

Parramatta CBD Strategic Transport Study



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1.0 Background

1.1 Study context

Parramatta is Sydney's second CBD and performs a key economic, social and cultural role. The Parramatta CBD is experiencing rapid growth and is of metropolitan significance as a regional employment centre, and it will continue to increase in importance as Western Sydney's population continues to grow.

The NSW Government's metropolitan strategy - *A Plan for Growing Sydney* - sets a direction to grow Greater Parramatta, including actions to connect and integrate the Parramatta CBD with surrounding precincts at Westmead, Parramatta North, Rydalmere and Camellia (collectively referred to as "Greater Parramatta").

City of Parramatta (Council) has prepared and adopted the *Parramatta CBD Planning Strategy*, one objective of which is to "set[s] a vision for the growth of the Parramatta CBD as Australia's next great city". To facilitate the expected growth and manage the changes in the CBD, Council has prepared a draft Planning Proposal to amend the planning controls for the Parramatta CBD. The Planning Proposal needs to be supported by a number of technical studies, including this Strategic Transport Study.

1.2 Purpose of report

Significant growth in jobs and dwellings is anticipated to place further demands on Council and the NSW Government to manage the impacts of population growth on transport infrastructure as well as identify necessary and desirable improvements to enable a safe, efficient and sustainable transport network.

The purpose of this document is to identify the transport task generated by the future Parramatta CBD, and develop an understanding of the scale and type of transport interventions required to support proposed planning control changes. This document is supported by three technical papers covering more detailed post-analysis of transport modelling outputs, CBD benchmarking, and a review of parking demand, supply and policy in the Parramatta CBD.

The objectives of this particular study are to:

- Identify, at a strategic level, current and forecast travel patterns and travel demand accessing the Parramatta CBD: accounting for likely changes as a result of relevant transport and land use plans and policies, including those envisaged in Council's draft Planning Proposal
- Review existing, proposed and planned transport infrastructure and services, consider these in relation to the proposed increases to residential and commercial capacity and determine likely impacts, at a strategic level, on the transport network
- Review the appropriateness of current policies in the context of the proposed changes in the CBD and those enforced in other similar CBDs
- Identify transport strategies and actions that should be implemented to support the proposed growth in the CBD.

This study has been undertaken in consultation with Transport for NSW and Roads and Maritime Services and informed through use of strategic transport demand modelling, using the Sydney Strategic Travel Model (STM).

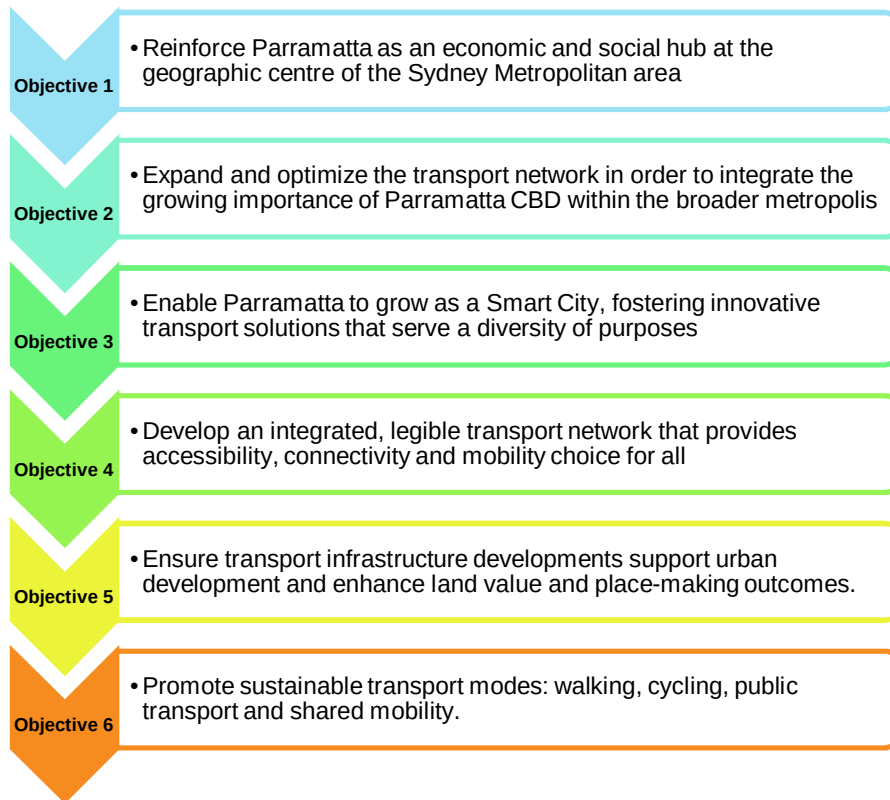
This study forms the beginning of the transport assessment process. The outcomes of this study along with the outputs of other concurrent transport studies being undertaken; including a Parking Strategy, Walking Strategy, Bike Plan and meso-scopic traffic modelling investigation, will be combined to form a consolidated Integrated Transport Plan that will support the final Planning Proposal.



2.0 Aspiration and objectives

“To provide Parramatta with a true CBD-quality transport system: one that supports a diverse range of travel behaviours, and activates Parramatta as a place that is attractive to live, work and play.”

The following objectives have been set to support this aspiration:



3.0 Benchmarking

Knowing and understanding the strengths (and weaknesses) of how transport mobility is performed and how it activates other cities around the world is key in providing insight as to how change may be instigated elsewhere.

Australia's availability of space has enabled its cities to, in the past and to a strong degree still today, sprawl. Europe's ten most dense cities reach densities of 8,000 to 21,000 people per square km¹, whilst metropolitan Sydney's (i.e. excluding Central Coast and Blue Mountains) population density is estimated at 2,037 people per square km². As a more direct comparator (accounting for varying degrees of definitions of urban areas), in 2011 Greater London had more than double metropolitan Sydney's current population, contained within a 10 per cent smaller urban footprint³. Professionals in the field of integrated transport and land use planning see this as the result of replicating trends in similar spatially unconstrained American cities in the past (rather than applying lessons learnt from other parts of the world).

A dispersed distribution of homes creates longer travel distances for a broad range of trip types including home-based commute, education, retail and recreation trips, and for many transport customers limits active transport as a viable means of making a trip. The effect makes higher order transit (e.g. rail, light rail, bus rapid transit) less economically feasible for Government to deploy, with the frequency and quality of the public transport service often reflecting and responding to density of the urban form. Hence a low density urban form often leaves the private vehicle as the preferred mode for many trip types. This challenge is present in the areas surrounding Parramatta CBD as indicated by the high travel distances, vehicle ownership and car mode share data highlighted in Section 5.3.

High application of the low density residential 'R2' zoning, and delivery of the large-block single dwelling house, has been ever present in Sydney's central and west (see Section 5.3). This high application can be linked to a fulfilling of Australian's cultural needs (for a home and backyard), or serving as a mechanism of addressing housing affordability pressures: through releasing Greenfield (undeveloped) land parcels to increase housing supply.

¹ https://en.wikipedia.org/wiki/List_of_European_Union_cities_proper_by_population_density

² https://en.wikipedia.org/wiki/Geography_of_Sydney

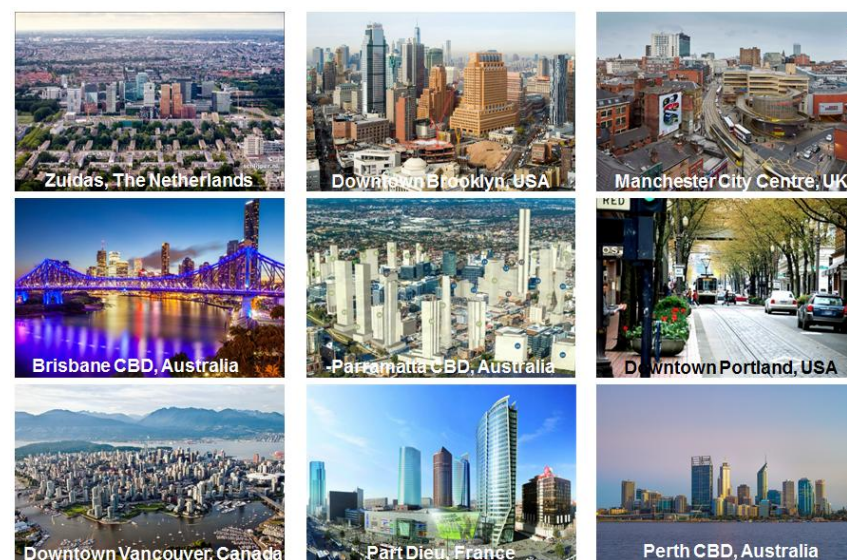
³ https://en.wikipedia.org/wiki/Greater_London#cite_note-6

A benchmarking exercise was undertaken as part of this study to identify centres comparable to Parramatta CBD, and use the lessons learnt to help shape the future of Sydney's "Central City". A qualitative and quantitative analysis of Parramatta CBD was conducted and 19 global metropolitan areas were compared and ranked based on 15 criteria such as population, size, density, transportation and mode share.

Eight CBDs were deemed as appropriate benchmarks for Parramatta CBD:

- Zuidas (a second CBD of Amsterdam), Netherlands
- Downtown Brooklyn (a third CBD for New York), United States
- Manchester City Centre, United Kingdom
- Brisbane CBD, Australia
- Downtown Portland, United States
- Downtown Vancouver, Canada
- Part Dieu (a second CBD for Lyon), France
- Perth CBD, Australia

Figure 1 The eight CBDs identified as appropriate benchmarks for Parramatta CBD



The benchmarking exercise established a mode share spectrum for the eight CBDs. Perth CBD has the highest car mode share (47 per cent). Perth's high car mode share can be attributed to the city's relatively low density and sprawling urban form. As the city's dominant employment hub, Perth CBD attracts workers from across the metropolitan area. Many workers live in areas without strong public transport links and long established commuting behaviours.

Part Dieu, Lyon has the lowest car mode share (26 per cent). This can be attributed to major transport infrastructure – including France's second largest railway station and light rail - relatively high residential density and compact urban form. Lyon also has a bike share scheme and progressive policies that discourage car use.

Several key lessons were drawn from this analysis, which will help shape the transport response for the future Parramatta CBD:

- Dense residential development planned in and around Parramatta CBD presents an opportunity to strengthen walking and cycling links and end-of-trip facilities that could encourage a shift away from private vehicles.
- A degree of self-containment can be achieved with a balance of land uses, allowing people to live, work and play in the same area.
- Provision of well-planned public transport is vital to embed travel behaviours early and support businesses and residents outside traditional CBDs.
- New public transport infrastructure that offers cost, time and convenience benefits over cars can encourage a modal shift away from private vehicles.
- Progressive policies that discourage car use in CBDs can be effective in encouraging the use of public transport, walking and cycling.
- Cultural and sporting venues are key catalysts for change outside traditional CBDs.

The Australian and American cities identified through the benchmarking exercise have similar built forms contributing to a car dependency. Australian and American cities typically have small, high density commercial cores at the centre of sprawling, low density residential suburbs. The car has helped to shape this built form in Australian and American cities, and vice versa. Infrastructure investment in Australia and America has typically focussed on accommodating high car use through higher order road (rather than transit) infrastructure with high speed limits, parking provisions and competitive parking prices. As a result, Australian and American cities have a different appreciation for private vehicles than cities in Europe.

European cities are typically older than their Australian and American counterparts. Many European cities were comprehensively designed and built prior to the advent of the car. As a result, European cities generally have larger, higher density cores, land use mixes and extensive public transport networks. Research shows higher population densities, genuine mixed land uses and proximity to public transport can result in lower car mode share. A range of land uses also typically enables people to walk and cycle for generated shorter trips, whilst longer trips are supported by extensive transit networks, which prove appealing when compared with car trips on slow and often constrained street forms. As a result, residents of European cities also place less emphasis on car ownership and car use than their Australian and American counterparts.

In moving forward, and acknowledging the issues currently present, future benchmarking exercises (to be undertaken as part of the development of the Integrated Transport Plan) could look internationally to more specific examples of cities which have successfully (or partially) bridged the gap between the current transport and land use environment and that envisioned by Council and the transport cluster. In addition to the land use and urban built form context, this could look further into the economic and behavioural / cultural perspectives that influence mode choice and implementations and interventions that have been put in place to forge the desired transport outcome.

Figure 2 Part Dieu (France) commercial centre



4.0 The role of Parramatta

Parramatta is the geographical, commercial and civic centre of Western Sydney. Parramatta is the second largest CBD in Sydney and the sixth largest in Australia. With a \$23 billion economy the Parramatta LGA has a broad economic base spread across health, commercial (i.e. finance, information and communications technology, and insurance) and Government sectors. Parramatta also has a strong retail and education presence and serves as the civic centre of Western Sydney, accommodating attractions such as the Western Sydney Stadium, Riverside Theatres and Parramatta Park.

Government has strong aspirations for Parramatta in terms of its role within the Sydney metropolis, backed with plans to bolster all its supporting transport modes.

4.1 Government's aspirations for Parramatta

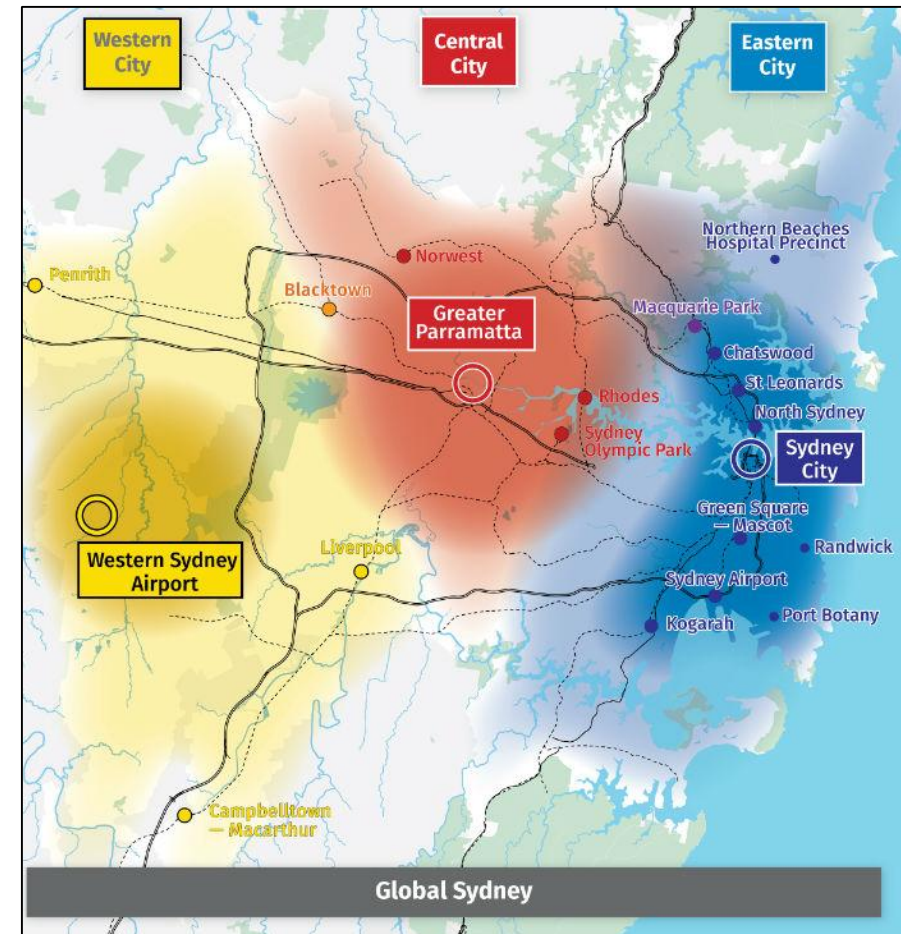
4.1.1 Metropolitan strategy

Through collaboration between various State and Local Government agencies including the Department of Planning and Environment, Urban Growth NSW, Greater Sydney Commission (GSC) and local Councils, much work has been undertaken in recent years on developing and refining metropolitan strategies for growing Sydney. This work has focussed on addressing Sydney's significant forecast growth through identifying the needs this growth will generate, and how planning strategies should be developed and implemented to accommodate these needs.

Government's aspirations for Parramatta have been highlighted and reinforced at various tiers of city planning. At a metropolitan scale Greater Parramatta has been identified by the NSW Government in successive metropolitan strategies as Sydney's second CBD, and more recently as the core of Sydney's 'Central City' in GSC's draft vision for the Greater Parramatta and Olympic Peninsula (GPOP).

Our 2036 vision: GPOP will be Greater Sydney's true centre – the connected, unifying heart. (GSC, 2016)

Figure 3 The 'Three Cities' of Sydney



Source: Greater Parramatta and the Olympic Peninsula, GSC (2016)

At a 'Greater Parramatta' scale, A *Plan for Growing Sydney* (APfGS) identified three key actions, reaffirmed in GSC's "Towards our Greater Sydney 2056":

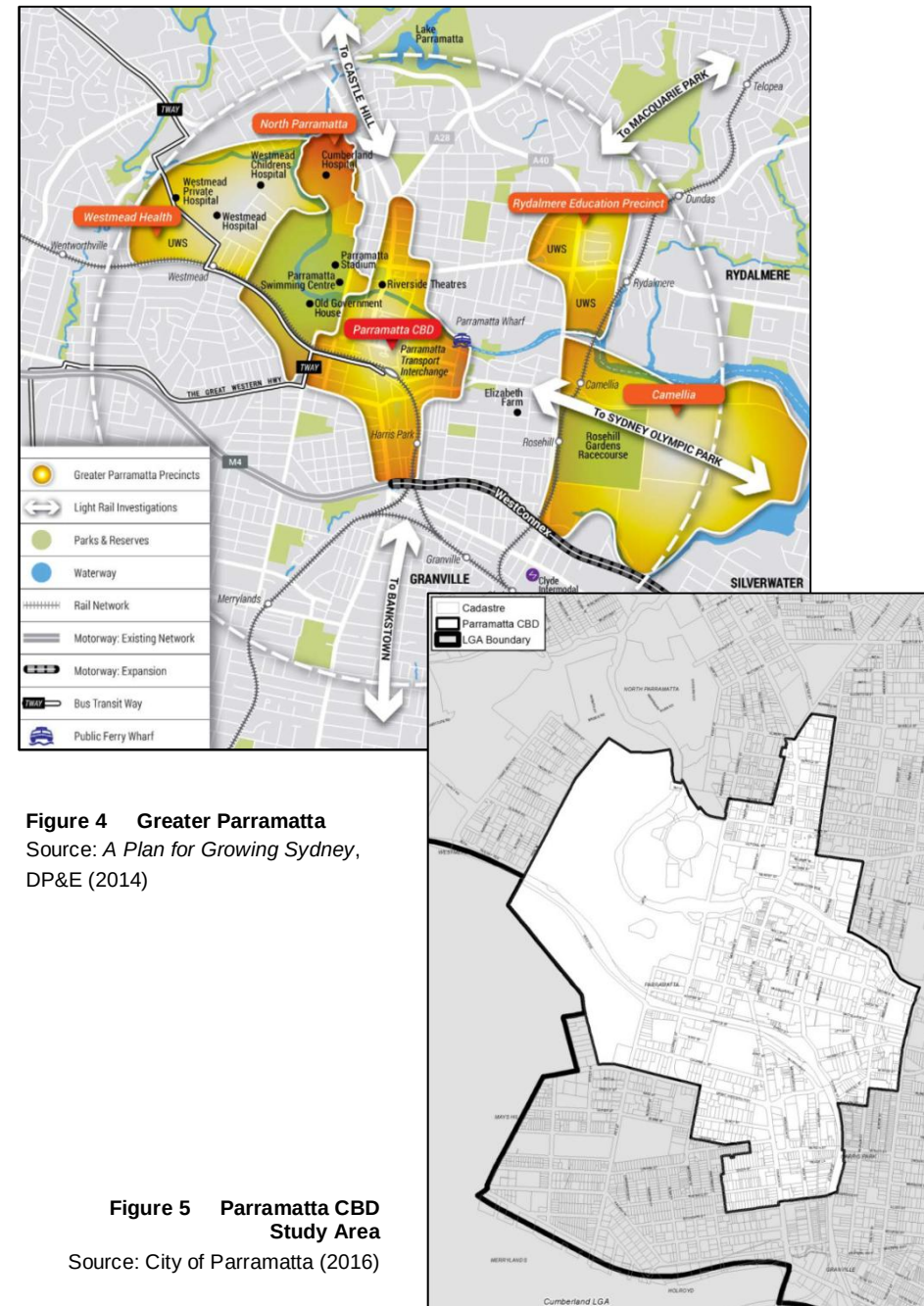
- Grow Parramatta as Sydney's second CBD by connecting and integrating Parramatta CBD, Westmead, Parramatta North, Rydalmere and Camellia
- Grow the specialised health and education precincts at Westmead and Rydalmere
- Renew Parramatta North to create a vibrant mixed-use precinct

GSC's vision for GPOP reinforces the Parramatta CBD and Westmead as a commercial, health and education 'super precinct', and Greater Parramatta's critical role in providing more jobs closer to homes for the fast growing skilled workforce of Western Sydney.

In response to NSW Government's metropolitan strategies, and in light of the insufficient capacity of current planning controls to accommodate long term growth, Council has prepared a draft Planning Proposal for the Parramatta CBD (which forms the focus of this study) to amend the Parramatta Local Environment Plan 2011.

To fully realise its role, Parramatta must facilitate significant job and dwelling growth to increase its social and economic prosperity. The objectives of the draft Planning Proposal, as adopted by Council on 11 April 2016, are to:

- Strengthen Parramatta's position as the dual CBD for metropolitan Sydney.
- Increase the capacity for new jobs and dwellings so as to create a dynamic and diverse city.
- Encourage a high quality and activated public domain with good solar access.
- Facilitate the provision of community infrastructure to service the growing city.
- Strengthen opportunities for the provision of high quality commercial floor space.
- Futureproof the city through efficient and sustainable use of energy and resources.



4.1.2 Transport

The *NSW Long Term Transport Master Plan* (LTTMP) (Transport for NSW, 2012) sets the long term direction for transport planning to the year 2031, providing a framework for transport policy and investment decisions that respond to key challenges across NSW. The LTTMP, and its supporting suite of modal plans and other specific strategies, have formed a basis for coordinating and integrating metropolitan growth with planning for transport. The LTTMP has also underpinned NSW Government's unprecedented investment in transport infrastructure and services in recent years. Plans and aspirations for transport relevant to Parramatta CBD (and Greater Parramatta) are highlighted as follows.

It is noted that the LTTMP is currently being refreshed, with the updated version to be released in 2017.

Walking and Cycling

In *Sydney's Cycling Future* the NSW Government places a focus on improving cycle connectivity within five kilometres of strategic centres. 'Connecting Parramatta' is a key initiative identified and comprises three projects:

- Parramatta Valley urban renewal
 - Six sections of the Parramatta Valley Cycleway have recently been completed, the \$4.5m Subiaco Creek link is to be completed mid-2017
- Completing the network within the Parramatta CBD
- Merrylands to Parramatta

Further corridors to be investigated next are: City Centre Cycleways, Westmead connection, a northern connection across Darling Mills Creek, a southern connection along the Duck River and a cycleway alongside the Carlingford Line. The completion of these cycling connections will significantly improve connectivity and safety, and the appeal of cycling as a transport option. A 'Green Grid' for Parramatta was also identified in APfGS with an aspiration to create an integrated network of multi-purpose open spaces interlinked by a series of shared pathways.

Transport for NSW identify comfortable walking and cycling distances of two and five kilometres respectively for major centres such as Parramatta, with catchments to be expanded to ten kilometres in the longer term: these catchments will form the focus of future investment for the Parramatta CBD.

Figure 6 Connecting Parramatta (Transport for NSW, 2013)

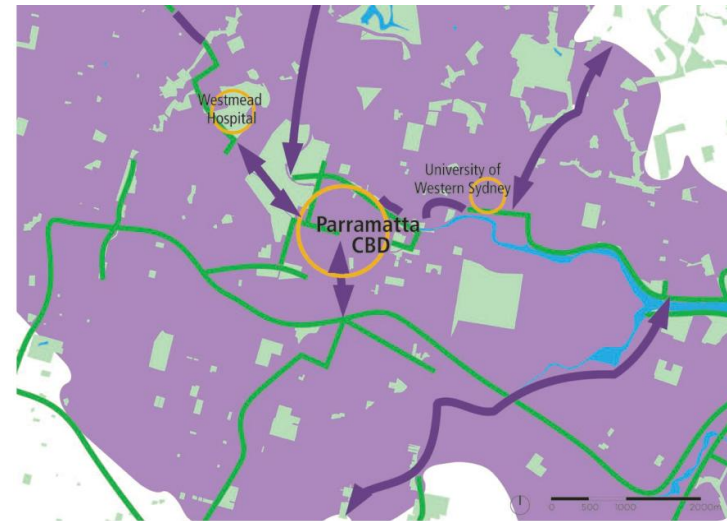
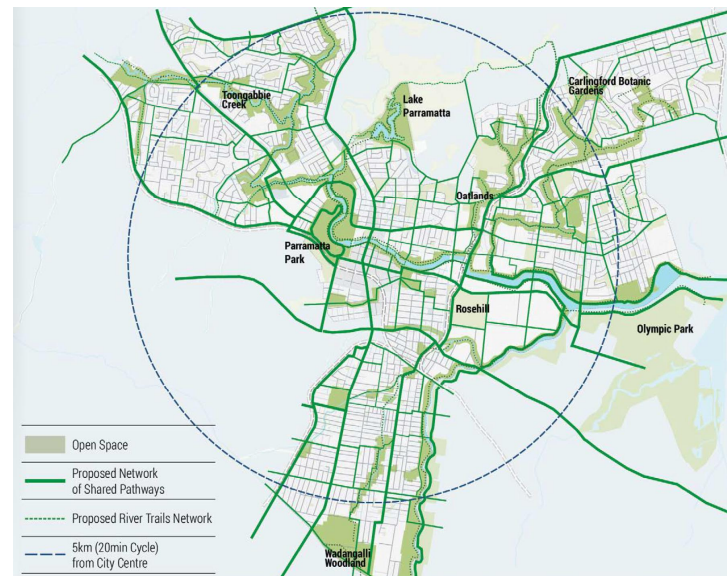


Figure 7 Green Grid for Parramatta (DP&E, 2014)



Rail

Whilst current investment commitment in rail is focussed on the delivery of Metro infrastructure and services to Sydney's northwest, CBD and southwest, the Australian and NSW governments are also undertaking a scoping study to better understand the need, timing and service options for rail investment to support Western Sydney.

In order to address short term needs along the T1 Western Line, the NSW Government is undertaking works to increase capacity and improve journey times and reliability. However, preliminary findings of the study confirm higher order solutions are required to address longer term needs with patronage demand forecasting indicating that the T1 corridor is currently forecast to be Sydney's most overcrowded in the long term.

An initial set of eleven options to address long term needs have been identified as part of preliminary investigations through the *Western Sydney Rail Needs Study*, four of which pass through Parramatta. Each option will be subject to a multi-criteria assessment, as well as feedback from community consultation. It is understood there is currently no funding available for potential upgrades: consideration of funding mechanisms will form part of the finalisation of the study.

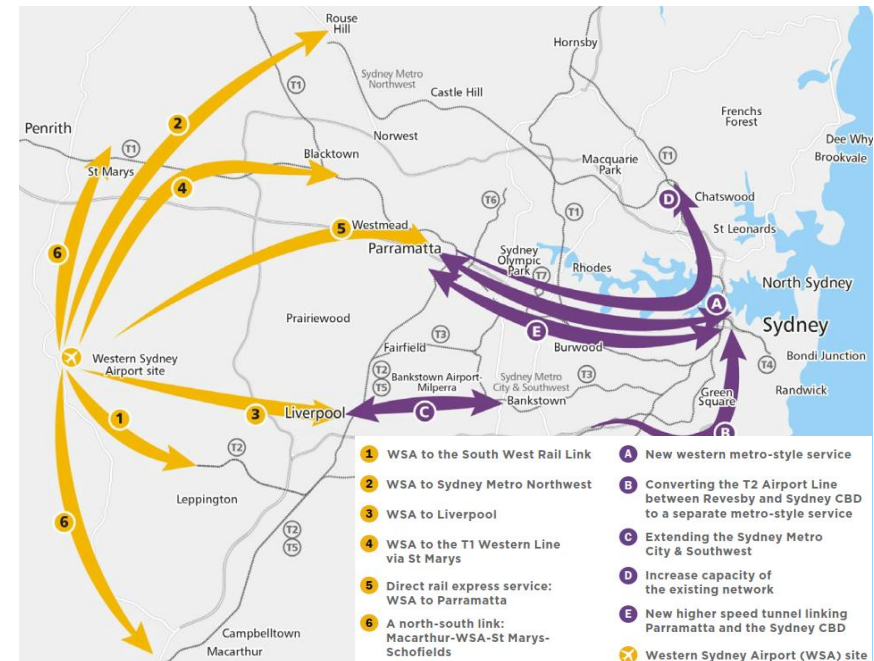
In parallel with the scoping study, the NSW Government has announced a new underground metro railway line between the Parramatta and Sydney CBDs (see Figure 8 Option A), with stations proposed to support major intermediate precincts indicated in Figure 9. The project will support GSC's vision for Greater Parramatta as the 'Central City' capital, providing the additional needed capacity and improved travel times between Sydney's two key CBDs. The project will also free up capacity on Sydney Trains' network for faster and more frequent services to Parramatta CBD from areas of western Sydney. A key part of the refinement of the Project will be how it integrates with the broader trunk transport network, including interchange to the proposed Parramatta Light Rail, other heavy rail services and existing extensive bus network.

Ferry

Transport for NSW is proposing to upgrade Parramatta Wharf to provide: improved access, amenity and safety; quicker and more efficient boarding and disembarking as well as increased wharf capacity for future growth of ferry services and more efficient interchanges with other modes of transport.

Transport for NSW also plans to modernise the ferry fleet, developing a new style ferry for the Parramatta River. This work is underway.

Figure 8 Western Sydney rail options



Source: *Western Sydney Rail Needs Scoping Study*, Transport for NSW (2016)

Figure 9 Sydney Metro West proposal



Source: Transport for NSW (2016)

Bus and Light Rail

The NSW Government plans to provide a comprehensive bus and light rail network to support the growing Greater Parramatta. Four potential light rail corridors have been identified that when integrated with the existing two west facing bus transit ways (T-Ways), form a vision of a comprehensive radial transit network providing access to the CBD: for which the tiers of serviceability along each can be adapted in response to demand as the city and surrounds grow.

The four light rail corridors were identified by Transport for NSW for further investigation via a Strategic Business Case (SBC) process, following a multi-criteria assessment of thirteen potential routes. In July 2015, Transport for NSW recommended a preferred network: a 22 kilometre network from Parramatta to Strathfield and Parramatta to Carlingford. The preferred network would improve public transport connections to:

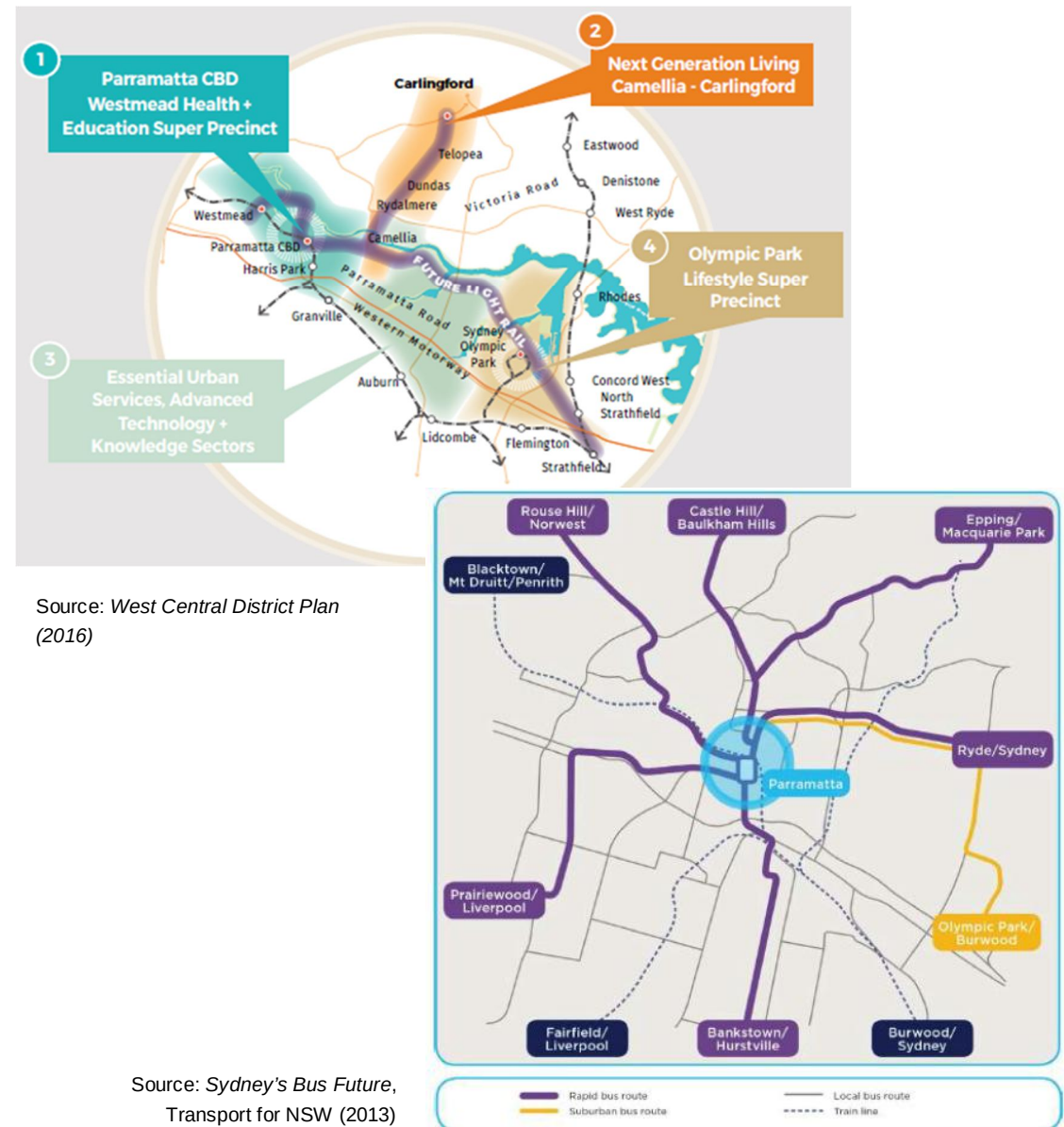
- Employment hubs such as the Parramatta CBD, Westmead, Sydney Olympic Park and Rydalmere where development intensification is planned.
- Urban renewal projects such as Parramatta North, Camellia and Sydney Olympic Park.
- Major trip generators such as ANZ Stadium, Allphones Arena, Sydney Showground, Western Sydney Stadium, Western Sydney University and Rosehill Racecourse.

The Carlingford to Macquarie Park section was found to present a number engineering challenges that required further investigations before proceeding.

The NSW Government has made a strong financial commitment towards delivering the preferred network with \$1billion set aside. The remaining funds are likely to be unlocked through value capture; however the preferred network remains subject to Final Business Case and planning approval.

Until such infrastructure is delivered, these corridors will be serviced by a network of high-frequency Rapid and Suburban bus services, for travel between suburbs and the Parramatta CBD.

Figure 10 Parramatta Light Rail preferred corridors and bus route hierarchy



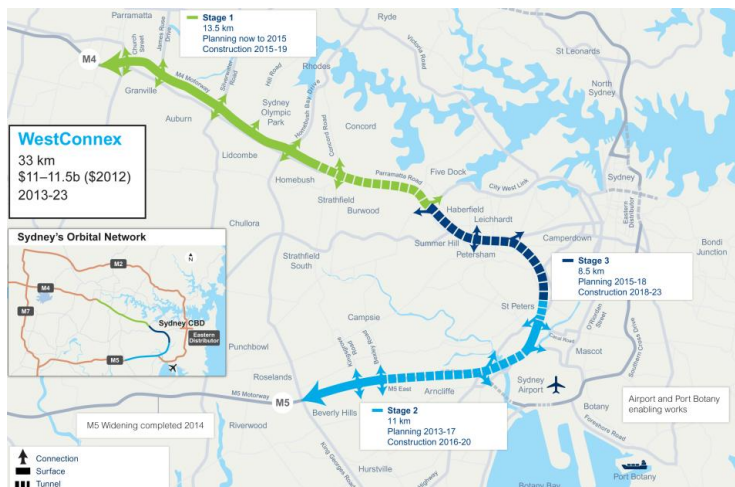
Road network

To facilitate the movement of people, goods and services by road, the NSW Government is investing in the **WestConnex** project: a 33 kilometre motorway project linking Parramatta and Sydney's south west with the Sydney CBD, Sydney Airport and Port Botany. Construction of Stage 1 commenced in early 2015, with completion of all three stages programmed to be complete by 2023.

It is anticipated that completion of WestConnex will have significant impacts on reducing traffic volumes on currently congested roads and potentially improve mobility for road based modes accessing the Parramatta CBD, including bus and freight. Traffic volumes will be reduced along parts of Parramatta Road and other parts of the road network, however may increase on other key links such as the Great Western Highway due to toll diversion⁴.

The NSW Government have also committed \$1 billion to enhancing connectivity to WestConnex, with proposed extensions at both the north and south. Delivery of these extensions would further increase the size of the catchment from which road-based modes, including freight, could more easily access the Parramatta CBD.

Figure 11 Proposed WestConnex network (Source: Roads and Maritime, 2015)

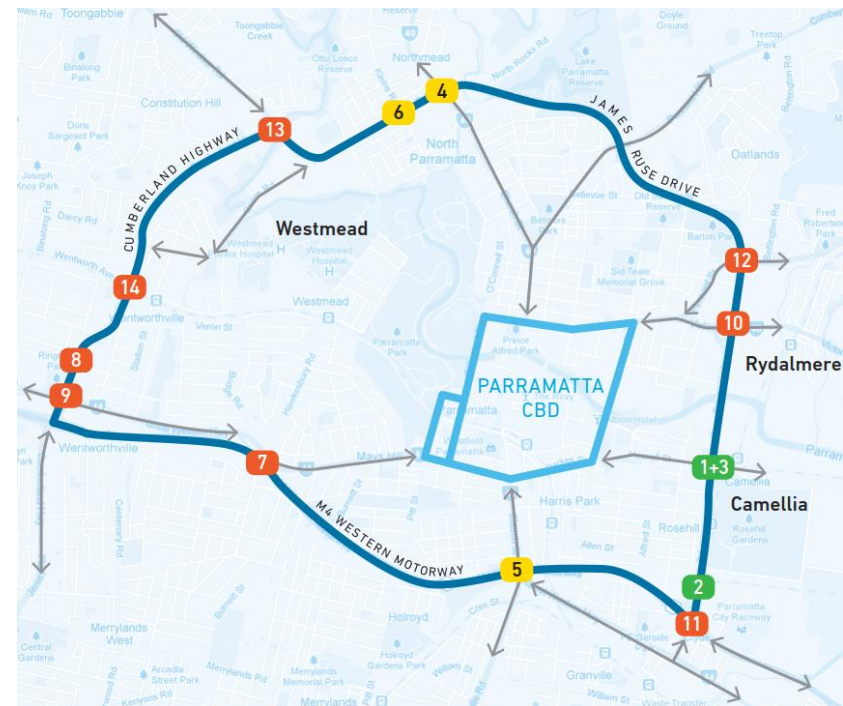


⁴ Section 7.2.2 and 7.3 - WestConnex M4 Widening - Traffic and Transport Working Paper).

Council have also identified that upgrades to the Western Sydney **Regional Ring Road** can improve traffic flow in the region and support the continued growth of the city of Parramatta. The function of the regional ring road is critical in managing traffic flow, particularly in managing regional 'through' traffic away from the CBD.

A series of upgrades along the M4, James Ruse Drive and Cumberland Highway have been identified by Council to create a free flowing arterial road and allow traffic to circumnavigate Parramatta and Westmead quickly and efficiently. Roads and Maritime have completed, and is continuing, works along James Ruse Drive as well as investigating potential works along other corridors such as Old Windsor Road as part of the Pinch Point Program. Council is also reviewing the CBD's **Inner Ring Road** to complement the Regional Ring Road and establish best practice traffic management.

Figure 12 Inner and Regional Ring Roads of Parramatta



Source: City of Parramatta (2012)

Technology and Transport

The NSW Government have recently developed *The Future Transport Technology Roadmap* that has included a comprehensive review of potentially influencing transport technologies, and what Government plans to do with them in the short and longer term. In pursuing its aspiration of staying in touch with and maximising the use of technology, Transport for NSW will adopt five strategies:

1. **Personalise customer interactions.** *Develop and connect real-time digital information, navigation, payment and engagement platforms so they are simpler to understand, easier to use and can give personalised service relevant to individual needs and preferences*
2. **Transform mass transit networks.** *Increase automation and apply new technologies to mass transit networks to improve efficiency, deliver better service frequency and reduce transit times, increasing the attractiveness of the services they offer their customers.*
3. **Foster shared demand-responsive services.** *Stimulate the development of new technology-enabled service offerings to offer a greater variety of mobility options and flexibility of choice that matches customers particular needs*
4. **Enable connected and automated vehicle platforms.** *Pursue national standards for the road infrastructure, systems, safety and regulatory frameworks needed to adopt greater levels of vehicle automation earlier, and identify how best to deliver community benefits that autonomous vehicles will bring*
5. **Create intelligent transport networks managed with data.** *Invest in smart infrastructure and collect and use the data generated to enable increasingly efficient, flexible and dynamic service delivery with improved safety, availability, reliability and responsiveness.*

Technology has the potential to significantly impact how the transport system is utilised, and hence how we plan for transport in the future: particularly with the growing take up of on-demand transport and developing autonomous vehicle technologies for private vehicles, buses and trains.

Gathering data produced by those new technologies, public authorities can turn the data into actionable intelligence to have a better understanding on how people travel and to provide better Mobility as a Service (MaaS).

Technology also has the ability to also affect the need to travel. People are more and more connected to each other without being physically together. Internet and web planning tools allow sharing content, organising meetings across the world without travelling.

Authorities, public transport users and companies have been learning to adapt to congestion promoting new working habits such as flexible working hours to avoid peak hour commutes and homeworking. Cities are growing and densifying; if the current travel habits do not change, we will face the saturation of (particularly road) infrastructure and a critical lack of space to build more capacity. Therefore, we need to focus on optimising our travel patterns and work toward the reduction of the need to travel, in addition to changing the mode of travel. A wide range of usual travel purposes can be addressed from home thanks to technology (e.g. online shopping - including grocery, clothes, event and travel bookings, homeworking, etc.).

“As well as building new infrastructure, we need to look at smarter systems and technology-driven solutions to cope with demand. We need to stay ahead of the game so it's time we ask, what are the next big ideas? What are the next systems and technologies that are going to challenge us and shape the transport system in NSW?”

5.0 Travel patterns

5.1 Drivers of travel demand

When considering the planning of transport infrastructure and services, it is critical to understand the integration of land use and transport. It is important to recognise that transport has a derived demand driven by the need for people and goods to move from 'A to B'. It is further important to understand the location of 'A' and 'B', and the purpose of the trip between them is driven by the urban form, or more specifically the type, location and intensity of the land use that comprises it. It is these features of a city that drives the need for, and type of, transport response.

5.2 Metropolitan patterns

As identified in the *NSW Long Term Transport Master Plan*, Greater Parramatta is an area where various travel demand corridors converge (see Figure 13). Demand within these corridors is generated by a combination of local and metropolitan-wide land uses. The 'destination-dominant' areas of inner Sydney (such as the Sydney CBD) and the 'origin-dominant' (residential) areas of central and western Sydney creates a metropolitan-wide east-west travel flux.

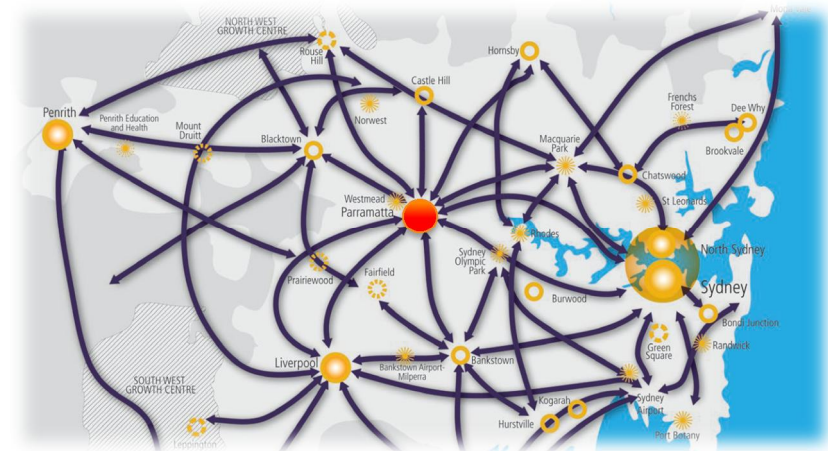
This effect drives significant east-west demand through Parramatta facilitated by the highest order transport infrastructure in the area: the T1 Western / Blue Mountains rail corridor and the M4 Motorway. Patronage data indicates that approximately one-third of passengers approaching Parramatta in the AM peak exit at Parramatta Station, the remainder comprises of through-demand.

This effect also drives a significant interchange function between transit services within Parramatta, with the Parramatta Transport Interchange facilitating intermodal transfer between the trunk rail network and a majority of the significant cross-regional bus services operating along each of the converging road corridors.

Also important to note are the key trip types that comprise travel demand across Sydney's transport network. When the cumulative impact and timing of each key trip type throughout a typical weekday is considered, it becomes clear why the AM peak period is widely considered as the 'critical' peak for the purposes of assessing transport infrastructure and services in Sydney (see Figure 14), including in this study. 2014-2015 Household Travel Survey (HTS) data illustrates that three trip types in particular converge in the typical Sydney AM peak period:

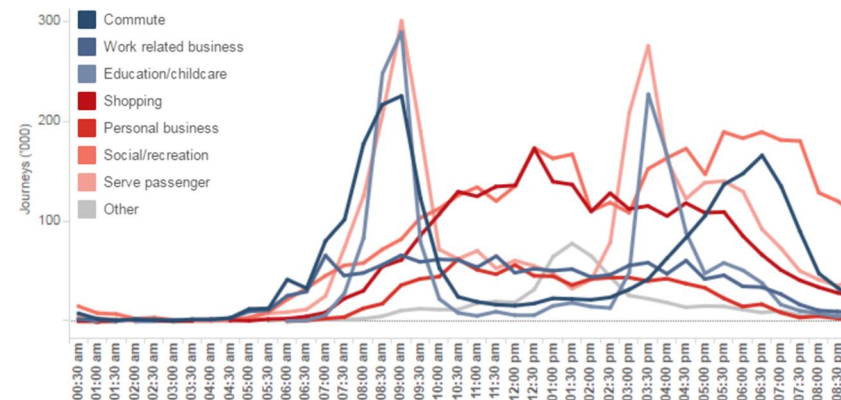
- Serve passenger: broadly defined as dropping off / picking up someone
- Commute: trips to / from work
- Education: trips to / from places of education (e.g. schools and universities)

Figure 13 Major travel demand corridors that converge at Parramatta



Source: *NSW Long Term Transport Master Plan*, Transport for NSW (2012)

Figure 14 Travel by time of day by purpose (average weekday in Sydney)



Source: Household Travel Survey 2014/2015

5.3 Sub-regional patterns

It is estimated that the City of Parramatta LGA has a resident population of 245,482 and 159,796 local jobs. The City of Parramatta LGA is one of few across Sydney that have a jobs surplus (i.e. more local jobs than workforce), providing employment to workforce residing in many areas around Sydney. In combination with the education and retail precincts within the area, this makes Parramatta very much destination-dominant, serving as an attractor of travel demand.

Land use

A high level review of the land use types that comprise Greater Parramatta yields dominant land uses that are roughly consistent with current land use zoning:

- **Commercial Core (B3) / Mixed Use (B4):** comprising the Parramatta CBD
- **Residential (R2, R3, R4):** including predominantly medium and high density residential, surrounding the Parramatta CBD and along the rail corridors, whilst outside of these low density residential dwellings are dominant.
- **Industrial (IN1, IN2, IN3):** predominantly in Camellia and Rydalmere.
- **Infrastructure (SP2):** including the Westmead and Rydalmere Health and Education precincts, as well as trunk road and rail corridors.
- **Recreation (RE1, RE2):** including public recreation immediately to the west at Parramatta Park and private recreation (Rosehill Gardens).

These land uses typically generate varying levels of transport demand and directionality through differing parts of a typical week. The Parramatta CBD commercial core yields one of Sydney's largest high-density employment centres, in combination with significant retail and civic uses. Commercial and retail land uses typically form the most intensive in travel demand generation, depending on the type of jobs and retail provided. Residential areas serve as trip origins for each of the above, including travel to work, education and shopping.

Trip characteristics

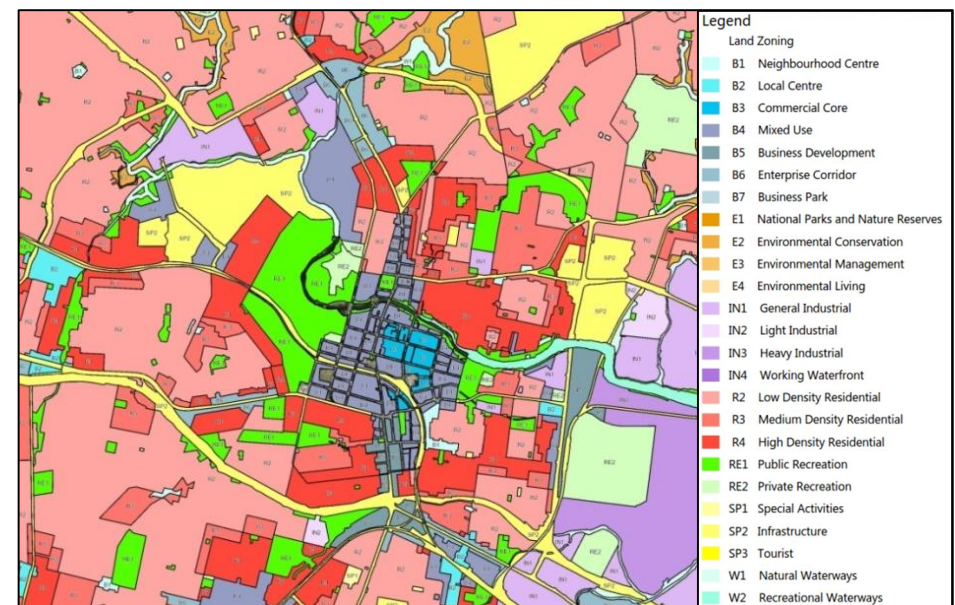
For the Parramatta LGA, HTS data collected in 2014-2015 indicates:

- Four key trip purpose types comprise the significant majority of travel demand: Social Recreation⁵ (22 per cent), Commute (19 per cent), Serve passenger (19 per cent) and Shopping (16 per cent)

- Average trip distances and travel times to work are relatively long at an average of 8.2km and 38 minutes respectively, compared to 4.3km and 29 minutes respectively for the City of Sydney LGA
- Car mode share is 68 per cent, compared to 32 per cent in the City of Sydney LGA
- Vehicle ownership is 1.5 vehicles per household, versus 0.8 in City of Sydney LGA.

The distinct differences in trip characteristics between the Parramatta LGA and the City of Sydney LGA can be reasonably associated with the contrasting urban forms and land uses that comprise each, as well as the transport networks and policies that support the mobility needs of each. The urban density of Parramatta and its surrounds is lower than the areas comprising and surrounding the Sydney CBD. City of Sydney LGA contains approximately 10 per cent less residential population than the City of Parramatta⁶, in less than one third of the land area. The transit network supporting inner Sydney is hence of a much higher order in terms of serviceability and capacity whilst policies and provisions of parking are more stringent and costly.

Figure 15 Land use zoning



Source: AECOM (2016)

⁵ Includes travel for any recreational activities for leisure
20-Mar-2016
Prepared for – City of Parramatta – ABN: 49 907 174 773

⁶ 3218.0 – Regional Population Growth, Australia, 2014–15". Australian Bureau of Statistics

5.4 Parramatta CBD

The Parramatta CBD forms as a key destination for a variety of key trip types, including the dominant journey to work trip (or commute). The following provides a summary of journey to work (JTW) data collected in 2011 for both employees and residing workforce of the Parramatta CBD.

Employee trip patterns

Of the 43,600⁷ employees recorded in the JTW data in the area approximately comprising the CBD, 5,700 (13 per cent) resided in the Parramatta SA3⁸ (see Figure 16). The otherwise dispersed nature of work origins observed underlines the strategic importance of the Parramatta CBD and its place as a major employment centre. 31 per cent of all workers commuted to the Parramatta CBD from the west. This reinforces Parramatta's position as 'Western Sydney's CBD'. In contrast, 23 per cent commuted from the south, 16 per cent from the north and 16 per cent from the east. More than 40 per cent of work origins were from SA3s outside the nine key origins listed in Figure 16.

Private vehicle (car) was the dominant mode for employees accessing work in the CBD, accounting for 56 per cent trips. Public transport only accounted for 37 per cent of all JTW trips whilst walking and other modes (such as cycling) comprised just 5 per cent.

Resident workforce trip patterns

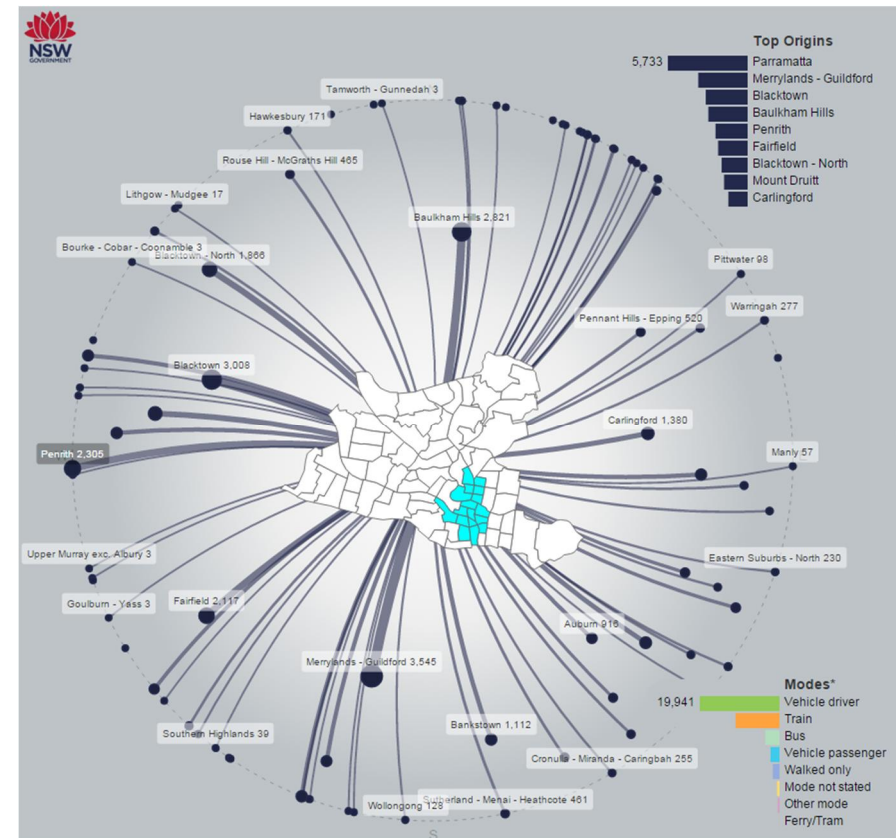
As highlighted above, approximately 5,700 of the residing workforce in the Parramatta CBD were employed within the Parramatta SA3 in 2011. 48 per cent of all resident workforce in the Parramatta CBD commuted to the east for work. This is intuitive given the quantum of jobs available in key centres to the east of

Parramatta such as the Sydney CBD, Macquarie Park, North Sydney, Chatswood, St Leonards and Sydney Airport. The most common JTW destination outside of

Parramatta was Sydney Inner City SA3 (22 per cent). Only approximately 10 per cent of the resident workforce commuted to jobs in each the south, north and west.

Public transport and the car accounted for an equal share of approximately 90 per cent of all JTW trips made by the resident workforce. Other modes of transport (such as walking and cycling) accounted for 930 trips (12 per cent) of all JTW trips.

Figure 16 Journey to work trip patterns for employees of the Parramatta CBD



Source: Transport for NSW (2011)

⁷ Value in accordance with 2011 JTW data based on the 2011 BTS Travel Zones highlighted in Figure 16. BTS September 2014 Release Employment Forecasts indicate there were 49,513 employees within the 'Parramatta Centre' in 2011, as defined in August 2014. Reasons for typical discrepancies between JTW employee counts and employment estimates are noted in the BTS forecast release notes. Slight discrepancies may also result from different definitions of the CBD area.

⁸ Statistical Area Level 3 – SA3: an area designed to provide a regional breakdown of Sydney / Australia, usually with a population of 30,000 to 130,000 people

6.0 The transport task

The Parramatta CBD is experiencing significant growth, and is forecast to continue to grow as illustrated by Council's 'vision for the future' (see Figure 17). Significant growth in jobs and dwellings is expected to place further demands on the current transport system, and on Government to deliver necessary and desirable improvements to enable the ongoing safe and efficient operation of transport infrastructure and services.

Identification of strategic-level transport needs to support Parramatta's growth has been informed by post-analysis of strategic transport modelling, through use of the Sydney Strategic Travel Model (STM). STM is developed and maintained by Transport for NSW and is a strategic metropolitan-scale model that forecasts travel patterns across Sydney's Greater Metropolitan Area (including Sydney, Newcastle and Illawarra statistical divisions) under different land use, transport and pricing scenarios.

The STM has been used to inform the study through estimating:

- Overall increases in travel demand generated by the Parramatta CBD
- Trends in mechanised modal demand, travel directionality and trip distances
- Estimate growth along key transport corridors and links on approach to the Parramatta CBD and other select locations.

The demand forecasts produced by STM are developed based on a number of assumptions and processes that attempt to replicate people's travel choices and behaviour, as well as a number of assumptions on future growth and changes in the transport network. The STM is considered to be best suited to examining the effect of significant proposals (such as that for the Parramatta CBD) at a strategic level. Further, more detailed transport modelling will be undertaken prior to gazettal of the Planning Proposal to build on these initial forecasts.

Though it is acknowledged that some elements of the transport network, including its supporting infrastructure and services, will be driven by PM peak period conditions, this study has focussed on the critical two hour AM peak period in light of the strategic nature of the study.

Demographic forecasts that underpin the STM outputs account for Sydney's forecast population growth and Government's current aspirations for the surrounding precincts such as the Parramatta Road Urban Transformation, Camellia, and Parramatta North. The model also assumes a 'most likely' future transport network including projects such as WestConnex and Parramatta Light Rail. Note that Sydney Metro West was excluded as no commitments had been made by Government at the time of undertaking the modelling task: integration of Sydney Metro West will form a critical element of future transport assessments including the Integrated Transport Plan.

Figure 17 Parramatta CBD's future skyline



Source: City of Parramatta, 2016

6.1 Demographic projections for the CBD

Subsequent to the development of the *Parramatta CBD Planning Strategy*, Council developed three potential development scenarios for sensitivity testing as part of this study. The development capacity of each scenario, and assumed 'market consumption' periods are summarised for each the forecast residential population and employees in Table 1 and Table 2 respectively. The resultant calculated demographic projections for the CBD for each the 2036 and 2056 modelling timeframes are summarised in Table 3.

The figures presented in each table are based on economic and market analysis advice provided to Council, and represent 'most likely' scales of future development uplift.

The values shown also critically form the key underlying assumptions of this study, and the preliminary assessment of the draft Planning Proposal. These yields will be refined through the Planning Proposal assessment process, and as other technical studies are undertaken. Should higher development yields within the CBD be forecast or realised then further analysis would be required to understand the impacts on the transport network.

Notably, the forecasts represent:

- An almost doubling in number of Parramatta CBD employees by 2056, and a 40-50 per cent increase by 2036
- A 135-225 per cent increase in residential population by 2056, and a 65 per cent-115 per cent increase by 2036

Important to each scenario is the proposed proportional increase in residential mix.

Table 1 Proposed capacity and forecast 'take-up' timeframe – residential population

	Residential population		% Take-up by	
	Capacity increase	Assumed year of full take-up	2036	2056
Medium capacity	+28,200	2047	65%	100%
High capacity	+47,100	2055	51%	100%

Table 2 Proposed capacity and forecast 'take-up' timeframe – employment

	Employment		% Take-up by	
	Capacity increase	Assumed year of full take-up	2036	2056
Medium capacity	+42,200	2049	61%	100%
High capacity	+48,800	2055	51%	100%

Table 3 Parramatta CBD draft Proposal population and employment forecasts

Scenario		Demographic forecasts			
		Residential population		Employment	
2016	Current	20,800		53,900	
2036	Existing controls	34,100	(+13,300)	76,300	(+22,400)
	Medium capacity	39,000	(+18,200)	79,500	(+25,600)
	High capacity	45,000	(+24,200)	78,900	(+25,000)
2056	Medium capacity	49,000	(+28,200)	96,100	(+42,200)
	High capacity	67,900	(+47,100)	102,700	(+48,800)

Source: City of Parramatta, 2016

Note: An assumed linear take-up of capacity results in a marginally lower employment forecast in 2036 for the 'high capacity' scenario when compared to the 'medium capacity' scenario

6.2 Forecast travel trends

6.2.1 Travel demand

The total number of trips generated by Parramatta CBD is estimated to increase by two to three times by 2036 (see Figure 18), and could potentially increase by three to four times by 2056.

The demand expected to impact on the broader trunk transport network providing access to the CBD is represented by the 'to' and 'from' trips, and indirectly form a focus of this study. The 'within' trips represent trips that are forecast to be contained within the CBD. General observations of the forecasts include:

- The proposed medium growth scenario does not represent significant change in demand, to 2036, from what current planning controls allow
- However, a two-hour AM peak nett growth of 48,000-59,000 trips in the medium term (2036) and 90,000 to 108,000 trips in the long term (2056) represent significant increases in total travel demand.
- The proportional increase in 'to' and 'from' demand is forecast to be less than the proportional increase in 'total' and 'within' trips.
 - High growth scenarios show particularly significantly higher total demand, though most of the relative difference is 'within' (contained) trips with more modest impact on 'external' (to/from) travel demand

The final points demonstrate the impact of a higher residential mix on reducing relative impact on the transport network providing access to the CBD.

6.2.2 Origin and destination patterns

Figure 19 and Figure 20 over page illustrate the forecast changes in the spatial distribution of trips accessing the CBD from the 2016 to 2056 'High' scenario, based on forecast land use changes. The trends indicate that:

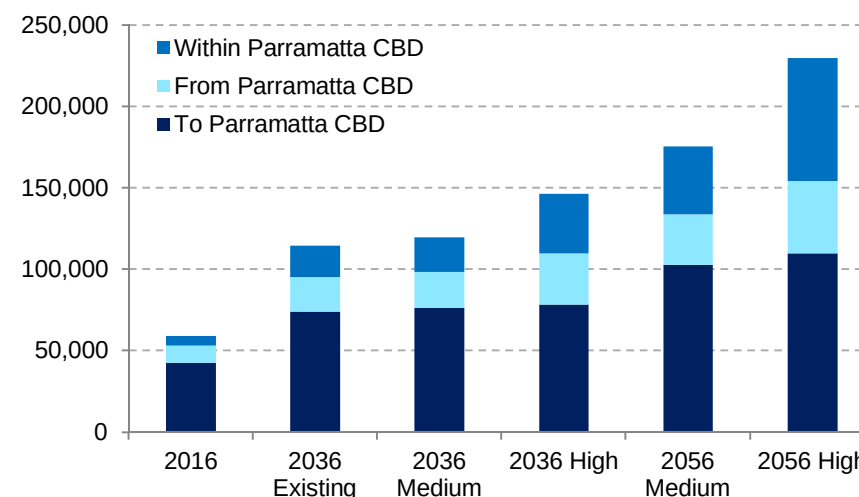
- The proportion of shorter trips will increase significantly: an outcome of the proposed significant residential component of the CBD, and proposed densification / uplift of nearby precincts (such as Parramatta North, Camellia etc) as homes are provided closer to jobs

- Both the decrease in average trip distance (7-13 per cent) and the increase in short distance trips create a huge opportunity for a potential shift in mode from private vehicle to active transport
- The west will continue to be the main external origin of trips, whilst areas to the east are forecast to provide the main destinations

When considering the transport network that supports the spatial distribution of the trips providing access to the CBD, it is important to acknowledge the high number of key 'access' corridors that will support the CBDs growth including: four rail corridors (T1, T5 and Sydney Metro West), two proposed light rail corridors (east to each Carlingford and Strathfield), seven key radial bus corridors (with current service headways less than five minutes), eight trunk road corridors, in addition to walking, cycling and ferry access corridors.

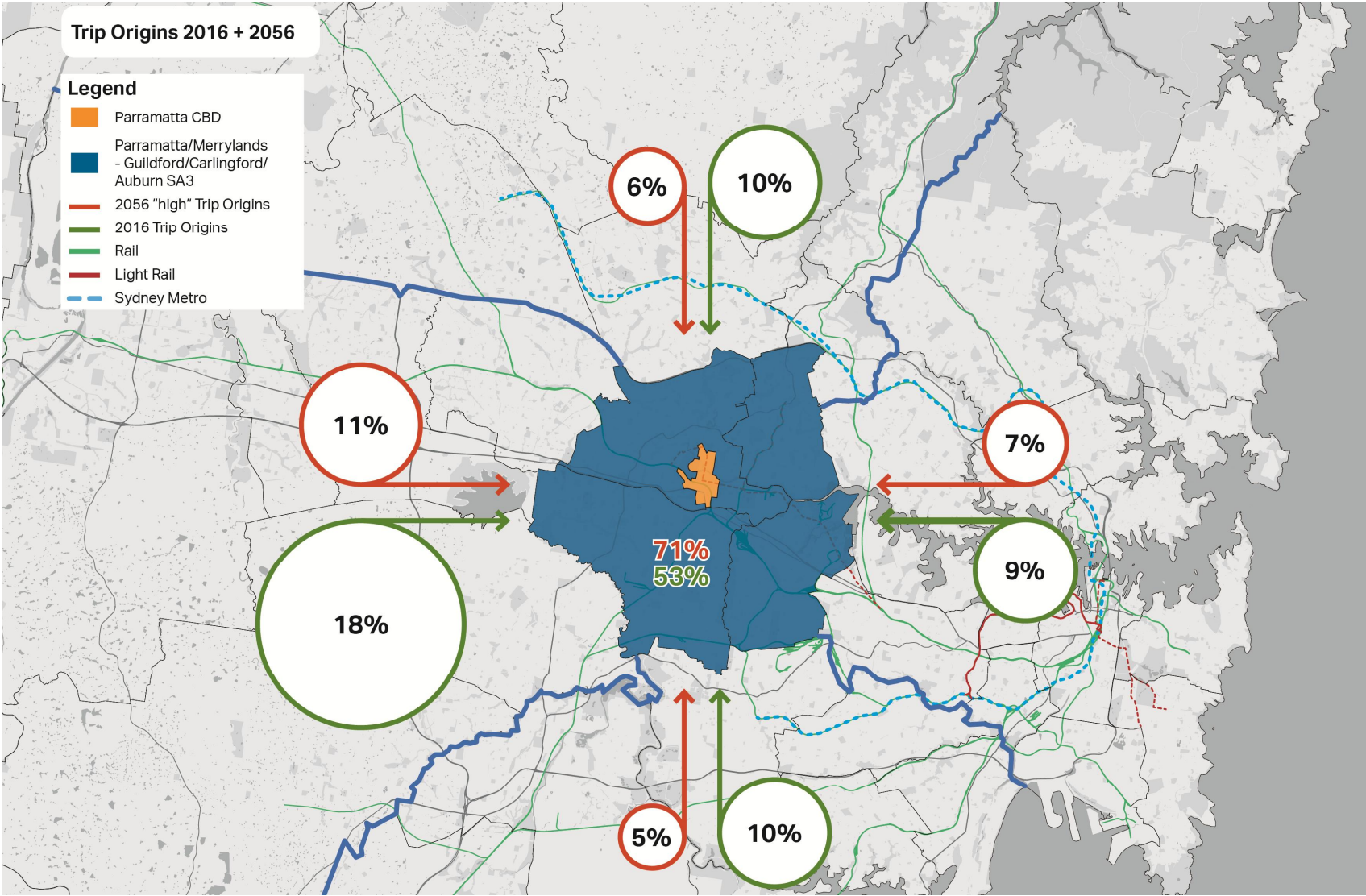
In this context, the Parramatta CBD can capitalise on its centralised location within the Sydney metropolis and the less constrained natural environment – particularly compared to other water-based CBDs such as the Sydney CBD – to distribute demand.

Figure 18 Forecast travel demand (AM two hour peak)



Source: STM, Transport for NSW, 2016

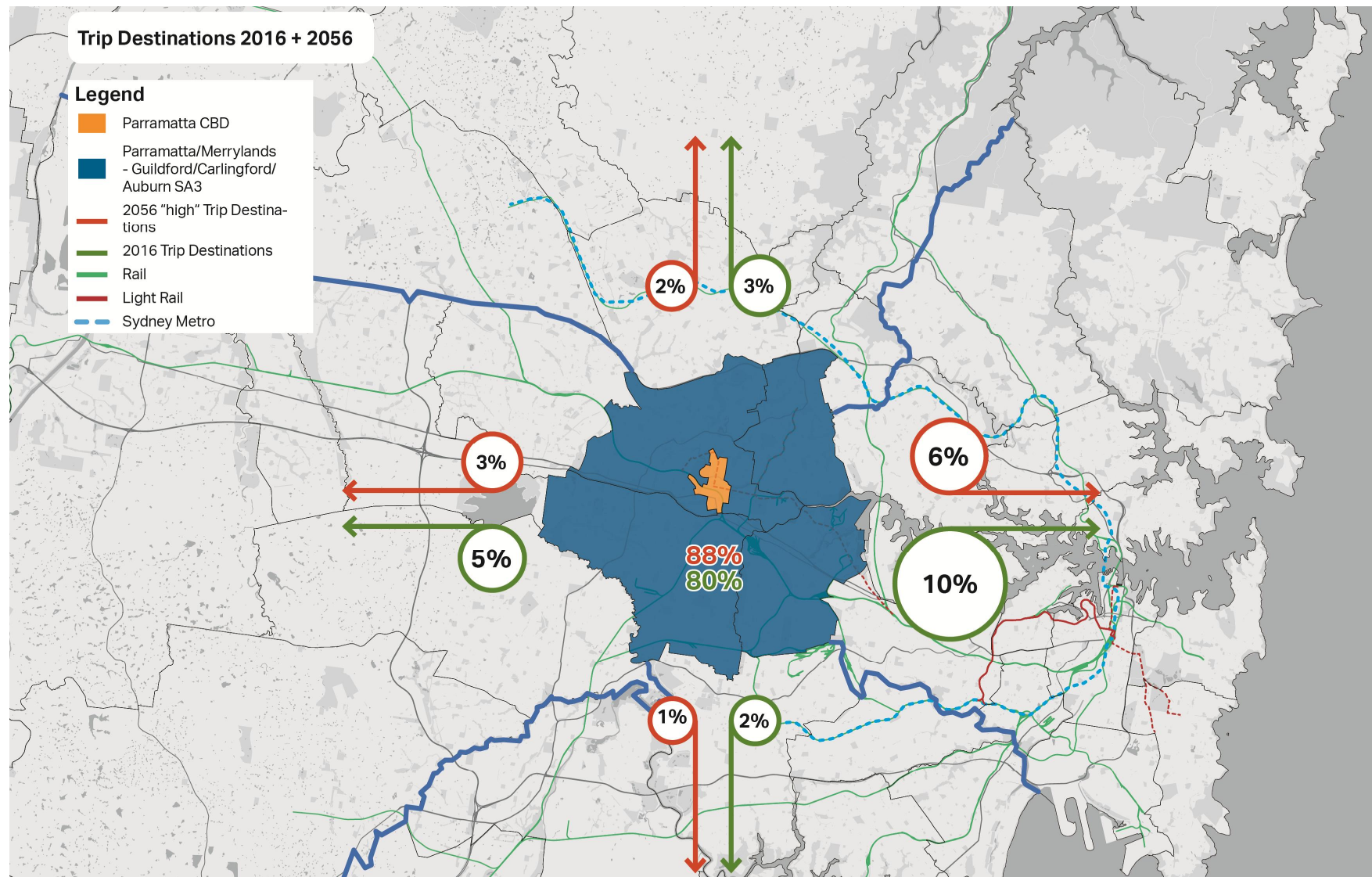
Figure 19 Forecast trip origin distribution patterns (AM peak)



*Note: Values / scales are presented as a portion of total demand in the relevant scenario

Source: STM, Transport for NSW, 2016

Figure 20 Forecast trip destination patterns (AM two hour peak)



*Note: Values / scales are presented as a portion of total demand in the relevant scenario

Source: STM, Transport for NSW, 2016

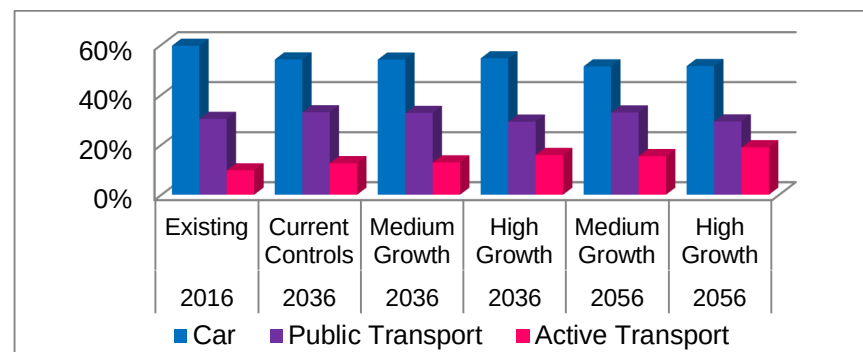
6.2.3 Mode share

Mode share data indicates that private vehicle remains the predominant means of employees accessing the CBD, as well as getting around the Parramatta LGA in general: comprising of 57 per cent and 68 per cent of the transport task associated with each. Comparatively, public transport comprises only 37 per cent and 14 per cent of each.

Strategic level modelling indicates that future land use and transport changes will result in a general trend of re-moding of travel away from car: forecasting approximately 10 per cent shift over the 40 years to 2056, with corresponding increases in sustainable transport use. It is considered that these outputs represent a lower order estimate of transfer to sustainable transport modes, as the modelling process does not fully account for 'external' key influences that are likely to impact how people may access the CBD in the future (e.g. congestion, strict parking policies).

The model outputs represent only a slight decrease of the private vehicle car mode share and supporting strategic level traffic analysis indicates this would result in significant congestion on the road network in the long term. To avoid complete saturation of the road network, it's necessary to reduce the role of the private vehicle through promoting and investing in sustainable transport modes in line with disincentives to private vehicle use: to help achieve the ultimate goal of a more efficient and sustainable transport outcome, as well as optimising use of space in the CBD and improving its amenity and value.

Figure 21 Forecast AM peak mode choice trends



Source: STM, Transport for NSW, 2016

6.3 Implications on the trunk transport network

6.3.1 Rail

Rail forms the spine of the public transport network in Sydney, and this is no different in the west. Parramatta Station, serviced by the T1 Western, T5 Cumberland and the Blue Mountains lines, is the fourth busiest train station in Sydney with almost 70,000 customer movements on a typical weekday.

Current AM peak train crowding levels suggest that demand is approaching the nominal capacity of current critical T1 Western and T5 Cumberland Line services. Train crowding levels are even more critical upstream on approach to the Sydney CBD. Issues are also already experienced at Parramatta Station, where crowding and minor delays can be experienced at vertical transport connections to the platforms as trains unload in the morning peak periods.

It is forecast that the future Parramatta CBD will:

- Require significant additional services to support growth: strategic demand forecasts indicate a need for the equivalent of at least 15 additional AM peak hour services by 2056
- Require significant additional station and interchange capacity: with demand through Parramatta Station forecast to double by 2036 - surpassing current turnover through Town Hall during peak periods – and would increase further with the proposed delivery of Sydney Metro West.

With successful implementation of and adherence to sustainable transport plans and policies, as recommended within this study, it is anticipated that patronage would be even higher.

The NSW Government is undertaking works on the T1 corridor to increase capacity and improve journey times and reliability to address short term needs. However, higher order solutions are required to address longer term needs with patronage demand forecasting indicating the T1 corridor will be Sydney's most overcrowded by 2051.

Council's Planning Proposal will bring forward the need for, and increase the feasibility of, additional rail infrastructure in western Sydney. This includes the Sydney Metro West project recently announced by the NSW Government, as well as other options outlined in the WSRNSS that connect to Parramatta. It would also

increase the feasibility of improving existing services (e.g. along the T5 Cumberland line) and drive investigation and consideration to other new potential corridors / demand markets (e.g. providing improved rail interconnectivity in the west in the long term through a connection from Parramatta to NWRL).

6.3.2 Ferry

Ferry services accommodate less than one per cent of the current mode share for employees accessing the Parramatta CBD. Passenger data collected for the F3 Parramatta River service further supports low utilisation with very low patronage at wharves at the western end of the service during peak periods. This can be attributed to several factors including:

- **Slow journey times.** The full length ferry journey between Circular Quay and Parramatta is 75 to 90 minutes compared with 48 minutes by train and 40 minutes by car.
- **Infrequent services.** Ferry services operate hourly even in peak periods.
- **Perceived unreliability.** Ferry services to/from Parramatta are affected by low tides. Passengers must consult a Transport for NSW calendar when this occurs, as replacement buses run between Parramatta and Rydalmere.

The findings of the demand modelling exercise infer that there is not a strong link between CBD growth and growth on Ferry service demand. It is hence considered that future strategies for ferry services should focus on catalysing the mode and encouraging / activating travel via this aesthetically attractive travel mode through measures such as:

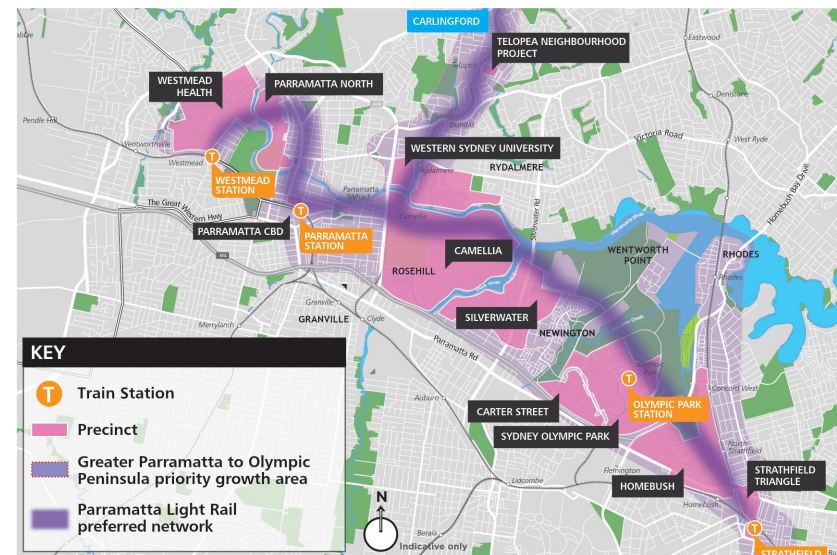
- Increasing the number of services to Parramatta Wharf, particularly as uplift of the Greater Parramatta to Olympic Peninsular urban renewal precinct occurs
- Better integrate the wharf with other modes, such as the planned Parramatta Light Rail, enhancing linked trip options via ferry
- Consider ways to reduce the impact of tides on service accessibility to the Parramatta Wharf through mechanism such as dredging of the Parramatta River (as undertaken prior to the Sydney 2000 Olympic Games).

6.3.3 Light Rail

Delivery of light rail infrastructure and services is currently in planning stages. The NSW Government has identified four preferred light rail corridors radiating from the Parramatta CBD, and plans to deliver a 22 kilometre light rail network to the CBD's east. The light rail network will improve public transport connections to major employment hubs (Parramatta CBD, Westmead, Sydney Olympic Park and Rydalmere), urban renewal precincts (Parramatta North, Greater Parramatta to Olympic Peninsular) and other major trip generators (ANZ Stadium, Allphones Arena, Sydney Showground, Western Sydney Stadium and Western Sydney University). The NSW Government has recently announced the preferred route for Stage 1, including the Westmead to Carlingford section with 16 stops, to be delivered by 2023. The business case is yet to be finalised.

It is considered that the Planning Proposal will increase demand for Light Rail in Parramatta, and increase the need for and feasibility of a future light rail network. It is considered that Council and the NSW Government should collaborate to ensure that forecast growth within the Parramatta CBD and along key radiating corridors is appropriately accounted for in the planning and delivery of the Light Rail network.

Figure 22 Proposed Parramatta Light Rail network (Source: Transport for NSW, 2016)



6.3.4 Bus

Buses play a key role in the Parramatta CBD, whilst the majority of JTW trips are made by car and rail the bus network plays a key role in providing transit accessibility to the CBD and to rail via the Parramatta Interchange: where a significant majority of Parramatta's bus services converge and constraints to operations are already observed. Buses are required to cover an extensive geographic catchment along key radial corridors from the CBD and well beyond. A high degree of priority infrastructure is available for buses; including two transit-ways (T-ways) to the north west and south west: these corridors also cater for the largest bus passenger volumes accessing the CBD.

Passenger demands crossing ten cordons around the Parramatta CBD have been reviewed for current and future scenarios, to understand the future task for bus as the CBD grows and its appropriateness as a mode along these corridors in the future. Key findings include:

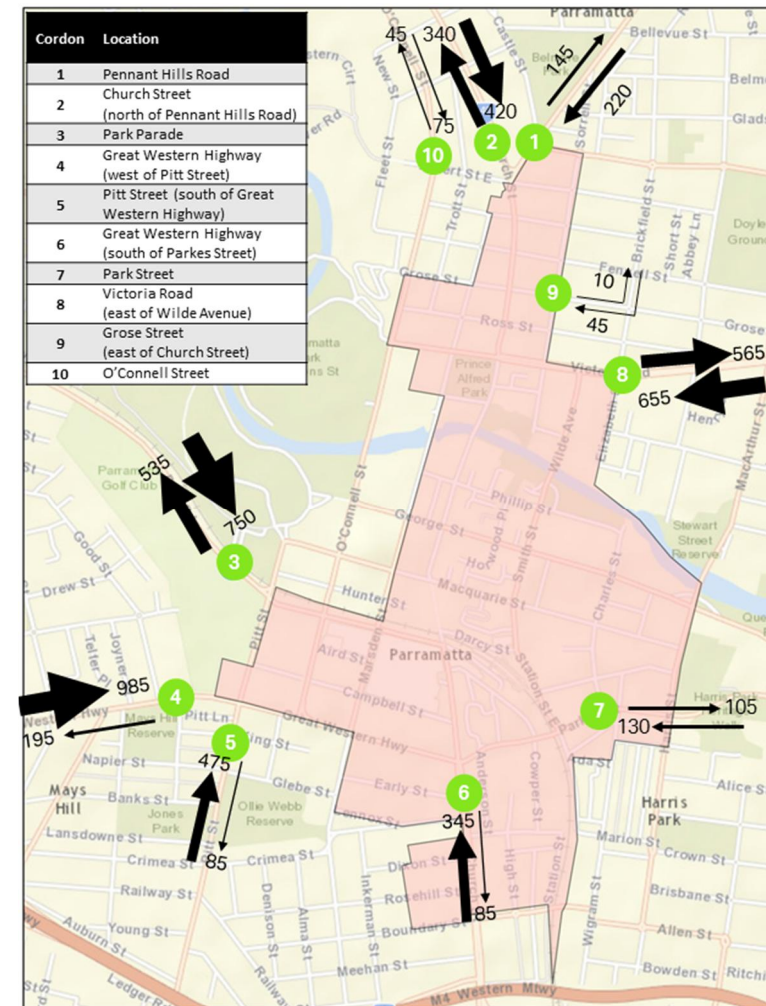
- Total bus patronage crossing the Parramatta CBD cordon is expected to increase by approximately 10,000 and 20,000 inbound passengers in the 2036 and 2056 two hour peak respectively, including demand for the equivalent of 45 and 90 additional services on each of the busiest T-way corridors.
- Required average service headways at certain corridors could be required to go as low as one minute in 2056, with six bus cordon locations exceeding the typical minimum allowed interval time.
- For desirable operation and level of service, it is recommended to target a level of vehicle occupancy of 80 per cent and minimum 3 minute service intervals: with these criteria certain corridors may warrant further investigation for escalation to higher order services including light rail.

The function of bus in accommodating Parramatta CBD's long term transport task is subject to potentially significant evolution depending on the development of higher order modes - light rail, heavy rail, and metro – in line with growth of the CBD. The bus network would need to be restructured accordingly, identifying major corridors to maintain, reinforce or develop.

Any major increase in bus patronage will require additional bus services, which will add to operational issues at bus stops, on the road network and also critically at Parramatta Interchange, including layover. Layover is an essential function to

ensure efficient and reliable bus operations and can be space consuming. In order to optimise the use of high value land, it could be considered to integrate bus layover within the basement of new CBD development: reducing visual and noise amenity impacts of bus operations and enabling alternate use of road space.

Figure 23 Existing AM peak hour bus demand at key cordon locations



Source: AECOM, adapted from Skyhigh (2014)

6.3.5 Walking and Cycling

Active transport options are attractive to commuters wishing to reduce their environmental footprint, improve their health and avoid traffic congestion. Parramatta is reasonably flat and has attractive natural features such as the Parramatta River and Parramatta Park, lending itself to active transport options. Despite this, walking and cycling mode share is low accounting for 4 per cent of JTW trips by CBD workers, and cycling accounting for less than 1 per cent. Local cycling demand has been observed to focus on the east along the Parramatta River and the west around Parramatta Park.

The Parramatta CBD is directly connected to a primary east-west cycling route via the Parramatta Valley Cycleway along the Parramatta River. Key regional cycle routes include Parramatta Valley Cycleway, M4 Motorway viaduct route, Liverpool to Parramatta Rail Trail, Liverpool to Parramatta T-way and North-West T-way. A majority of the dedicated cycle infrastructure lies to the south and serves radial desire lines centred on the CBD; however gaps are present in the network. The cycle network is particularly disconnected within and on approach to the CBD, particularly for north-south trips. The majority of cycle routes to the north are in an on-road environment with moderate to high difficulty for cyclists, with limited dedicated infrastructure.

Transport for NSW identify comfortable walking and cycling distances of two and five kilometres for major centres such as Parramatta, with investment in cycling catchments to be expanded to ten kilometres in the longer term. The Planning Proposal will increase the number of short trips (less than ten kilometres) to, from and within Parramatta CBD. Up to 71 per cent of trips to Parramatta CBD in the AM peak will be less than ten kilometres, indicating a strong potential demand for walking and cycling. A total of 7,000 to 14,000 trips are forecast to be contained within the CBD in the AM two hour peak, indicating a strong demand for trips by both walking and cycling: and strongly associated with the significant residential component of the Planning Proposal (higher in the 'high capacity' scenarios).

If the Planning Proposal is to proceed, there needs to be provisions for a connected, dedicated and direct cycle network to and through the city centre, reducing pressure on the road network by providing a safe and healthy alternative. The forecasts also underline the need for separated cycle facilities, appropriate pedestrian walkway space and permeability and priority through the city, particularly at transport hubs and other key walking and cycling generators.



6.3.6 Roads

The road network is the State Government's biggest asset, and facilitates the majority of the transport mobility task in Sydney. Congestion on the Sydney road network cost an estimated \$6.1 billion in 2015: 37 per cent of the total across all eight Australian capital cities (BITRE, 2016).

2015 AM and PM peak hour travel speeds on the road network surrounding Parramatta CBD is shown in Figure 24 and Figure 25 respectively. Peak period congestion on the key '**Inner Ring Road**' network (fringe of the CBD) is observed at select locations including the Great Western Highway, Pitt Street, Parkes Street and Macarthur Street (at its crossing of the Parramatta River – the Gasworks Bridge). Operations along key east-west and north-south inner CBD streets, are generally observed to be reasonable despite prioritisation of pedestrian movement, high bus volumes and parking manoeuvres.

In terms of key State roads that form the '**Regional Ring Road**', significant congestion is observed along the M4 Motorway and at select locations on James Ruse Drive and the A28 Cumberland Highway: particularly at intersections with Old Windsor Road and Windsor Road.

The NSW Government has committed over \$846 million to fixing pinch points across Sydney's road network including the \$246 million Pinch Point Program and the \$300 million Urban Roads Pinch Point Program: established to ease congestion on 32 of Sydney's busiest road corridors over the next 10 years. The funding will go towards reducing congestion and improving traffic flows on corridors including the relevant Cumberland Highway, Parramatta Road, Old Windsor Road and Pennant Hills Road corridors. In combination with the WestConnex project, it is anticipated that the Parramatta CBD will be more accessible by road during peak periods in the short to medium term.

Figure 24 Current AM peak hour travel speeds (Transport for NSW, 2015)

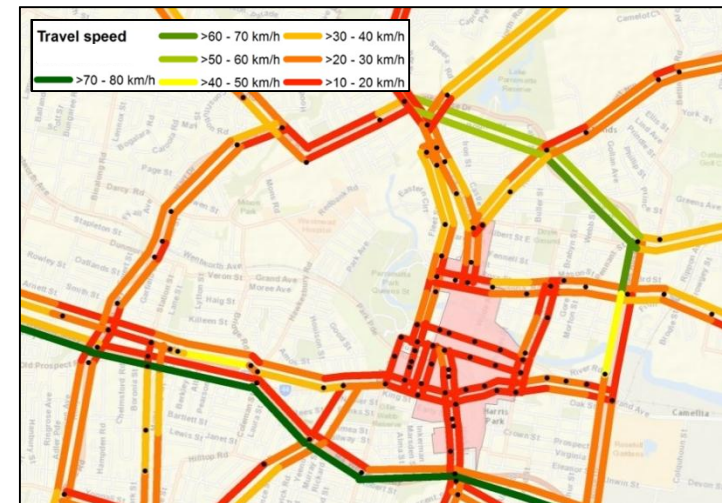
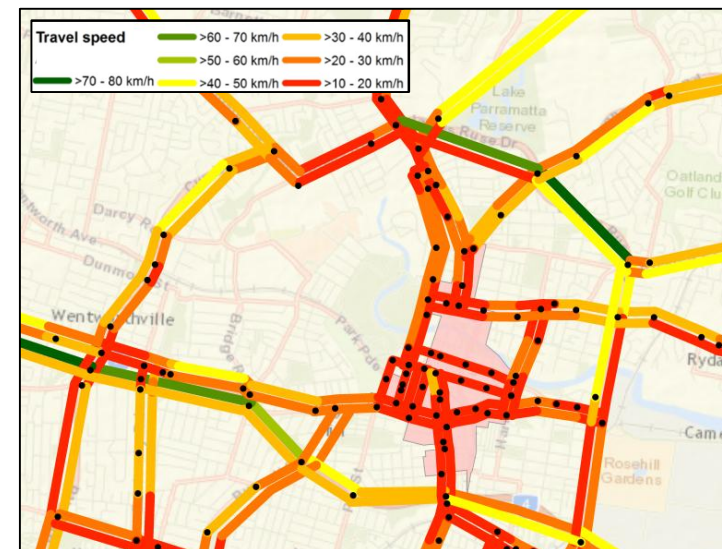


Figure 25 Current PM peak hour travel speeds (Transport for NSW, 2015)



A link based Volume to Capacity Ratio (VCR) analysis has been undertaken at 16 key locations on the State road network, with a focus on understanding at a strategic level the performance of key road links / corridors converging on the Parramatta CBD. This includes eight locations on the CBD external cordon, five river crossings and three locations on the Western Sydney Regional Ring Road

The analysis has been undertaken to make strategic level commentary on the likely performance of the road network in the future at key locations, with more detailed (AIMSUN) traffic modelling investigations currently in development, with the results for the 2036 and 2056 AM peak period illustrated in Figure 26 and Figure 27.

Key outcomes from the strategic analysis include:

- An additional 4,000 to 5,000 vehicles per hour are forecast to cross key Parramatta CBD cordons by 2036, resulting in other key links providing access to the CBD to potentially reach capacity: such as Victoria Road, Marsden Street and Wilde Avenue
- If current car-dependency trends are not significantly curbed by the long term (2056) it is expected that the majority of analysed road links, including trunk road corridors radiating from the CBD, will reach capacity resulting in significant congestion across the road network both within and in proximity to the Parramatta CBD.

Within the CBD, where the additional car trips generated by the CBD converge, it is considered that significant congestion could be expected without a balanced combination of infrastructure upgrades, traffic management works (to be confirmed by more detail traffic modelling currently in development) and interventions to reduce private vehicle use. A congested CBD would impact on the mobility of all road-based modes and users including buses, cyclists and freight.

Figure 26 Forecast 2036 AM peak road network performance (AECOM, 2016)

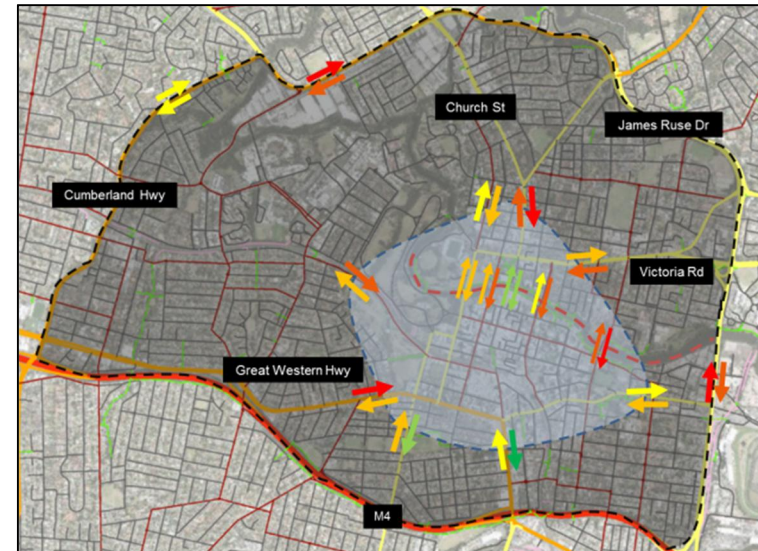
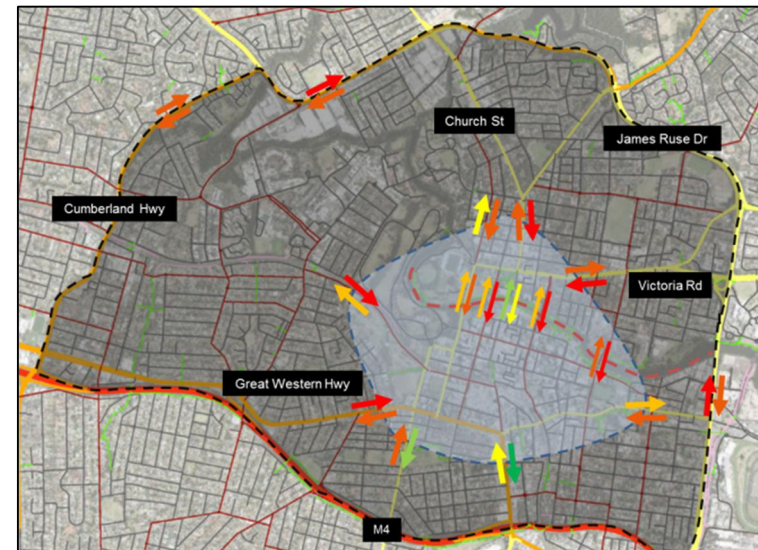


Figure 27 Forecast 2056 AM peak road network performance (AECOM, 2016)



Private vehicle use and parking

To gain a better understanding of the spatial distribution of car use, the dominant travel mode for each statistical area was estimated from STM, as shown in Figure 28. The outputs indicate public transport is currently the main transport mode for trips from areas located along the rail line, however only a low proportion of trips to Parramatta CBD originate from these areas. Private vehicle is the primary mode for areas without immediate access to rail including those within immediate vicinity of the Parramatta CBD where a majority of trips originate from. STM outputs further indicate that, based on current land use and transport planning, private vehicle will remain the main transport mode in the future even from areas immediately surrounding the Parramatta CBD including Parramatta, Auburn and Merrylands.

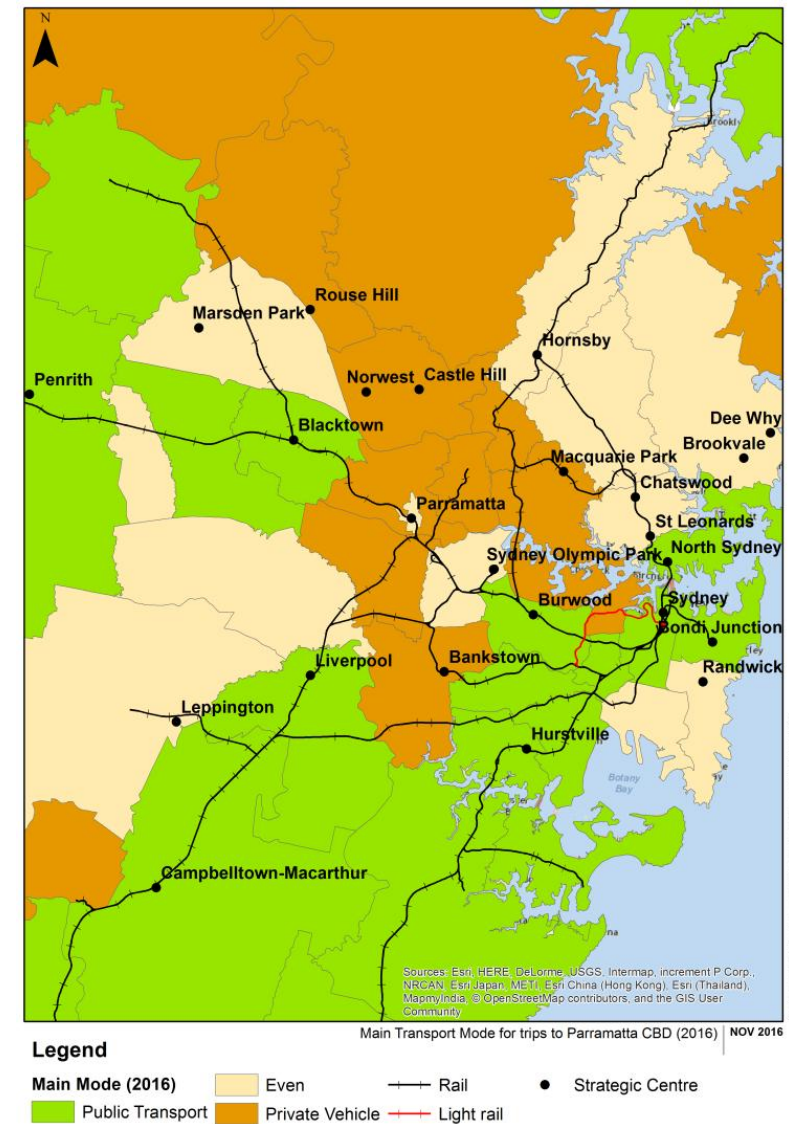
Relative attractiveness of accessing the CBD by car is considered to be strongly tied to parking supply and the cost of parking. Benchmarking parking policies and costs against North Sydney and Sydney CBDs yielded the following key messages:

- Driving to work and parking in Parramatta is relatively attractive as a JTW option, through:
 - **High supply:** Parramatta CBD has 26,800 parking spaces, equating to roughly one car space to every two workers in the CBD. The City of Sydney estimates there is just one parking space for every six workers in the Sydney CBD
 - **Low cost:** Public 'early bird' parking rates are approximately a third of those in Sydney CBD, and have lower parking levies.
- Parramatta CBD's parking provision rates are approximately four to five times higher than other benchmark CBDs in Sydney: resulting in an almost 60 per cent increase in parking supply already proposed as part of current development proposals.

Continuing to supply proportional parking provisions in the future has the potential to encourage significantly higher volumes of traffic on the road network, increase congestion impacting on all road-based travel modes, decrease urban amenity and 'place' function of Parramatta CBD (regardless of proportional investment in road infrastructure) and ultimately devalue the land that comprises Parramatta CBD and impact of the feasibility of the Planning Proposal.

The current car dependence is not sustainable; a shift towards more sustainable transport modes and traffic reduction are highly recommended and detailed in the strategies (section 7.0). A detailed review of the allocation of road space to address the needs of all road-based modes into the future will be a critical part of the Planning Proposal assessment process.

Figure 28 Primary AM peak transport mode for trips to the Parramatta CBD



Source: Transport for NSW, 2016

6.4 Key messages

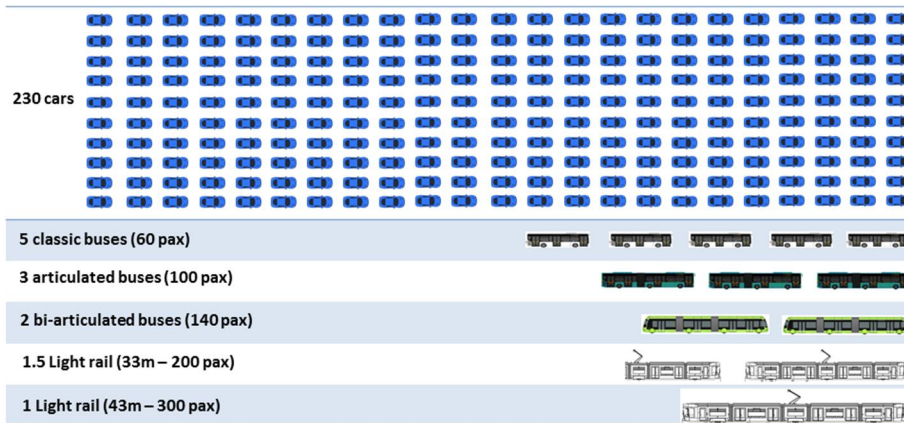
The transformation of Parramatta in consolidating its role as Sydney's dual CBD will provide new challenges in the associated transport task, driven by planned significant increases in both residential population and jobs.

The number of trips accessing the CBD is expected to increase significantly: approximately tripling or quadrupling in AM peak period demand between now and 2056. However without more significant and focussed intervention, strategic model forecasts indicate the mode split will remain relatively consistent resulting in a large increase in the effective number of cars on the city's streets, intensifying local and broader road congestion.

Strategies need to be implemented to drive a shift toward more sustainable and efficient transport modes, through a combination of improving quality and attractiveness of these modes and discouraging private vehicle utilisation: bringing mode choice trends of the Parramatta CBD in line with other CBDs in Sydney and worldwide. The spatial efficiency of public transport modes in moving people, versus the private vehicle, is illustrated in Figure 29.

Figure 29 Spatial efficiency of moving people in cars versus public transport

What if 300 persons need to travel at the same time ?



Source: AECOM, 2016

Note: assumes full public transport vehicles

Several key transport infrastructure projects are planned or being delivered that will help address the forecast increase in trips, however some critical elements of transport infrastructure planning are still in early development: such as **rail for Western Sydney (WSRNSS)**. A committed long term rail plan for Western Sydney will critically help ensure Sydney's dual CBD is connected to broader metropolitan Sydney. It will also help shape the role of other key 'intermediate' public transport modes (bus and light rail) in providing a hierarchical public transport network.

The proposed future **light rail** network will complement travel needs within Parramatta, linking the CBD to other key destinations and homes in nearby suburbs to the east. More work needs to be done in identifying and planning future stages of the network, beyond that currently committed by Government.

The function of **bus** in accommodating Parramatta CBD's long term transport task is subject to potentially significant evolution depending on the development of higher order modes and the rate of growth. Development of a more detailed strategy for bus will be required that appropriately accounts for a planned development of higher order modes, growth in and surrounding the Parramatta CBD and operational constraints and opportunities.

The forecast high proportion of peak period trips contained within approximately 10km of the Parramatta CBD increases not only feasibility of enhancing the public transport service along key links and corridors, but also the potential take up of **cycling** as a viable transport mode. Further the forecast high trip containment within the CBD, particularly in scenarios with high residential mix, increases the opportunity for **walking** trips. Providing a connected, dedicated and direct cycle network to and through the city centre, and a permeable and activated city centre will be critical to a sustainable transport outcome for the Parramatta CBD.

In combination with the promotion and support of sustainable transport, **private vehicle** use will need to be appropriately discouraged. This will need to begin with a significant reduction in current parking provision rates, to be more in line with those employed in other benchmark CBDs.

7.0 The strategy for growing Parramatta CBD

7.1 Transport strategies

The Sydney Metropolitan Area is experiencing strong, sustained population growth. Its population passed five million in 2016, and by 2056 it is forecast that the city's population will reach 8.1 million⁹.

This growth is being planned for via a combination of the increase of density in existing neighbourhoods and centres but also by expansions towards the west. Sydney is developing into a polycentric city and in this context Parramatta has grown as a major urban area in Western Sydney. Today, the Parramatta CBD is of metropolitan significance as a regional employment centre, and it will continue to increase in importance as Western Sydney's population continues to grow.

It is hence important to integrate Parramatta within the global metropolitan transport network and to provide the appropriate level of transport service for all who want to travel to, from or within Parramatta: ensuring its growth is enabled and activated by transport, rather than constrained by it.

Increasing congestion will require Government to re-think the way we utilise road space, consider travel patterns and how land use intensification affects this. The challenge of creating a sustainable road network is in managing travel demand and planning for balance between 'movement' and 'place' function: supporting the liveability of our urban areas and regional centres without compromising the effective movement of people and goods on our roads.

In considering the above, transport strategies have been developed concentrically, looking at Parramatta CBD's transport needs beginning at a metropolitan scale and working inward to what is required within the CBD:

- At the metropolitan scale, Parramatta needs to be supported and connected as the 'Central City' of the broader Sydney metropolitan area
- At the sub-regional scale, Parramatta needs to be reinforced as the economic and cultural hub of Greater Parramatta
- At the local scale, focussing on the transport task within the Parramatta CBD: where all trips converge.

⁹ Australian Bureau of Statistics (2012), 3222.0 - Population Projections ('Series B').

7.1.1 The 'Central City': a major urban hub at the centre of greater Sydney

Parramatta is located in the geographic centre of the Sydney metropolitan area and recently GSC identified Greater Parramatta as Sydney's 'Central City'. People will travel from all over Greater Sydney toward Parramatta and future transport infrastructure and services should be developed that supports the growing importance of Parramatta within metropolitan Sydney.

Future transport should aim at offering an improved level of accessibility to Parramatta from across the Sydney metropolitan area.

- è **Action 1:** Work with NSW and Federal Government to plan a rail network for the future of Western Sydney, including the 'Central City', to support a growing distribution of jobs and services and move from a radial system to a connected system
 - o Action 1.1 As a minimum, address existing and forecast capacity issues along the T1 Western Line and improve serviceability along the T5 Cumberland Line to the south
 - o Action 1.2 Investigate feasibility of maximising the potential for travel by rail to the CBD from other existing or new demand markets including:
 - § Planned growth areas to the east such as the Greater Parramatta to Olympic Peninsula and the Bays Precincts, including via the proposed Sydney Metro West
 - § Western Sydney Airport
 - § North West and South West Growth Centres
 - o Action 1.3 Improve connectivity through increasing interchange opportunities in Western Sydney's rail network (e.g. connect NWRL to Parramatta)
 - o Action 1.4 Address the east-west geographic distribution of Sydney and provide efficient links between the 'Three Cities'
 - § Consider higher speed rail corridors in the long term as highlighted in the WSRNSS

- è **Action 2:** Encourage behaviours that optimise the use of existing infrastructure
- o Action 2.1 Promote car sharing initiatives
 - § Consider High Occupancy Vehicle lanes on congested highways and key roads
 - § Continue and enhance dedicated parking facilities for car sharing
 - o Action 2.2 Promote modal shift toward public transport
 - § Investigate feasibility of additional park and ride facilities at appropriate existing and future rail stations with an attractive fare policy
 - § Improve efficiency and attractiveness of existing public transport including
 - Ensuring quality and reliability of interchange, particularly at the Parramatta Interchange
 - Ensuring adequate public transport priority (particularly bus and light rail) in order to improve the reliability of travel times
 - Ensuring adequacy of services for all trip types during various parts of the weekday and weekends
- è **Action 3:** Plan and promote coordinated transport oriented urban development and renewal

The planning and delivery of major transport infrastructure can trigger increased urban development within the corridor, and vice versa. It is important that transport planning, town planning and other fields relating to the design and operation of urban systems work together to provide the city and community with 'density done well'.

- o Action 3.1: Council and the NSW Government should investigate the potential need and opportunities to further consolidate the geographic distribution of workforce and homes, particularly around existing / potential new transport corridors (i.e. do current and proposed planning controls supply enough homes close to Parramatta CBD and the rest of Greater Parramatta – particularly in locations with good transport connections?)
 - § This could include consideration of applicability of not just high density residential, but also opportunities for the 'missing middle' medium density housing (e.g. Terraces, Townhouses) as referred to in the draft *Medium Density Design Guide* (DP&E, 2016)
- o Action 3.2: Plan and prioritise urban developments located in the direct vicinity of existing and planned transport corridors, particularly rail and light rail corridors
- o Action 3.3: Integrate, as much as possible, transport infrastructure with new development
- o Action 3.4: Include high quality active transport amenities and facilities with all future urban development

Table 4 summarises how the metropolitan level strategies and actions support the objectives set in chapter 2.0.

Table 4 Actions and objectives matching matrix – metropolitan level

	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
	Reinforce Parramatta as an economic and social hub at the geographic centre of the Sydney Metropolitan area	Expand and optimize the transport network in order to integrate the growing importance of Parramatta CBD	Enable Parramatta to grow as a Smart City, fostering innovative transport solutions that serve a diversity of purposes	Develop an integrated, legible transport network that provides accessibility, connectivity and mobility choice for all	Ensure transport infrastructure developments support urban development and enhance land value and place-making outcomes.	Enable Parramatta to grow in a sustainable manner re-moding travel from private vehicle to sustainable transport modes.
Action 1						
Action 2						
Action 3						

7.1.2 Greater Parramatta: a future major urban area

With the Parramatta CBD at the core, Greater Parramatta is being built as a comprehensive city offering housing, commercial, retail, health and education facilities as well as recreational and cultural activities. Greater Parramatta is becoming a place where one can find everything. The number of trips contained within Parramatta and adjacent Government areas will increase with greater land use mixes. However according to post-analysis of model forecasts, the number of cars will inflate and is likely to lead to saturation of the road network, driving a need for intervention. The strategy, stated in actions, is developed to ensure the sustainable development of Parramatta CBD.

Provide Parramatta with adapted infrastructure and services in order to address increasing number of trips and the development of the urban area.

è **Action 4:** Develop a dense and hierarchical public transport network adapted to future needs

- o Action 4.1: Once a heavy rail / metro strategy for Western Sydney is defined, Council and the NSW government should collaborate in order to select the best rail corridor(s) and station locations for Parramatta and its surroundings
- o Action 4.2: Consider means to catalyse Ferry as an attractive travel mode through measures such as addressing current reliability (tidal impact) issues, increasing the number of services to Parramatta Wharf and improving integration with other modes
- o Action 4.3: Determine the desire lines for transportation for different time frames according to demand forecasts
- o Action 4.4: Make sure that future development is integrated with transport planning and delivery

è **Action 5:** Promote the use of public transport, through focus on customer experience

- o Action 5.1: Provide efficient and frequent public transport services to establish travel behaviour using public transport for all purposes; commuting but also educational, shopping and recreational trips

- o Action 5.2: Implement incentives to use public transport, such as distributing Opal cards with credit pre-loaded
- o Action 5.3: Design good quality new public transport stops, and upgrade existing stops that will no longer be fit-for-purpose
- o Action 5.4: Provide passenger information with clear mapping and walking catchments at public transport stops
- o Action 5.5: Provide real-time information at public transport stops and on board

è **Action 6:** Promote active transport for trips within a 10 km radius from Parramatta CBD

- o Action 6.1: Develop the principal and supporting cycling network in order to fill the existing gaps, focusing on dedicated and separated infrastructure to and through the CBD
- o Action 6.2: Widen pedestrian and cycle facilities to accommodate forecast increases in demand
- o Action 6.3: Undertake a behaviour change program to encourage transport users to walk and ride a bike for short trips
- o Action 6.4: Work with schools and universities to develop travel plans to encourage students to walk and cycle
- o Action 6.5: Integrate safe walking and cycling network and facilities into the planning and delivery of all precincts
- o Action 6.6: Update and expand the Walk Parramatta wayfinding strategy in line with international best practice
- o Action 6.7: Develop a public bicycle share scheme for residents, employees and visitors to travel within the area, with stations at every key location: transport interchange, shopping centre, commercial buildings, etc.
- o Action 6.8: Support bicycle initiatives e.g. NSW Bicycle Week, Ride to Work Day, free bike check-up events, 'Cycle Update' newsletter, etc.
- o Action 6.9: Consistently engage with Bicycle User / Consultation Groups

- è **Action 7:** Implement measures to reduce the number of cars travelling through Parramatta and the surrounding districts
- o Action 7.1: Implement restrictive parking policies that limit the number of parking spaces provided in future surrounding precinct developments
- è **Action 8:** Encourage innovation in the design of the city, utilise technology to maximise transport outcomes and prepare for change
- o Action 8.1: Provide widespread wireless internet on public transport and at stations
 - o Action 8.2: Benefit from the intensive use of mobile phone in customers' everyday life and utilise the wide range of applications to enhance the transport experience
 - § Identify potential new transport services (e.g. point to point)
 - § Public transport mobile ticket apps
 - § Enhance car sharing
 - o Action 8.3: Reduce the need to travel
 - § Use of the internet and technology to facilitate remote working via smart work hubs with high quality facilities or working from home
 - § Engage with employers to promote and encourage flexible working hours and arrangements
 - o Action 8.4: Investigate how technology, particularly in vehicles and mobility as a service, could be used to improve "first mile / last mile" connections to trunk public transport services

Table 5 summarises how the strategy and actions support the objectives set in chapter 2.0 at the Greater Parramatta scale.

Table 5 Actions and objectives matching matrix – greater Parramatta level

	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
	Reinforce Parramatta as an economic and social hub at the geographic centre of the Sydney Metropolitan area	Expand and optimize the transport network in order to integrate the growing importance of Parramatta CBD	Enable Parramatta to grow as a Smart City, fostering innovative transport solutions that serve a diversity of purposes	Develop an integrated, legible transport network that provides accessibility, connectivity and mobility choice for all	Ensure transport infrastructure developments support urban development and enhance land value and place-making outcomes.	Enable Parramatta to grow in a sustainable manner re-moding travel from private vehicle to sustainable transport modes.
Action 4						
Action 5						
Action 6						
Action 7						
Action 8						

7.1.3 Parramatta CBD: Sydney's next Smart City

Parramatta CBD faces a high growth in terms of population and job provision. As a compact area, it is necessary that public authorities intend to optimise infrastructure and the use of land with such high value. The transport offer, mobility and the efficiency in the use of space are key to an attractive, productive, sustainable and optimised city.

In order to lead Parramatta CBD to its best potential, the transport strategy should:

Respond to all mobility needs with public and active transportation and decrease car dependency.

- è **Action 9:** Set journey to work mode share targets for accessing the CBD, consistent with future urban and transport developments.

Mode share targets help align Government and key stakeholders towards achieving a common aspiration. Strategic-level analysis has highlighted the need to re-mode travel to create a sustainable city in the long term. The growing significance and Government support of Greater Parramatta as the heart of Sydney's 'Central City' allows setting a more ambitious aspiration and mode share targets for the future CBD.

A set of mode share targets have been developed, that transition along with the planned intensification of the Parramatta CBD and transport response and interventions. Figure 30 summarises the elements that would encourage a behaviour shift from private vehicle to public transport and active transport by 2036 and 2056, noting that significant planning work is yet to be done in the long term planning space. Figure 31 shows the resultant mode share targets for 2036 and 2056. These are predicated on a minimal increase in total private vehicle trips as the city grows: setting the requirement for take-up by sustainable modes. These should be refined as more detailed investigations are undertaken as part of the development of the Integrated Transport Plan for the CBD.

Progress of mode share changes should be tracked and measured with census data and other available data as appropriate (e.g. Opal data, count data, travel surveys etc.). Depending on the progress, transport plans, policies and interventions can be reviewed for effectiveness and appropriate responses developed accordingly.

Figure 30 Progression of transport planning /interventions and CBD development

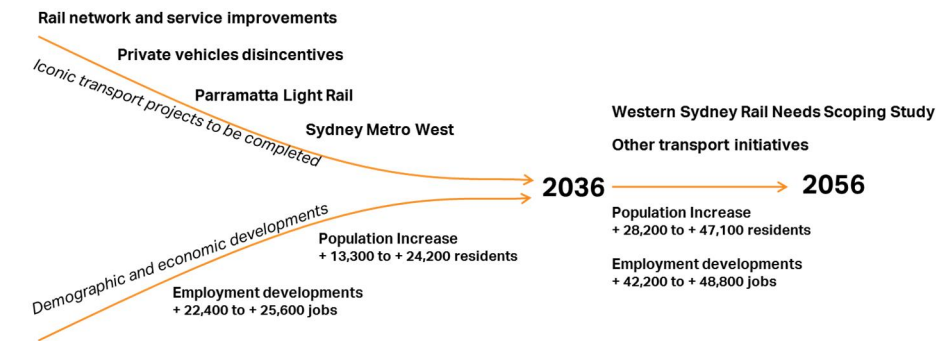
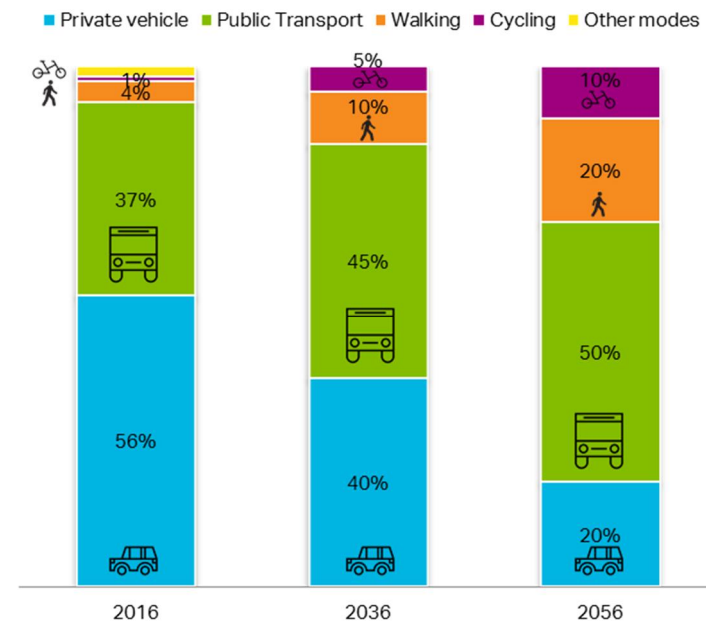


Figure 31 Journey to work mode share targets for Parramatta CBD



è **Action 10:** Create a dense, frequent public transport network accessible to the entire CBD

- o Action 10.1: Working with the NSW Government to develop a CBD Access Strategy (see right) that sets out a plan for how trains, light rail, buses, ferries, as well as cars, taxis, commercial vehicles, pedestrians and cyclists will interact and share space in the heart of CBD
- o Action 10.2: Consider the need for, and plan for a second railway station in the CBD in order to offer additional travel options from broader areas to the CBD and address future level of demand. Current forecasts indicate similar station demand to Wynyard by 2036; there is a need to decentralise demand and de-congest the Parramatta Transport Interchange
- o Action 10.3: Analyse future travel demand in order to design the best light rail alignment(s) within the CBD and connect it to the most important locations of Greater Parramatta and other key centres and nodes
- o Action 10.4: Develop a bus strategy in response to increased development and the planned delivery of higher order modes: ensuring the public transport network connects and serves all key attraction points and nodes
- o Action 10.5: Optimise transport interchange to improve intermodal connections



Source: Sydney City Centre Access Strategy, 2013

è **Action 11:** Integrate urban, building and transport functions when designing future development

- o Action 11.1: Work with developers to integrate community loading docks within new building basements, providing public loading spaces off-street and allocating on-street kerb space with a prioritisation similar to Sydney CBD
- o Action 11.2: Ensure appropriate space and infrastructure for pedestrian movement and permeability

è **Action 12:** Implement innovative solutions to develop Parramatta as a Smart City, working with Government to embrace technologies including:

- o Automated people movers
- o Electric cars
- o Driverless vehicles

è **Action 13:** Promote cycling as a means of accessing the CBD

- o Action 13.1: Provide dedicated cycling infrastructure within the Parramatta CBD that connects to the Principal Bicycle Network
- o Action 13.2: Design high quality and accessible end-of-trip facilities
 - § Centralised cycle hubs
 - § On-street secure bicycle storage
 - § Lockers and showers
- o Action 13.3: Implement free or bicycle share schemes for residents, employees and visitors to travel within the CBD, to and from other destinations in the CBD and nearby transport interchanges

è **Action 14:** Improve the walking experience in order to help achieve a mindset shift toward walking in the city, including working with developers and planners to:

- o Action 14.1: Provide sufficient footpath width to accommodate forecast increased pedestrian movement

- o Action 14.2: Investigate permeability of the CBD and utilise new development as a means to improve it with new through-links
- o Action 14.3: Consider the need for and feasibility of grade-separated pedestrian links at locations where demand is high and at-grade space is limited
- o Action 14.4: Investigate pedestrian prioritisation measures (e.g. traffic signal operations)
- o Action 14.5: Invest in embellishment works that will improve amenity
- o Action 14.6: Prepare behaviour change programs regarding the benefits of cycling and walking
- o Action 14.7: Implement infrastructure that supports, and investigate means to further improve, the 40km/h Pedestrian and Cycling Amenity Zone within the Inner Ring Road
- è **Action 15:** Implement restrictive parking policies
 - o Action 15.1: Reduce overall parking supply, particularly for commute trips, based on further analysis to be undertaken as a part of the Integrated Transport Plan
 - o Action 15.2: Continue to increase parking space provisions dedicated to electric vehicles and car share schemes
- è **Action 16:** Implement localised travel demand management strategies including travel plans, travel training and out of peak travel incentives
- è **Action 17:** Implement best-practice traffic and road use management
 - o Action 17.1: Adopt a 'movement' and 'place' typology to understanding the needs of the road links that comprise the CBD
 - o Action 17.2: Focus on reallocation of existing road space to cater for the CBD's competing transport mobility needs
 - o Action 17.3: For 'movement' links, target investment in traffic management to improve efficiency of road space, with road space expansion (upgrades) at key locations only

- o Action 17.4: Consider road user charging to dissuade drivers from entering the CBD, particularly during peak periods

Table 6 summarises how the strategy and actions support the objectives set in chapter 2.0 at the local scale.

Table 6 Actions and objectives matching matrix –Parramatta CBD level

	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
	Reinforce Parramatta as an economic and social hub at the geographic centre of the Sydney Metropolitan area	Expand and optimize the transport network in order to integrate the growing importance of Parramatta CBD	Enable Parramatta to grow as a Smart City, fostering innovative transport solutions that serve a diversity of purposes	Develop an integrated, legible transport network that provides accessibility, connectivity and mobility choice for all	Ensure transport infrastructure developments support urban development and enhance land value and place-making outcomes.	Enable Parramatta to grow in a sustainable manner re-moding travel from private vehicle to sustainable transport modes.
Action 9						
Action 10						
Action 11						
Action 12						
Action 13						
Action 14						
Action 15						
Action 16						
Action 17						