraded modes – planned and unplanned) disruption to transport modes will be minimised.	Include objectives within the SSP Framework to ensure that the planning and implementation of CPRP minimise any negative impact on operations created by the development of Central Precinct.
There are limited opportunities for pedestrians to cross the rail corridor between Eddy Avenue to the north, and Cleveland Street to the south.	Provide a safe, efficient pedestrian network with convenient movement and minimal conflict through the Precinct.	Extension of Central Walk to Lee Street and George Street as part of CPRP, and providing additional east-west connections via new land bridges across the rail corridor from Chalmers Street and Prince Alfred Park To be delivered as part of CPRP
Pedestrian congestion impacting performance of the intersection of George Street, Lee Street and Pitt Street	Provide a safe, efficient pedestrian network with convenient movement and minimal conflict through the Precinct.	Reprioritise road space on Lee Street to provide additional space for pedestrians. To be delivered as part of CPRP and/or through alternative funding programs
Pedestrian congestion impacting performance of the intersection of Pitt Street and Eddy Avenue	Provide a safe, efficient pedestrian network with convenient movement and minimal conflict through the Precinct	Investigate and implement improvements to provide additional pedestrian capacity across the intersection of Pitt Street and Eddy Avenue. To be delivered as part of CPRP and/or through alternative funding programs
Pedestrian congestion impacting performance of the midblock pedestrian crossing on Eddy Avenue, adjacent to Eddy Plaza	Provide a safe, efficient pedestrian network with convenient movement and minimal conflict through the Precinct.	Investigate and implement improvements to provide additional pedestrian capacity along and across Eddy Avenue. To be delivered as part of CPRP and/or through alternative funding programs
Pedestrian congestion impacting performance of the intersection of Elizabeth Street and Foveaux Street	Provide a safe, efficient pedestrian network with convenient movement and minimal conflict through the Precinct.	Investigate and implement improvements to provide additional pedestrian capacity across the intersection of Elizabeth Street and Foveaux Street To be delivered as part of CPRP and/or through alternative funding programs
Pedestrian congestion impacting performance of the intersection of Broadway and Harris Street	Provide a safe, efficient pedestrian network with convenient movement and minimal conflict through the Precinct.	Investigate and implement improvements to provide additional pedestrian capacity across the intersection of Broadway and Harris Street. Support and advocacy – falls outside scope of CPRP

Issue	Aspirations	Solutions
Congestion on footpaths adjacent to Central Station	Provide a safe, efficient pedestrian network with convenient movement and minimal conflict through the Precinct.	Provide wider footpaths along George Street, Eddy Avenue, Broadway, Pitt Street and Quay Street through road space reallocation to support growing pedestrian movements. To be delivered as part of CPRP and/or through alternative funding programs
A localised point of conflict is yet to be resolved at the intersection of Elizabeth Street and Foveaux Street, where pedestrian demands intersect with the cycling corridor.	Adopt scalable design and management approaches to prioritise pedestrians and cyclists, ensuring safe, efficient and convenient movement with minimum conflicts when connecting the Precinct to the surrounding street network.	Investigate and implement improvements to improve pedestrian and cyclist separation at the intersection of Elizabeth Street and Foveaux Street Support and advocacy – falls outside scope of CPRP
The bicycle parking rates specified in City of Sydney DCP 2012 may not achieve target mode share	Provide a dedicated scalable facility for bike storage, as well as end-of-trip facilities and bike parking at multiple access locations.	Inclusion of enhanced rates in the SSP Framework.
Visitor cycling spaces are currently not identified in the Central Precinct Master plan	Provide a dedicated scalable facility for bike storage, as well as end-of-trip facilities and bike parking at multiple access locations.	Provision of visible and secure bicycle parking in the public domain for visitors to Central Precinct. Update the Central Precinct master plan.
Current passenger demands add to train loading and unloading times, increasing wait times for trains during busy periods.	Accommodate and support planned and potential network/station facility upgrades.	Increased service frequency and capacity to accommodate passenger growth as part of More Trains More Services program and Metro network construction Support and advocacy – falls outside scope of CPRP
Access between regional and suburban platforms is poor, with interchanging customers walking long distances to reach their next service.	Support safe integrated, multimodal transport and supporting infrastructure access across the Precinct	Extension of Central Walk to Lee Street and George Street as part of CPRP, providing direct interchange opportunities between regional, suburban and metro lines To be delivered as part of CPRP
There is poor connectivity between the light rail stops and the bus interchange at Railway Square as well as to the suburban rail lines within Central Station.	Support safe integrated, multimodal transport and supporting infrastructure access across the Precinct	Extension of Central Walk to Lee Street and George Street as part of CPRP, providing direct interchange opportunities between regional, suburban and metro services with bus services at Railway Square. To be delivered as part of CPRP
Commuters waiting for bus services restrict pedestrian movements along footpath next to the bus stops, including along Eddy Avenue, and at the bus interchange at Railway Square.	Ensure safe efficient and convenient customer interchange between buses and other transport modes across Central Precinct	Reallocate road space to accommodate both waiting passengers and moving pedestrians on Eddy Avenue and at Railway Square. To be delivered as part of CPRP and/or through alternative funding programs

Issue	Aspirations	Solutions
High pedestrian demands moving through the Precinct create delays and impacts service frequency and reliability of road-based public transport	Ensure the surrounding road network balances the movement needs of on-road transport services and convenience and connectivity for pedestrians	Prioritise bus light rail movements at intersections around the Precinct ahead of through traffic to support and maintain service frequency and reliability. To be delivered as part of CPRP and/or through alternative funding programs
Ensuring regional connectivity for customers accessing Sydney CBD	Provide a world-class transport interchange with turn-up and go services	Support potential investigations by others into opportunities for a coach terminal facility outside of the Precinct to a location that provides transfer to the public transport network and direct access to the freeway network. Support and advocacy – falls outside scope of CPRP
The road network around Central Precinct is congested, with limited capacity for additional vehicle demands.	Facilitate an external road network, that balances the need to move people and goods with the need to create and enhance places for people.	Investigate opportunities to maintain network efficiency and redirecting through traffic to routes that bypass the city centre. Support and advocacy – falls outside scope of CPRP
High pedestrian demands moving through the Precinct create delays and impacts the efficiency of the road network.	Ensure the surrounding road network balances the movement needs of the Precinct with improved convenience, amenity and connectivity for pedestrians	Reallocate road space in accordance with road space hierarchy. To be delivered as part of CPRP and/or through alternative funding programs
Road safety issues and road crashes in the Precinct with an over representation of pedestrians and cyclists in crash data and high fatal and serious injury crashes.	Ensure the surrounding road network is safe for pedestrians and cyclists	Investigate lowering the speed limit around Central Precinct to align with surrounding land uses and support a safe and integrated network. Support and advocacy – falls outside scope of CPRP
The car parking rates specified in City of Sydney LEP 2012 may not support the reduced private vehicle mode share	Reduce/minimise the need for vehicular access to the development through appropriate design and private vehicle parking provisions	Inclusion of updated car parking rates in the SSP Framework.
The car share rates specified in City of Sydney LEP 2012 may not support the reduced private vehicle mode share	Provide a dedicated scalable facility for bike storage, as well as end-of-trip facilities and bike parking at multiple access locations.	Inclusion of enhanced car share rates in the SSP Framework.
Loading and servicing of the Precinct will require enhanced management approaches to limit the impact on the surrounding network	Support safe integrated, multimodal transport and supporting infrastructure access across the Precinct, placing transport functionality (including interchange, freight and servicing) at the forefront of Precinct outcomes.	Inclusion of loading and servicing requirements in the SSP Framework.
Potential for Central Precinct construction activities to impact on the operations of Central Station, the surrounding transport interface and pedestrian movement through the Precinct.	Ensuring that during operation (including degraded modes – planned and unplanned) disruption to transport modes will be minimised.	Inclusion of construction traffic management requirements in the SSP Framework.

Appendix B – Statistical Area datasets

Appendix B – Statistical Area datasets

Table B-1 Statistical area datasets

Statistical area level 2 name	Statistical area level 1 code
Pyrmont – Ultimo	11703133441
Redfern – Chippendale	11703133512 11703133513 11703133515 11703133524 11703133526 11703133528
Surry Hills	11703133601 11703133610 11703133616 11703133623 11703133637 11703133638
Sydney – Haymarket – The Rocks	11703133709 11703133711 11703133714 11703133755 11703133758 11703133759

Appendix C – Precinct transport model results

Appendix C – Precinct transport model results

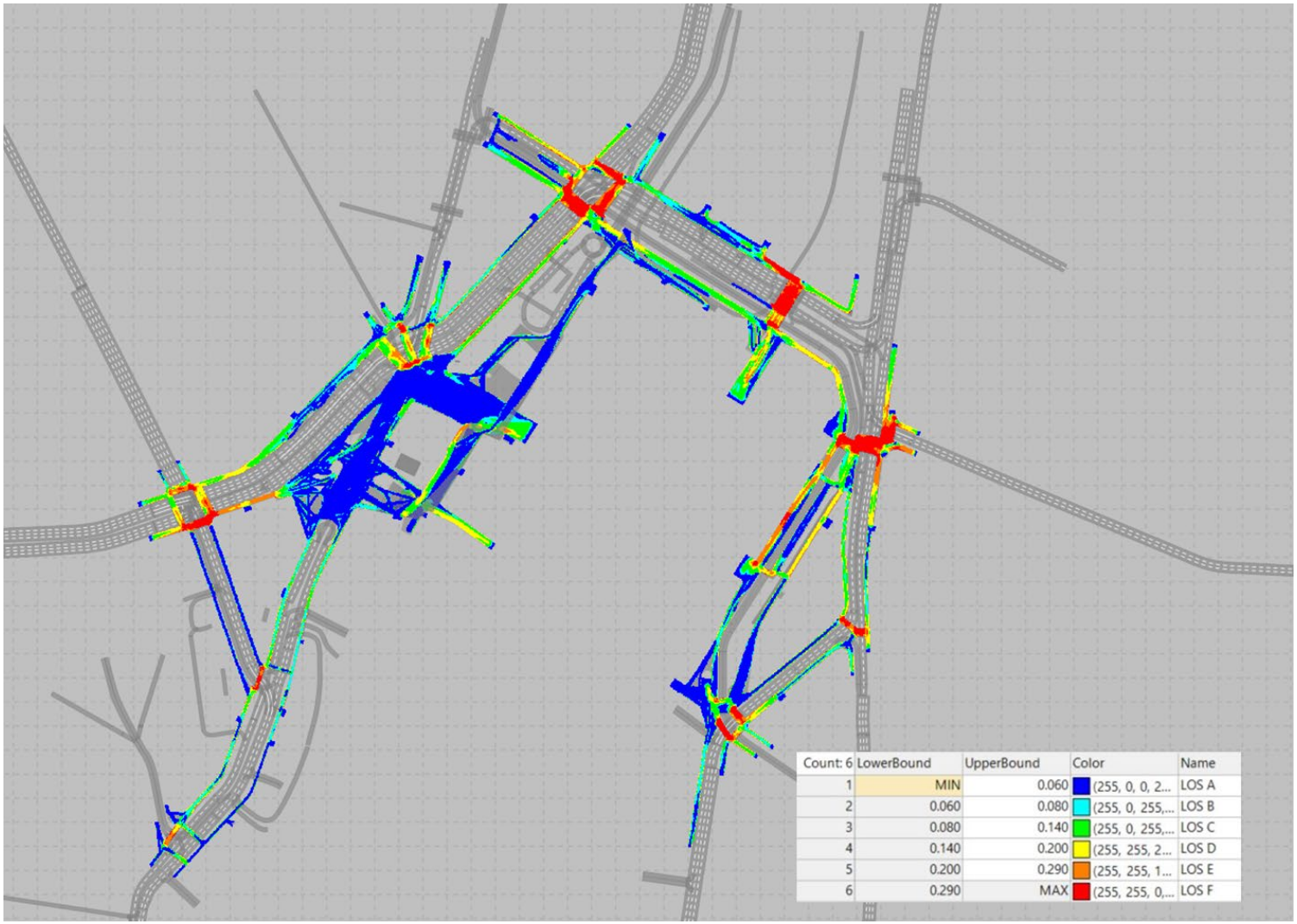


Figure C-1 AM Walkway LOS based on experienced density (average)

Figure C-2 AM Walkway LOS based on density (average)

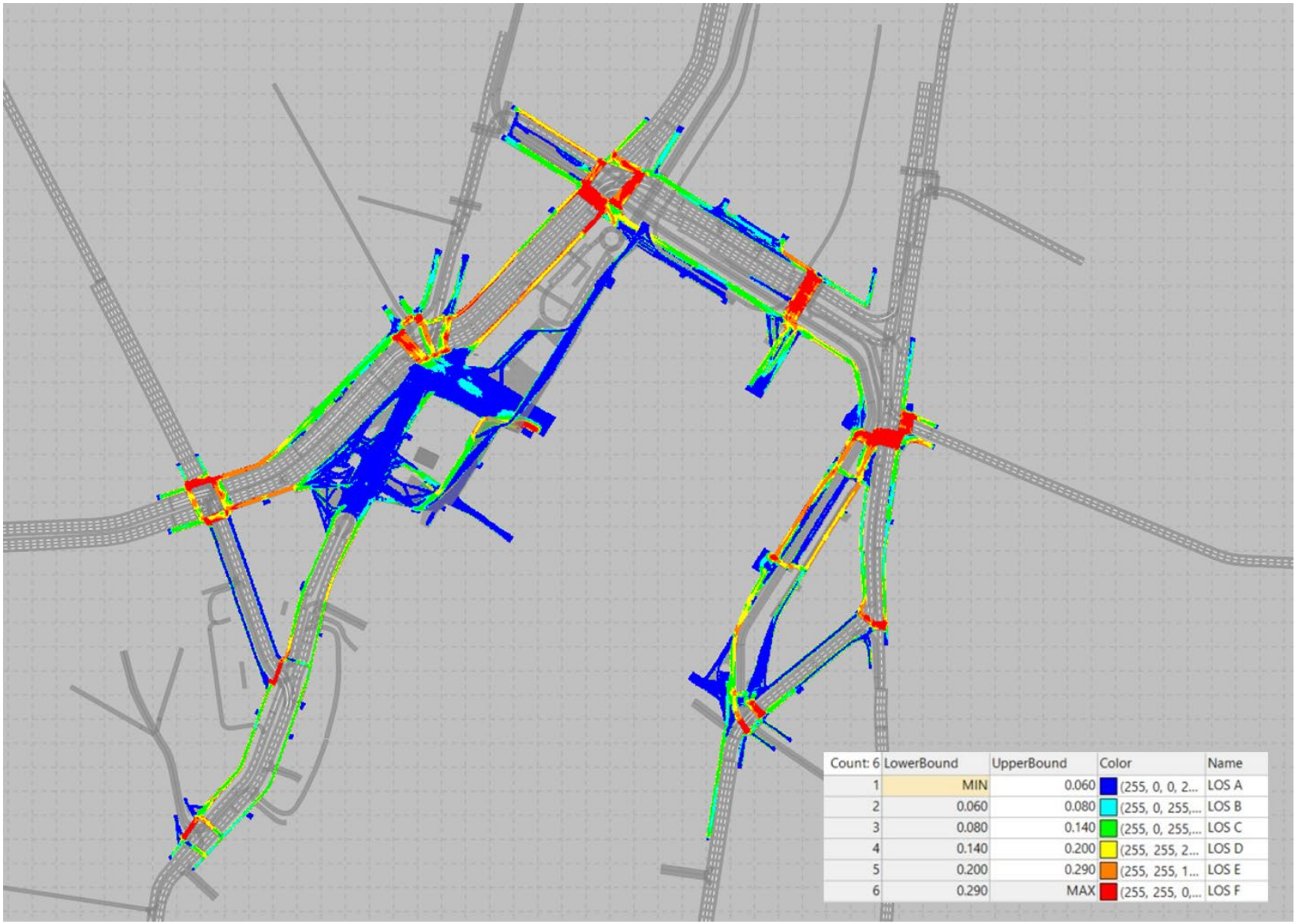


Figure C-3 PM Walkway LOS based on experienced density (average)

Figure C-4 PM Walkway LOS based on density (average)

Appendix D – Over station model results

Appendix D – Over station model results

Analysis of the 2036 deck layout above Central Station has been undertaken during the AM peak and PM peak periods. The results are summarised in **Table D-1** to **Table D-3**.

Figure D-1 shows the location and provides an identification for each of the walkways assessed in **Table D-1** and **Table D-2**.

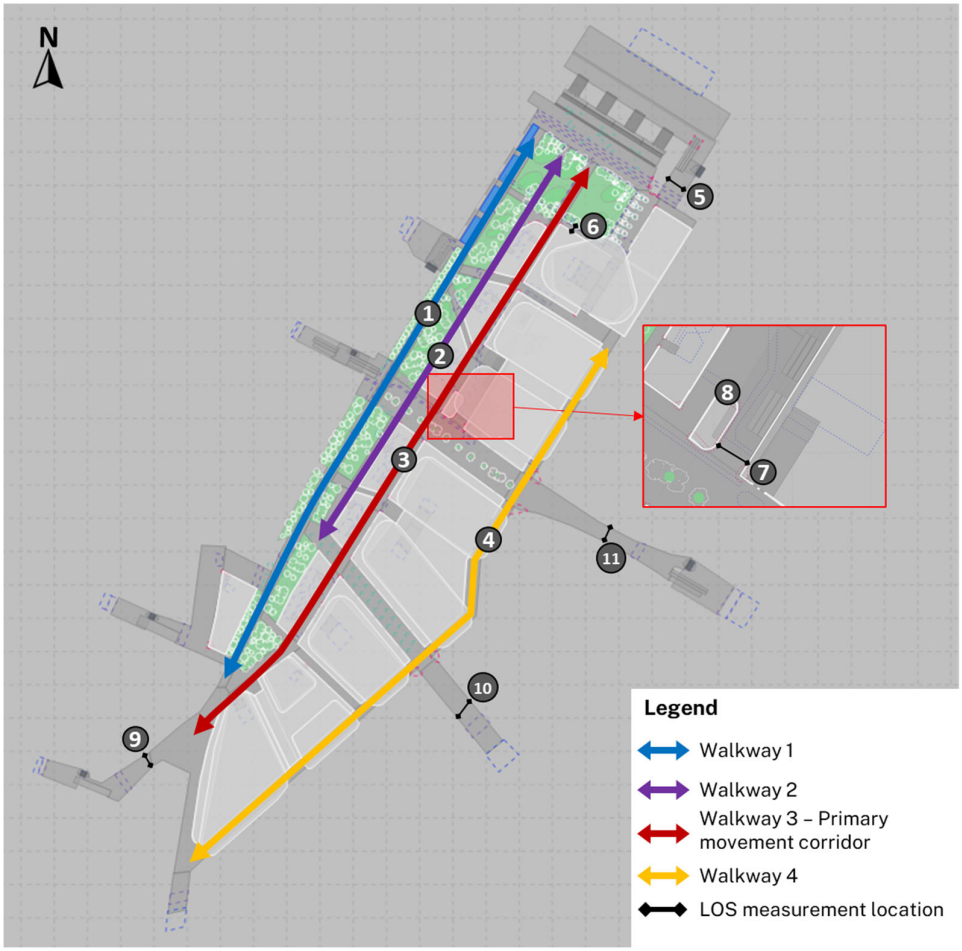


Figure D-1 Walkway performance measurement locations

The average demand to each of the staircases and escalators per minute in the five-minute peak interval for the modelled hour have been reported in Table D-1 and Table D-2. The demand has been reported alongside level of service results.

While results were measured at multiple points along the north-south walkways, only the maximum value for flow rate and LOS was recorded for each corridor.

Table D-1 Over station model walkway LOS results – AM peak

ID	Walkway	AM base case			AM stress test		
		Flow (ped/min/m)	Fruin	NSW	Flow (ped/min/m)	Fruin	NSW
1	Walkway 1	2	A	A	2	A	A
2	Walkway 2	3	A	A	1	A	A
3	Walkway 3	13	A	D	14	A	E
4	Walkway 4	1	A	A	1	A	A
5	Grand Concourse	3	A	A	3	A	A
6	E-W walkway at A1	5	A	B	1	A	A
7	Central Walk (south)	10	A	C	10	A	C
8	Central Walk (west)	17	A	E	18	A	E
11	Mortuary Station	1	A	A	1	A	A
12	Prince Alfred Sidings	1	A	A	1	A	A
13	Devonshire Street	4	A	A	4	A	A

Table D-2 Over station model walkway LOS results – PM peak

ID	Walkway	PM base case			PM stress test		
		Flow (ped/min/m)	Fruin	NSW	Flow (ped/min/m)	Fruin	NSW
1	Walkway 1	2	A	A	1	A	A
2	Walkway 2	1	A	A	1	A	A
3	Walkway 3	9	A	C	9	A	C
4	Walkway 4	1	A	A	<1	A	A
5	Grand Concourse	1	A	A	1	A	A
6	E-W walkway at A1	4	A	A	3	A	A
7	Central Walk (south)	7	A	C	7	A	C
8	Central Walk (west)	10	A	C	10	A	C
11	Mortuary Station	1	A	A	<1	A	A
12	Prince Alfred Sidings	1	A	A	<1	A	A
13	Devonshire Street	2	A	A	2	A	A

Table D-3 Over station model vertical transport LOS results

ID	Vertical transport element	AM peak hour		PM peak hour	
		Flow rate (ped/min/m)	LOS	Flow rate (ped/min/m)	LOS
Staircases					
1	Grand Concourse stairs 1	2	A	2	A
2	Grand Concourse stairs 2	2	A	2	A
3	Grand Concourse stairs 3	2	A	2	A
4	Grand Concourse stairs 4	2	A	2	A
5	City Square stairs	3	A	2	A
6	Henry Deane Plaza stairs	4	A	3	A
7	Goods Line stairs	1	A	1	A
8	Mortuary Station stairs	<1	A	1	A
9	Devonshire Street stairs	7	A	4	A
Escalators					
10	Grand Concourse escalator 1 (down)	3	A	7	A
11	Grand Concourse escalator 2 (AM: up | PM: down)	19	A	7	A
12	Grand Concourse escalator 3 (up)	17	A	4	A
13	Henry Deane Plaza escalator (up)	9	A	1	A
14	Henry Deane Plaza escalator (down)	6	A	12	A
15	Devonshire Street escalator (up)	23	A	5	A
16	Devonshire Street escalator (down)	2	A	10	A
17	Central Walk escalator 1 (down)	3	A	26	B
18	Central Walk escalator 2 (up)	32	C	5	A
19	Central Walk escalator 3 (up)	33	C	5	A
20	Central Walk escalator 4 (down)	3	A	24	B
21	Central Walk escalator 5 (down)	3	A	25	B
22	Central Walk escalator 6 (up)	32	C	5	A

Appendix E – Internal Station model results

Appendix E – Internal Station model results

Analysis of the 2036 Central Station layout has been undertaken during the AM peak and PM peak periods. The results are summarised in **Table E-1** to **Table E-8**

- *Circulation Areas*

Table E-1 and **Table E-2** summarises the performance of concourse circulation areas for compliance against the Network Rail Station Capacity Planning Design Manual for the AM and PM peak hours respectively. The relevant planning criteria states that concourse circulation areas should not exceed 'Walkways' LoS C.

Table E-1 Level of Service Output Summary, Circulation Areas, LoS 'Walkways', 2036 AM Scenario

Station Area	LoS Threshold 'Walkways'	Compliance
Grand Concourse	B	Yes
Northern Concourse	C	Yes
Southern Concourse	C	Yes
Central Walk Concourse	C	Yes
Devonshire Street Tunnel	C	Yes

Table E-2 Level of Service Output Summary, Circulation Areas, LoS 'Walkways', 2036 PM Scenario

Station Area	LoS Threshold 'Walkways'	Compliance
Grand Concourse	C	Yes
Northern Concourse	C	Yes
Southern Concourse	A	Yes
Central Walk Concourse	C	Yes
Devonshire Street Tunnel	A	Yes

The results show that all concourse circulation areas compliant with the Network Rail Station Capacity Planning Design Manual across both the AM and PM peak hour.

- *Gatelines*

Table E-3 and **Table E-5** summarises the performance of gatelines for compliance against the Network Rail Station Capacity Planning Design Manual for the AM and PM peak hours respectively. The relevant planning criteria states that gatelines should not exceed 'Queuing' LoS D.

Table E-3: Level of Service Output Summary, Gatelines, LoS 'Queuing', 2036 AM Scenario

Station Area	LoS Threshold 'Queuing'	Compliance
Grand Concourse Gateline	C	Yes
Eddy Plaza Gateline	C	Yes
Eastern Stairs Gateline	A	Yes
Elizabeth Street Gateline	A	Yes

Station Area	LoS Threshold 'Queuing'	Compliance
Central Walk East Gateline	C	Yes
Central Walk West Gateline	A	Yes
Central Walk OSD Gateline	A	Yes
Chalmers Street Gateline	A	Yes

Table E-4: Level of Service Output Summary, Gatelines, LoS 'Queuing', 2036 PM Scenario

Station Area	LoS Threshold 'Queuing'	Compliance
Grand Concourse Gateline	A	Yes
Eddy Plaza Gateline	B	Yes
Eastern Stairs Gateline	A	Yes
Elizabeth Street Gateline	A	Yes
Central Walk East Gateline	B	Yes
Central Walk West Gateline	A	Yes
Central Walk OSD Gateline	A	Yes
Chalmers Street Gateline	A	Yes

The results show that all gatelines are compliant with the Network Rail Station Capacity Planning Design Manual.

- *Platforms*

Table E-5 and **Table E-6** summarises the performance of platforms for compliance against the Network Rail Station Capacity Planning Design Manual for the AM and PM peak hours respectively. The relevant planning criteria states that circulation areas should not exceed 'Walkways' LoS C.

Table E-5: Level of Service Output Summary, Platforms, LoS 'Walkways', 2036 AM Scenario

Station Area	LoS 'Walkways' Threshold	Compliance
Platform 4/5	E	No
Platform 6/7	C	Yes
Platform 8/9	C	Yes
Platform 10/11	C	Yes
Platform 12/13	C	Yes
Platform 14	B	Yes
Platform 16/17	E	No
Platform 18/19	D	No
Platform 20/21	E	No
Platform 22/23	D	No

Station Area	LoS 'Walkways' Threshold	Compliance
Platform 24/25	F	No
Metro Platforms	E	No

Table E-6: Level of Service Output Summary, Platforms, LoS 'Walkways', 2036 PM Scenario

Station Area	LoS 'Walkways' Threshold	Compliance
Platform 4/5	A	Yes
Platform 6/7	A	Yes
Platform 8/9	A	Yes
Platform 10/11	B	Yes
Platform 12/13	A	Yes
Platform 14	A	Yes
Platform 16/17	D	No
Platform 18/19	D	No
Platform 20/21	D	No
Platform 22/23	E	No
Platform 24/25	E	No
Metro Platforms	C	Yes

The results of the platform analysis show that several platforms operate at or above 'Walkways' LoS D which exceeds the Network Rail Station Capacity Planning Design Manual threshold in both peak hour periods. Significant queueing forms at vertical circulation following the arrival of peak services, with this congestion preventing other passengers from circulating along the platform.

All platform waiting areas are compliant with the Network Rail Station Capacity Planning Design Manual threshold of 'Queuing' LoS B.

- *Vertical Transport*

Table E-7 and **Table E-8** summarises the performance of vertical transport for compliance against the Network Rail Station Capacity Planning Design Manual for the AM and PM peak hours respectively. The relevant planning criteria states the following:

Boarding areas for escalators and stairs should not exceed 'Queuing' LoS C,

Stairways should not exceed 'Stairways' LoS C,

Platforms should clear within 120 seconds on through platforms and 240 seconds on terminus platforms.

Table E-7: Level of Service Output Summary, Escalators & Stairs, 2036 AM Scenario

Station Area	LoS 'Queuing' Threshold	LoS 'Stairways' Threshold	Platform Clearance Compliance	Compliance
Platform 4/5	D	-	Yes	Yes
Platform 6/7	A	-	Yes	Yes

Station Area	LoS 'Queuing' Threshold	LoS 'Stairways' Threshold	Platform Clearance Compliance	Compliance
Platform 8/9	A	-	Yes	Yes
Platform 10/11	D	-	Yes	Yes
Platform 12/13	D	-	Yes	Yes
Platform 14	C	-	Yes	Yes
Platform 16/17	D	D	Yes	Yes
Platform 18/19	D	C	Yes	Yes
Platform 20/21	D	C	Yes	Yes
Platform 22/23	A	A	Yes	Yes
Platform 24/25	D	E	No	No
Metro Platforms	D	-	Yes	Yes

Table E-8: Level of Service Output Summary, Escalators & Stairs, 2036 PM Scenario

Station Area	LoS 'Queuing' Threshold	LoS 'Stairways' Threshold	Platform Clearance Compliance	Compliance
Platform 4/5	C	-	Yes	Yes
Platform 6/7	A	-	Yes	Yes
Platform 8/9	A	-	Yes	Yes
Platform 10/11	C	-	Yes	Yes
Platform 12/13	A	-	Yes	Yes
Platform 14	A	-	Yes	Yes
Platform 16/17	A	A	Yes	Yes
Platform 18/19	D	B	Yes	Yes
Platform 20/21	D	B	Yes	Yes
Platform 22/23	A	A	Yes	Yes
Platform 24/25	D	E	Yes	Yes
Metro Platforms	A	-	Yes	Yes

The results show that the LoS observed at boarding areas to stairs and escalators operate at 'Queuing' LoS D across three island platforms, which exceeds the Network Rail Station Capacity Planning Design Manual threshold. This impacts Platforms 18/19, 20/21 and 24/25. Platform 24/25 also operates with 'Stairways' LoS E, which exceeds the Network Rail Station Capacity Planning Design Manual threshold.

The analysis shows that the vertical transport capacity is sufficient to meet the required platform clearance times across all platforms. As a result, the vertical transport capacity is considered appropriate despite exceedances of the relevant LoS threshold. The design is considered acceptable.

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