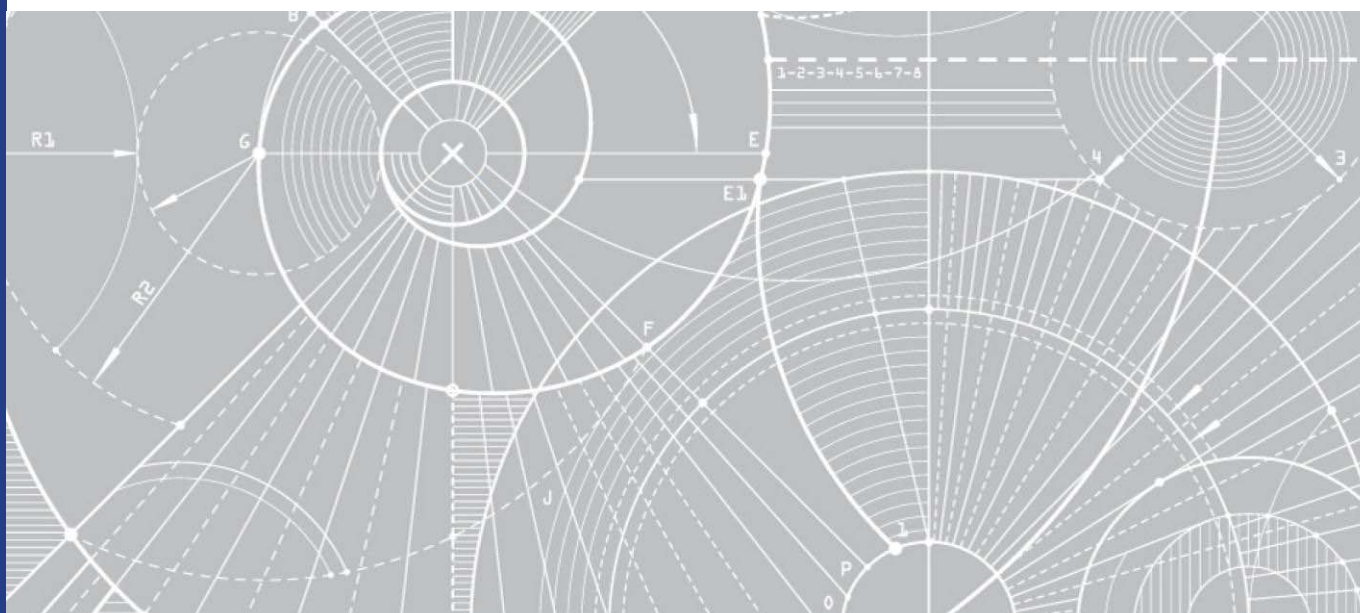


Employment Lands Transport and Access Report

CITY OF SYDNEY

Employment Lands Transport and Access Report

NB00018 | 16 April 2014



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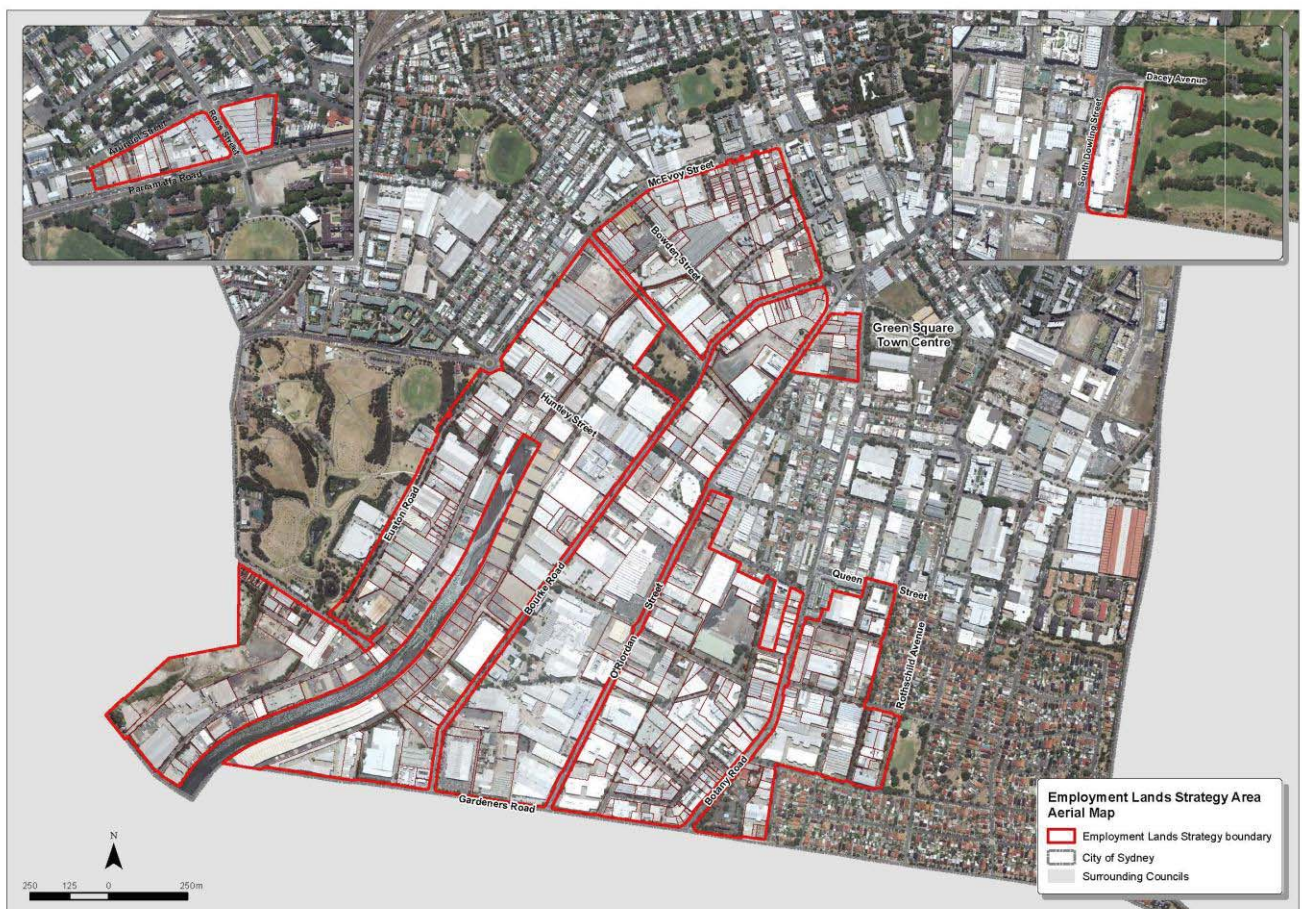
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Executive summary

In 2013, the City of Sydney Council publicly exhibited the City of Sydney Draft Employment Lands Strategy (the draft Strategy) which proposes amendments to the current land use zoning and planning controls for employment lands within the local government area.

The study area (shown below) is located in the “Global Economic Corridor” as defined by the Draft Metropolitan Strategy for Sydney to 2031. It is located 4 km south of the Sydney CBD area and 2 km north of the Sydney airport and Port Botany.



The study area is a strategically important location in Sydney. It is well connected to the Sydney CBD via Botany Road, the airport via O’Riordan Street and Bourke Road and Port Botany via Botany Road. The new town centre development at Green Square, the urban renewal area at Mascot and the Rosebery precinct provide residential surroundings that could provide employees and customers for the employment lands.

However, the study area is not only a trip generator from its own employment and residential profile. It also acts as a major corridor between significant trip generators, and is used by thousands of people passing through each day.

Its current land use zones include a mix of industrial, business and residential use. The draft Strategy proposes a change to the land use zones that currently apply in the study area. The proposed zones will facilitate a wider range of employment generating uses as well as potentially some growth in dwelling numbers.

The aim of this Study is to establish transport principles and strategies to guide the development of planning controls for the study area. Guided by the zoning proposed by the draft Strategy, it estimates trip generation for

three growth scenarios (low, medium, high) and provides a high-level assessment of their impact in 2021 and 2030. Based on existing mode share and indicative capacity constraints, management strategies and mitigation measures are proposed, including indicative mode share targets.

The existing mode share for the study area is dominated by car travel (driver and passenger) which makes up for 75% of all trips. Strategic demand forecasting indicates that under all growth scenarios the study area will see a significant increase in transport demand following the development of the area by 2030.

Forecast results for car trips were achieved using a “Business as Usual” approach, based on existing mode shares.

	Low growth			Medium growth		High growth	
	Existing	2021	2030	2021	2030	2021	2030
Total trips	18,129	23,774	32,919	26,407	39,716	29,586	48,627
Car trips	13,629	17,826	24,650	19,807	29,797	22,212	36,571

The indicative capacity calculations based on the degree of saturation show that capacity issues can be expected at the intersections of Gardeners Road/ Botany Road and Euston Road/ Sydney Park Road for the medium and high growth scenarios. In order to maintain an acceptable degree of saturation of 90% at these intersections, a significant mode shift would be required.

Two transport visions are discussed (“no car growth” similar to the Green Square Transport Management Accessibility Plan 2008, and “no road growth”), and the associated mode share targets calculated. The need for a mode shift from private car trips to public and active transport will be necessary for long-term development.

Indicative new bus routes would improve the quality of public transport services in the study area and would help to encourage a mode shift from car. However, these bus services would have limited capacity to service the mode shift required to achieve a necessary mode share target.

There is potential to increase the mode share of walking and cycling. Conditions could be greatly improved with the provision of better access routes to and within the study area as well as to public transport interchanges.

Consistent with the City’s approach to parking in its current planning controls, parking should continue to be expressed as maximums for all developments. Time limited on-street parking would also encourage a shift to the enhanced public transport services, but policy decisions need to be made with respect to resident parking reflecting the nature of the study area or the “no permit” precedent established for Green Square. These parking management initiatives should be established at the outset, recognising that it is more effective to encourage new employees and residents to adopt a sustainable transport alternative at the outset, rather than allow private car use to dominate and then need to invest in mode shift initiatives to change behaviour.

The Study identifies a number of opportunities and issues to be addressed, as well as next steps including:

- Identification of long term mode share targets.
- Determining appropriate development controls and strategies to encourage modal shift.
- Provision of additional public transport.
- Encouraging walking and cycling.
- Consideration of parking rates and (on-street) parking restrictions linked with changing accessibility of the area over time.
- Investigation of opportunities for encouraging mode shift.
- Development of a local area traffic management plan.

The study recognises the study area is in a strategic location that is impacted by major trip generators. There remains varying levels of uncertainty about how these substantial traffic and transport drivers might affect the area in the future, for example:

- WestConnex, and the location of its entry and exit portals, will likely have a profound impact on the study area. While it is understood RMS are modelling the likely outcomes of various scenarios, no information is available to the City at this time.
- The Mascot Town Centre, which is currently on hold until the WestConnex has been resolved.
- A second airport in the Sydney basin, which will likely impact on the function and transport demands on Sydney Airport and by extension the study area.
- Growth at Sydney Airport.
- A second rail crossing being provided on the Sydney Harbour Bridge, which is required to alleviate capacity pressures at Green Square and Mascot train stations.
- Take up of development opportunities in the study area as rezoning is introduced.
- Potential introduction of a one-way pairing on Bourke Road and O'Riordan Street, as identified in the NSW Government's Long Term Transport Master Plan.

It is premature to undertake detailed modelling and assessment of cumulative transport impacts associated with subregional growth until at least most of these factors have been resolved.

It is recommended that as more information becomes available, more nuanced modelling should be undertaken to establish long-term mode share targets and strategies to achieve these. Any future model should provide a sound basis for the City to make independent planning decisions. It is noted that much of this modelling is currently underway by RMS and will closely inform future modelling for the area.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs SKM is to identify, review and assess traffic and transport aspects of the City's rezoning planning as a desktop study in accordance with the scope of services set out in the contract between Jacobs SKM and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs SKM has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs SKM has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs SKM derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs SKM has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs SKM for use of any part of this report in any other context.

As a desktop study, without access to current traffic counts, the study is limited in the depth of the analyses. Further study is warranted and recommended.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs SKM's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs SKM and the Client. Jacobs SKM accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party

1. Introduction

1.1 The study

In 2013, the City of Sydney Council (City) publicly exhibited the City of Sydney Draft Employment Lands Strategy (the draft Strategy) which proposes amendments to the current land use zoning and planning controls for employment lands within the local government area (LGA). The relevant employment lands, with proposed zoning, are identified in Figure 1.

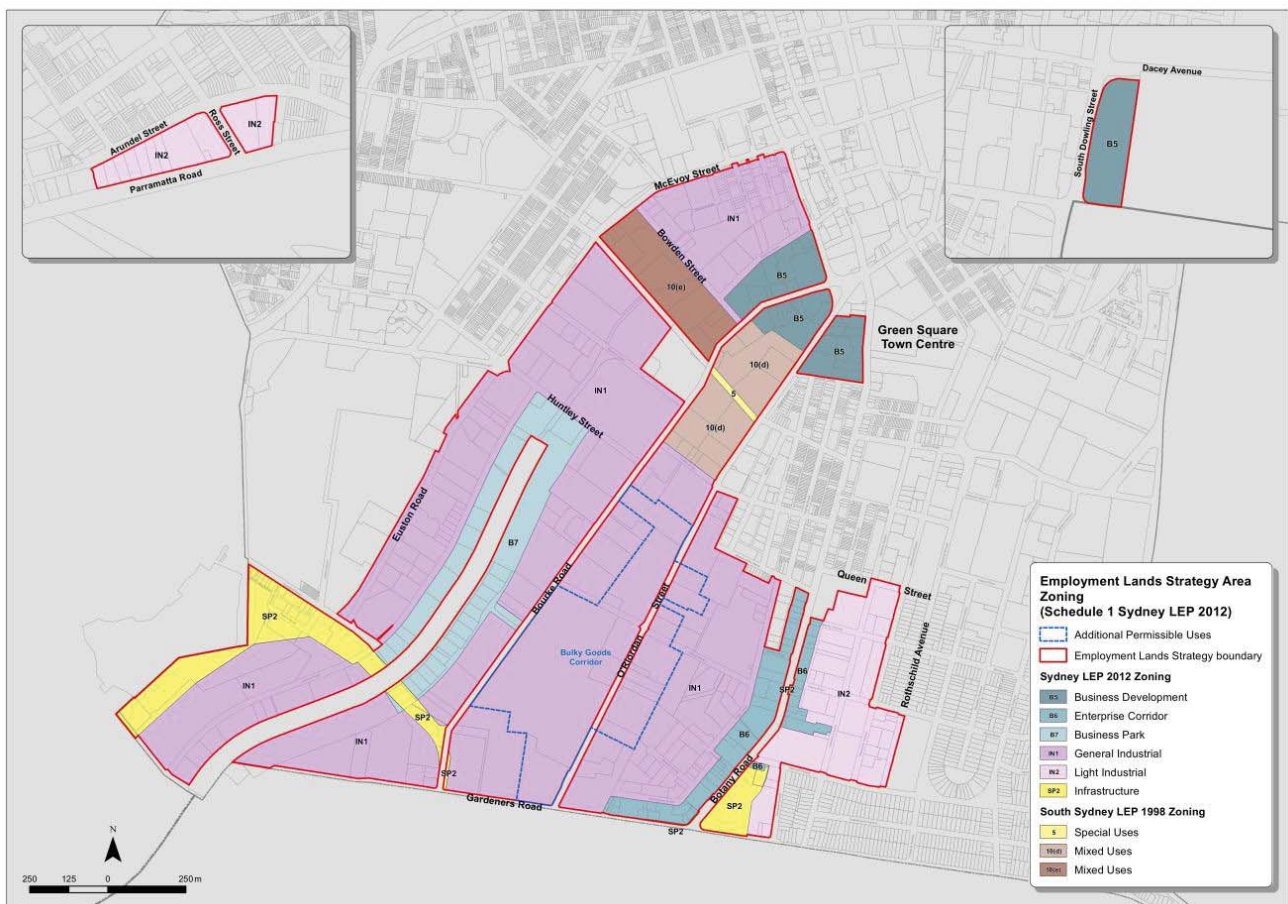


Figure 1: Study area with proposed land use zones

The draft Strategy proposes a series of land use and planning recommendations for three employment precincts in the LGA. Jacobs SKM has been appointed by the City to undertake a Transport and Access Study (the Study) for the employment lands in the Alexandria area (study area). The intention of the Study is to assist the City in identifying and understanding the impacts and implications of the land use and planning recommendations proposed by the draft Strategy.

The study area is located 4 km south of the Sydney CBD area and 2 km north of the Sydney airport precinct and Port Botany. Its current land use zones include a mix of industrial, business and residential use. The draft Strategy proposes a change to the land use zones that currently apply in the study area. The proposed zones will facilitate a wider range of employment generating uses as well as some growth in dwelling numbers. This growth will have an impact on transport and access, including traffic volumes and flows, public transport demand and demands for pedestrian and cyclist infrastructure in and around the study area.

The aim of the Study is to establish transport principles and strategies to guide the development of planning controls for the study area. It estimates trip generation for three growth scenarios (low, medium, high) and provides a high-level assessment of their impact in 2021 and 2030. Based on existing mode share and indicative capacity constraints, management strategies and mitigation measures are proposed, including indicative mode share targets.

The Study has been undertaken as a desktop study based on available information. No additional traffic count data was collected and no network or intersection modelling undertaken. General assumptions were made about background growth based on professional practice and local knowledge. Recommendations have been made for a Stage 2 study to address outstanding issues.

1.2 Strategic context

The study area is located within and surrounded by a number of major transport and urban development projects including:

- The Green Square Town Centre development (northeast of the study area).
- The Mascot Station Precinct Urban Activation (south of the study area).
- WestConnex Motorway (M5 East and M4 South) (west of the study area).

These projects have indicative timeframes that coincide with the timeframe for the draft Strategy (completion by 2030), seeing proposed completion dates between 2023 (WestConnex), 2031 (Green Square Town Centre) and 2036 (Mascot Station Precinct Urban Activation). Those projects will affect travel patterns through and with the study area and might create network capacity issues by 2031. This has been acknowledged and addressed in a number of planning documents including:

- Draft Metropolitan Strategy for Sydney to 2031.
- Transport for NSW's (TfNSW) Long Term Transport Master Plan (LTTMP).
- Green Square Urban Renewal Area Transport Management and Accessibility Plan (Green Square TMAP).
- Mascot Town Centre Precinct Transport Management and Accessibility Plan (Mascot TMAP).
- City of Sydney "Connecting our City" Transport Strategy and Action Plan.

1.2.1 Metropolitan planning

The NSW Government's Sydney Metropolitan Strategy: City of Cities (2005), Draft Sydney City Subregional Strategy (2008) (the draft Subregional Strategy), Metropolitan Plan for Sydney 2036 (2010) and Draft Metropolitan Strategy for Sydney 2031 (2013) all locate the study area within the "Global Economic Corridor". The draft Subregional Strategy specifically identifies the importance of the study area, noting its role in supporting the economy and servicing the City by facilitating light industries, heavy industry manufacturing, urban services, warehousing and logistics and high-tech based activities.

For the purpose of the Study, the most important objective is 13:

Provide a well-located supply of industrial lands — this objective recognises the need to ensure a supply of well-located industrial land with good accessibility to supply local and/or subregional demands. It also provides a framework to assess proposals to rezone industrial land, the "Industrial Lands Strategic Assessment Checklist" for rezoning of existing industrial land to other uses.

In addition, Objective 10, 11 and 18 all identify the requirement to provide and develop areas of high growth for industrial, business and retail purposes.

1.2.2 Long term transport master plan

The long term transport master plan (LTTMP) was released by TfNSW in December 2012 and provides direction for the future of the NSW transport system, including improvements that will affect the study area. The Master Plan identifies the challenges that the transport system in NSW will need to address, and actions to do so over the next 20 years.

The LTTMP sets out strategic targets and principles for NSW with a focus on future transport requirements. Whilst those targets are general and strategic, the LTTMP identifies Green Square Town Centre as a key growth area and makes recommendations that will affect the study area (see Section 1.2.6).

1.2.3 Green Square

Due to its proximity to the study area and its size, the Green Square Urban Renewal Area (GSURA) and Town Centre development is expected to have the biggest impact on the study area. Green Square is Australia's largest urban renewal site and by 2030, the expectation is to accommodate about 40,000 residents and 22,000 workers. The LTTMP from 2013 recognizes that "...the growth of Green Square does present transport challenges. While Green Square Station is on the Airport Rail Line and only a few minutes to the CBD, much of the forecast growth in the area will be beyond walking distance of the station. Other mass transit solutions may be needed to meet future travel demand and to secure direct connections with the CBD and other activity nodes such as the University of NSW".

As a consequence of this and in line with corridor improvements for the Sydney Airport to CBD corridor, TfNSW have identified key actions including additional train capacity and improvements to Botany Road.

The 2008 Green Square TMAP established that "...capacity in the regional road network to accommodate increased traffic from the Green Square Urban Renewal Area is limited, and there are strong public benefits for adopting mode share targets that should deliver no net increase in private vehicle traffic." The TMAP identified the need for an overall non-car mode share of 49% by 2031 to achieve a no car-growth scenario and made recommendations for significant upgrades of public transport services and pedestrian and cycling infrastructure upgrades.

Subsequent considerations have suggested mode share targets based on a "comparable area" scenario rather than the "no capacity increase" approach of the original TMAP, resulting in non-car mode share targets of 61% and 42% over the GSURA for residents and workers, respectively. In this study, Jacobs SKM has not been able to validate this approach.

1.2.4 Mascot Station precinct

The Mascot Station Precinct Urban Activation project proposes a mix of new residential developments and higher density housing and employment. The increase in population is expected to have an impact on rail capacity at Mascot Station as well as traffic volumes on Gardeners Road and Botany Road. The Mascot TMAP also identifies additional trips into the area due to new employment opportunities. Therefore, a significant mode shift away from car trips was postulated as being necessary to accommodate cumulative future traffic volumes. The TMAP identified non-car mode share target of 35% by 2021 and 43% by 2031, from a base of 20% in 2011.

At the time of preparing this report, the Mascot Station Precinct Urban Activation project is on hold "...pending additional information on some of the details relating to the WestConnex project, which will impact on planning for the area".

1.2.5 WestConnex

The proposed WestConnex motorway is a 33 km motorway connection between the existing M4 Motorway and M5 Motorway corridors. The planned location of WestConnex Stage 2 connections at Canal Road is in close proximity to the study area, with potential traffic implications onto Gardeners Road at the south of the study area. This will improve access to the study area for traffic approaching from Sydney's southwest, potentially

changing from Botany Road and Sydney Park Road to more dominant access direct from Gardeners Road. Trips from Sydney's west and northwest are likely to be affected in the longer term when WestConnex Stage 3 comes online. Transport modelling is still being refined by the WestConnex Delivery Authority, and needs to be monitored to confirm implications for the study area.

1.2.6 Western Sydney Airport

Recent announcements by the federal and state governments confirm that a second airport will be required in the Sydney basin to accommodate Sydney's growing population at Badgerys Creek. While it is noted that Sydney Airport is likely to remain the primary gateway to Australia, a second airport will have a significant impact on the study area, particularly with regard to quantum of "through" traffic. Given the lack of any detailed understanding about the future role of the second airport and its timing, it is impossible to project impacts at this time, although as more information becomes available it will be essential to factor in the implications on the study area.

1.2.7 Impacts on study area

Whilst the WestConnex M4 South is a step away from detailed planning and no actions affecting the study area have been identified as yet, the Green Square Town Centre and the Mascot Station Precinct planning papers recommend actions with direct effect on the study area.

The LTTMP proposes a one-way pair operation on Bourke Road and O'Riordan Street (or O'Riordan Street and Botany Road) as a key action. As part of this action, the removal of parking, bus priority on O'Riordan Street, upgraded pedestrian facilities and examination of an alternative cycleway are proposed. The LTTMP cites better management of increased traffic volumes as the purpose of the action, in particular stating the following advantages:

"This action:

- Provides greater through capacity for Bourke Road and O'Riordan Street.
- Removes contra-flow turning conflicts on the existing arterial roads, improving route safety.
- Enhances the through capacity for freight movement along the two road corridors.
- Provides for a dedicated bus-lane on each road to link Green Square and the Mascot precinct supporting a future possible project to provide bus priority along the O'Riordan Street corridor."

However, no timeframe for the implementation of this action has been identified.

The Mascot TMAP identifies a number of intersection upgrades including:

- Gardeners Road/ Botany Road.
- Gardeners Road/ O'Riordan Street.
- Gardeners Road/ Bourke Street/ Bourke Road.

The TMAP also recommends a re-alignment of Bourke Street outside Mascot Station, the introduction of dedicated busway facilities along Bourke Street and upgraded pedestrian facilities at key intersections to improve access to Mascot Station.

2. Existing conditions

2.1 Strategic location

The study area is located in the “Global Economic Corridor” as defined by the Draft Metropolitan Strategy. It is located approximately 4 km south of the Sydney CBD area and 2 km north of the Sydney airport and Port Botany.

The study area is a strategically important location in Sydney. It is well connected to the Sydney CBD via Botany Road, the airport via O’Riordan Street and Bourke Road and Port Botany via Botany Road. The new town centre development at Green Square, the urban renewal area at Mascot and the Rosebery precinct provide residential surroundings that could attract employees and customers for the study area. Due to its location between major trip generators, the study area is not only a trip generator itself, it also is used by thousands of people daily passing through.

It is served by Green Square and Mascot railway stations. Botany Road is both a major bus corridor and a major freight corridor. A major cycle link stretches along Bourke Road, connecting the study area to the CBD.

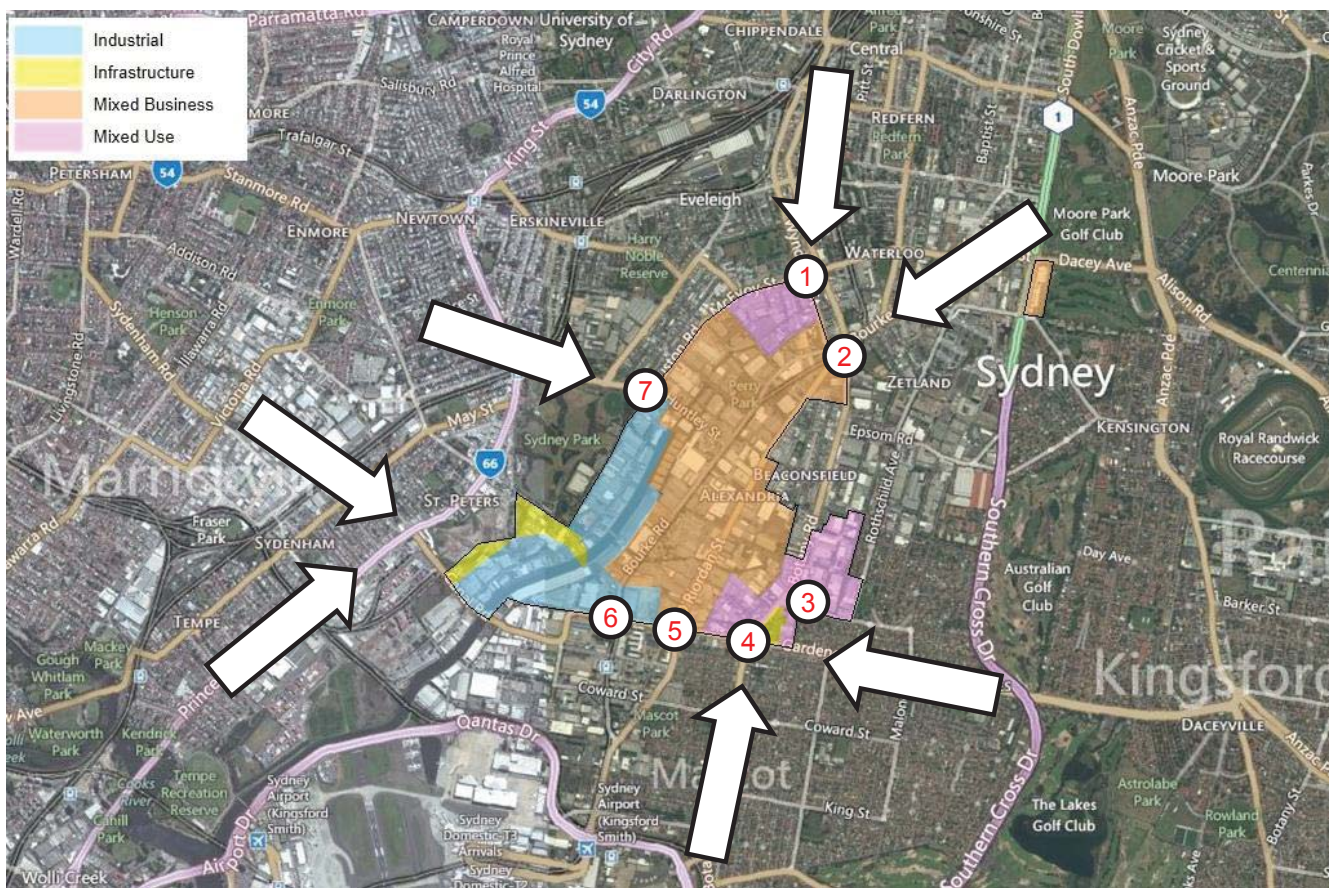


Figure 2: Strategic location of study area (proposed land use zones and key vehicular access points)

2.2 Current mode split

The existing mode share for the study area has been identified from Bureau of Transport Statistics (BTS) Journey-to-Work data and the household travel survey (2011). The data shows how people working in the study area travel to and from work. BTS Travel Zones were overlaid onto the study area to confirm consistency in boundaries (see Figure 17).

In 2011, the study area was dominated by car travel (driver and passenger) which makes up for 75% of all trips. Public transport currently has a mode share of 20%, and active transport (walking and cycling) has a mode share of 5%. An overview of mode shares in the study area can be found in Figure 3.

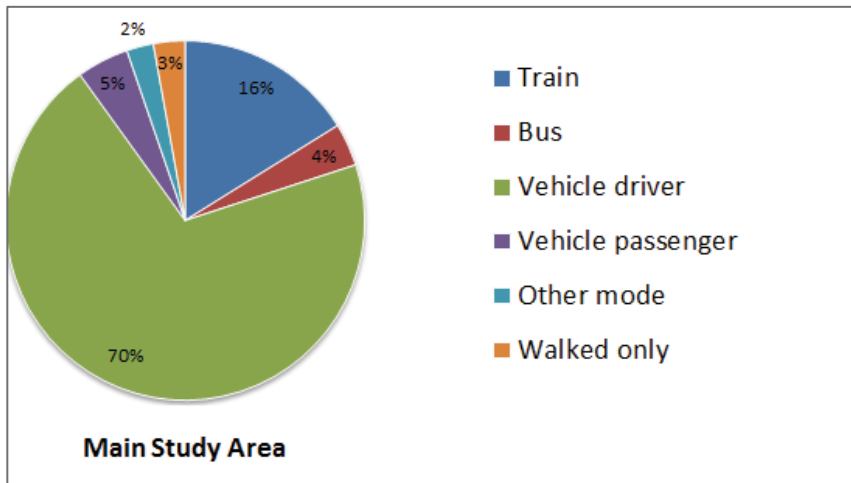


Figure 3: Journey to work mode share (Source: BTS Journey to Work 2011)

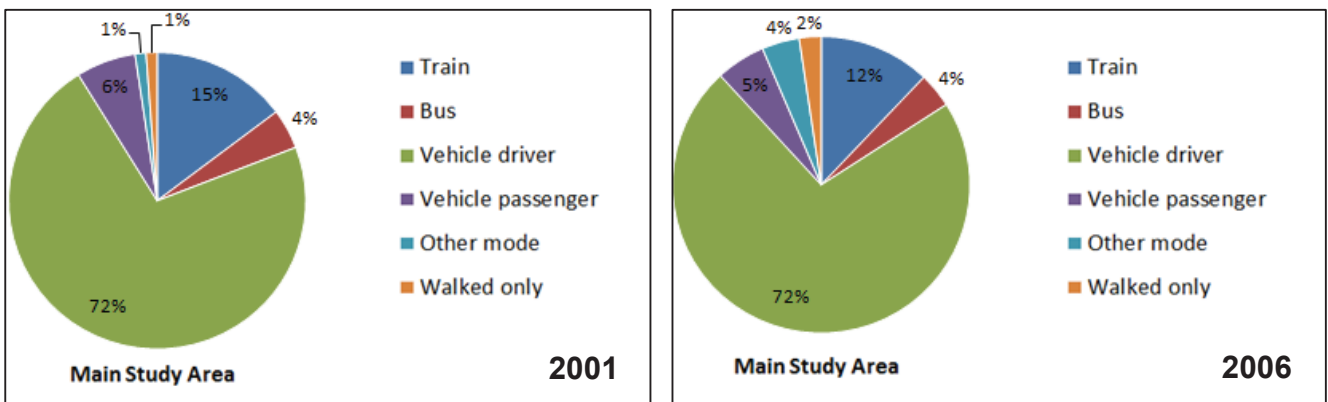


Figure 4: Journey to work mode share 2001/2006 (Source: BTS Journey to Work)

Figure 4 provides an historical perspective on journey to work mode shares for the study area for 2001 and 2006. The trend shows a slight decrease in car mode share (car driver and passenger combined) from 78% in 2001, 77% in 2006, to 75% in 2011. In the same period, walking has increased from 1% (2001) to 3% (2011). For the purposes of this study, the 2011 mode share profile will be adopted.

2.3 Origins of trips into the study area

The BTS Journey to Work data provides information about origin of work trips. This identifies from where employees working in the study area originate.



Figure 5: Origin of Journey to Work trips (Source: BTS Journey to Work 2011)

The predominance of trips from residential areas to the southwest of the study area reflects the socio-economic profile of the largely industrial and warehousing nature of current employment in the area.

As higher value jobs increase in the study area, there will be a potential shift in the origin of workers, and hence direction and mode of trips into the study area. This study has not explored these socio-economic drivers that will arise from changing employment profiles.

2.4 Road traffic

The study area is bordered by and includes a number of key roads including Botany Road, McEvoy Street, O'Riordan Street, Gardeners Road and Bourke Road. Key intersections include those at Green Square in the north (where Bourke Road, Botany Road and O'Riordan Street intersect) and Gardeners Road/ Botany Road in the south of the study area.

A number of key access points to the study area have been identified. The white arrows in Figure 2 show general approach directions for inbound traffic flows. Key intersections located on the boundary of the study area are shown in Table 1.

Table 1: Key intersections on the boundary of the study area

Number	Location
1	Wyndham Road/ McEvoy Street
2	Green Square (Botany Road/Bourke Road/O'Riordan Street)
3	Dunning Road/ Harcourt Parade
4	Gardeners Road/ Botany Road
5	Gardeners Road/ O'Riordan Street
6	Bourke Road/ Gardeners Road
7	Euston Road/ Sydney Park Road

A number of traffic counts from 2010 and 2011 at key access points to the study area were available from the City and provide some insight into the existing traffic flows at intersections into and out of the study area. Figure 6 shows vehicle trips into the study area during a two-hour AM peak period and Figure 7 summarises the trips leaving the study area in a 2-hour PM peak period.

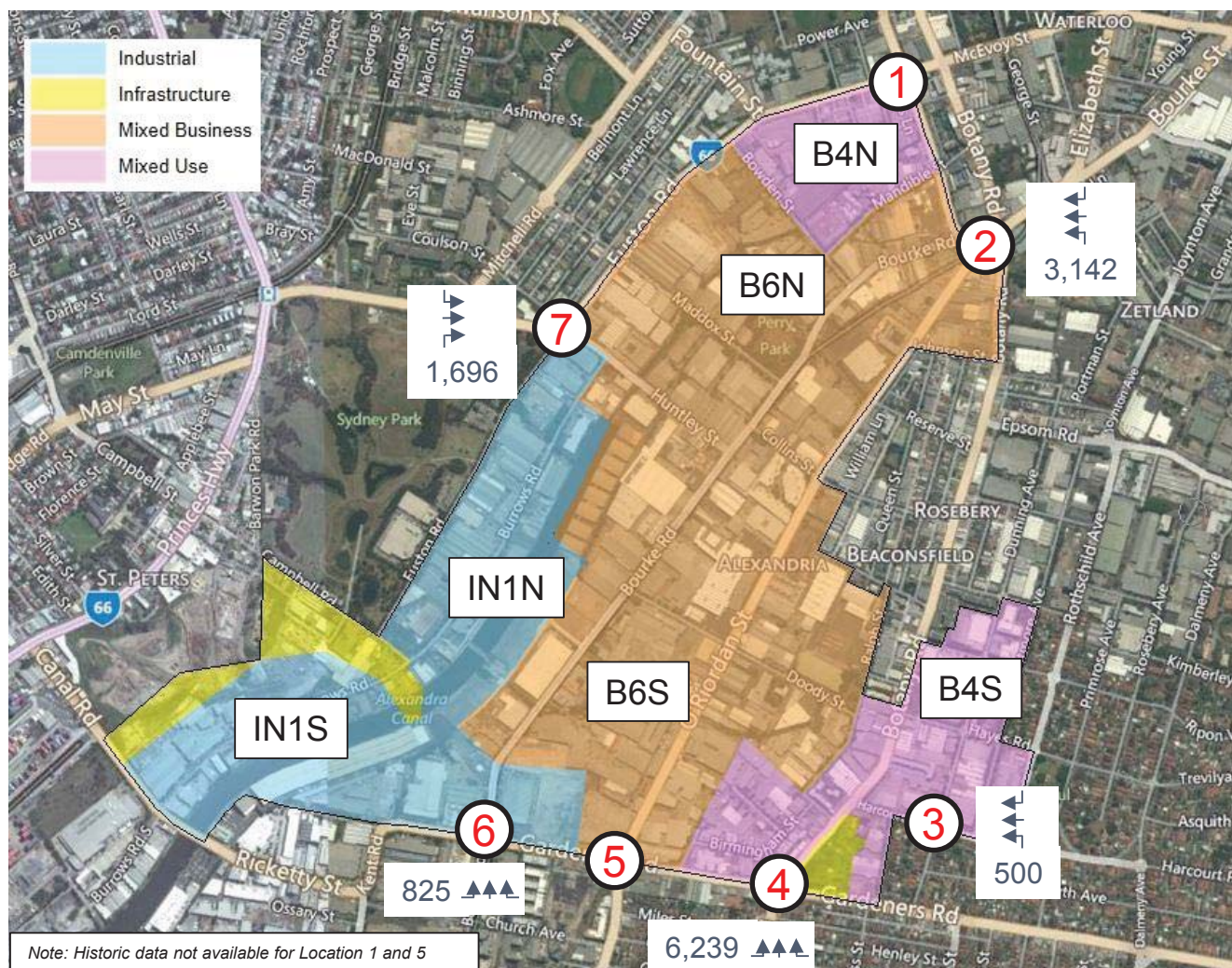


Figure 6: AM Peak (7.00 – 9.00 am) vehicles entering the study area (2010/11 counts)

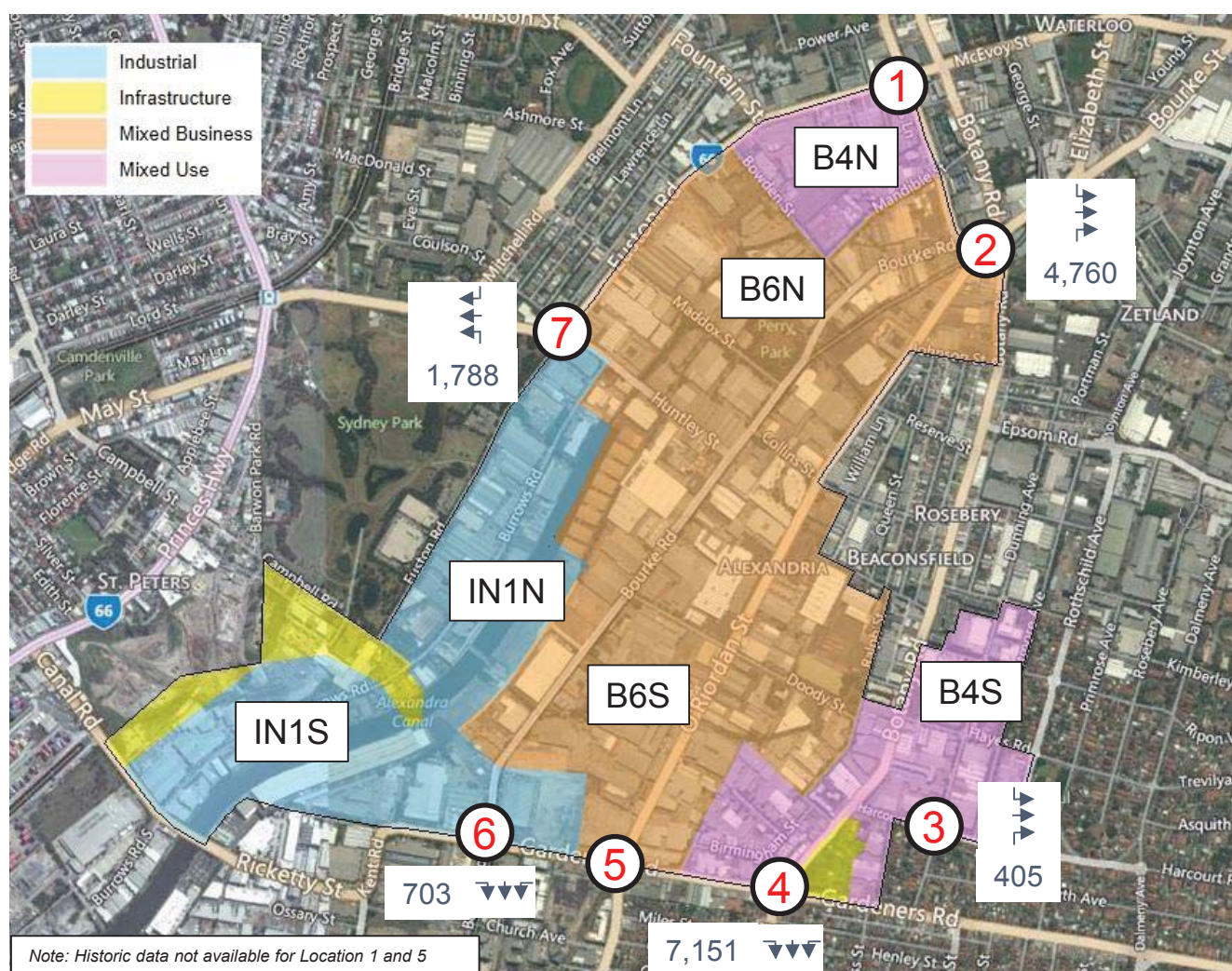


Figure 7: PM Peak (4.00 – 6.00 pm) vehicles leaving the study area (2010/11 counts)

Traffic numbers entering and leaving the study area (including through traffic) over the 2-hour AM and PM peak period at locations 2, 3, 4, 6, and 7 are summarised in Table 2. Historic traffic count information was unavailable for locations 1 and 5. Consequently, those locations were not included in further assessments. Assessment of future traffic volumes would need to be based on quantifiable information for all these locations.

Table 2: Traffic counts

Site	0700 - 0900		1600-1800	
	In	Out	In	Out
2. Green Square (Botany Rd/Bourke Rd/O'Riordan St)	3,142	3,403	5,641	4,760
3. Dunning Rd/Harcourt Pde	477	124	201	405
4. Gardeners Road/ Botany Road	6,239	3,494	3,772	7,151
6. Bourke Rd/Gardeners Rd	825	534	747	703
7. Euston Rd/Sydney Park Rd	1,696	756	616	1,788
Total	12,379	8,311	10,977	14,807

The study area is particularly dependent on a reliable road network due to its location within the Port Botany and Sydney Airport corridor. A specific challenge for the study area is the high proportion of through traffic, especially along Botany Road and Gardeners Road as a result of this strategic location. Whilst these traffic flows do not impact directly on the study area (only a short section of Botany Road lies within the area), they have an impact on the performance of key intersections on the study area boundaries.

The traffic counts along Botany Road confirm the importance of Botany Road as a key north-south spine road connecting the Sydney CBD to Sydney Airport and Port Botany. Gardeners Road also shows high traffic flows, demonstrating its importance as a key east-west connection between the Eastern Distributor/Anzac Parade and the Princes Highway. The traffic flows through the intersection of Euston Road and Sydney Park Road indicate that this is a key access point to the study area from Newtown and the Inner West.

These roads will continue to play an important role in moving people and goods through the corridor as further growth is experienced in Port Botany and Sydney Airport operations. Employment and residential growth in the study area will result in higher travel demands, also increasing pressure on the road network.

It is understood that the State Government has undertaken traffic modelling in the area to help plan for Airport growth. These modelling results have not yet been publicly released. However, the LTTMP identifies Botany Road and O'Riordan Street as currently "at capacity". Without significant improvements, these corridors will remain congested regardless of the employment and residential growth that may occur in the study area.

The ability of the road network to meet these demands is assessed in Section 4.

2.5 Public transport

2.5.1 Bus services

Sydney Buses operates eight bus routes within the study area. Bus stops are located at reasonable intervals along each route. Figure 8 shows the location of bus stops and bus routes in the study area.

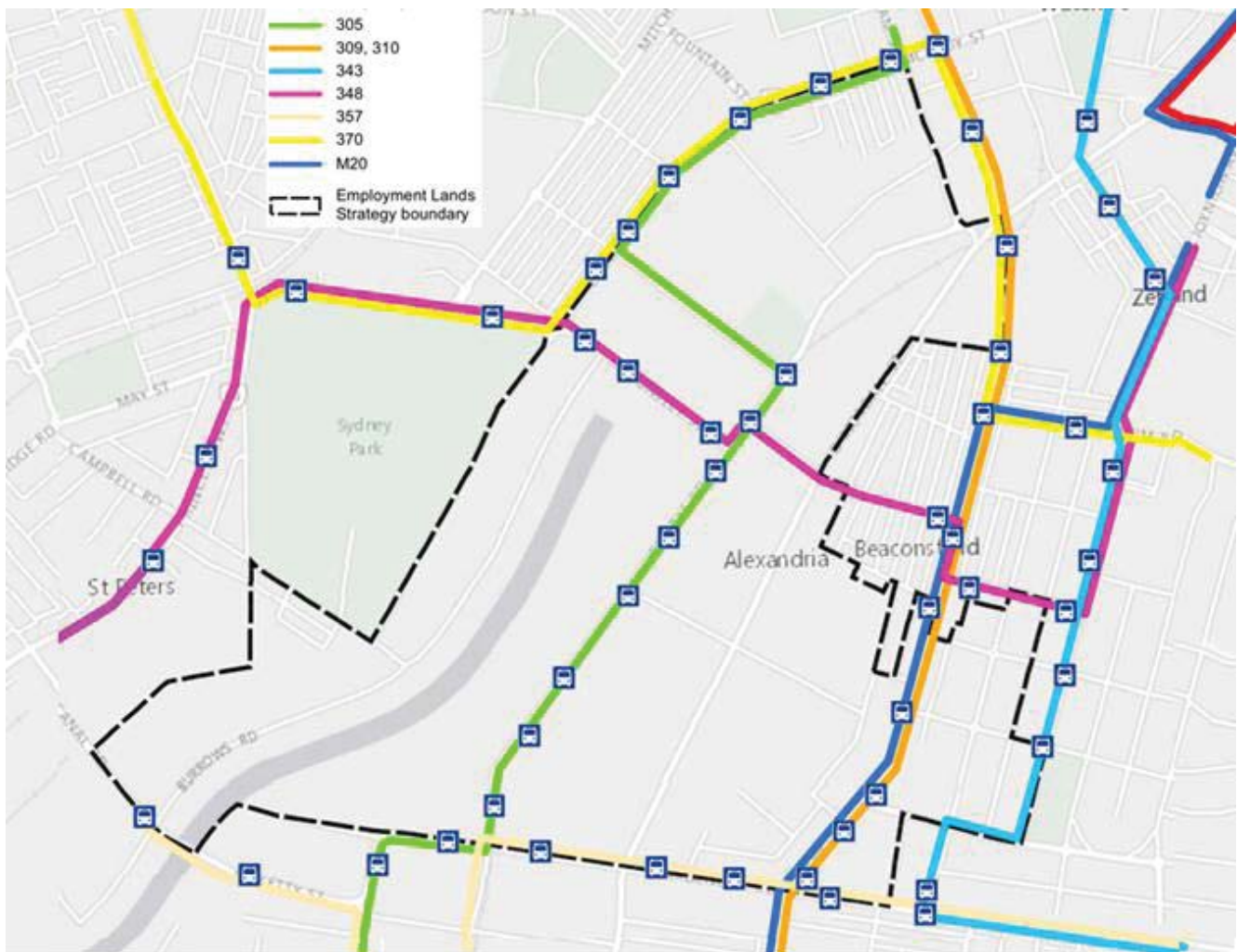


Figure 8: Bus routes

The study area has the potential to be well served by buses but currently only routes along Botany Road and sections of Wyndham Road offer sufficient peak hour services. O’Riordan Street, a key north-south spine in the study area, has no bus services, whilst Bourke Road, Gardeners Road and Collins Street have insufficient peak services.

Whilst the large number of bus routes and stops in the study area might imply a good level of service, the service frequencies are mixed. The highest frequency is achieved along Botany Road, which has over 15 services in the peak hour, but areas around Bourke Road and O’Riordan Street have significantly less services (3 buses during the peak hour). Figure 9 shows the frequency of bus services along each route.

Existing services are heavily focused on the perimeter of the study area; the only routes that currently traverse the study area are the 305 and 348. Route 305 operates as a limited and directional peak period service only whilst the 348 has half-hourly services between 6.30am and 6.30pm on weekdays only.

Figure 9 shows a 400 metres catchment around the bus stops in the study area, colour coded to represent the number of peak hour services at each bus stop. Whilst the entire area is well served with bus stops, it becomes obvious that key parts of the area not only have insufficient services but also are located in excess of 400 metres walking distance away from bus stops with frequent services. In addition, the large block sizes (such as on either side of O’Riordan Street) create long circuitous walk paths to the bus stops.

To improve bus services to and within the study area, higher service frequencies are required within the centre of the study area, in order to provide attractive and frequent north-south and east-west connections. The provision of improved bus services will be particularly important to achieve modal shift in the study area.

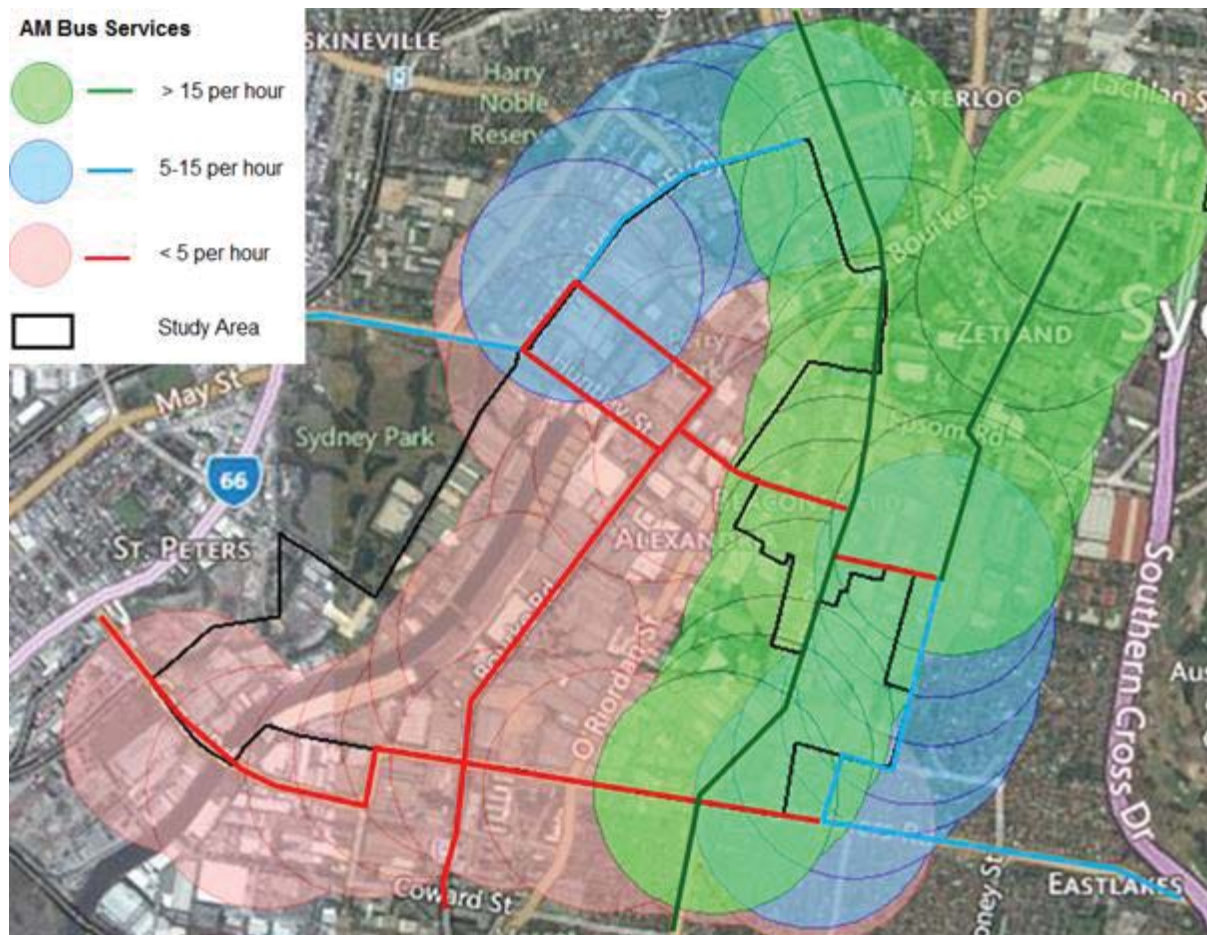


Figure 9: Bus service frequencies

2.5.2 Railway services

The study area falls between three railway stations. Green Square Station lies on the northern edge of the study area at the intersection of Botany Road, Bourke Road and O'Riordan Street and serves its northern part. Mascot Station is located approximately 300 metres south of the study border, providing service to some southern parts of the study area. The third railway station, St Peters Station, is located approximately 800 metres west of the study area, just outside the reasonable catchment area for the precinct.

The bulk of the study area cannot be adequately served by rail transport alone. The majority of rail passengers have either to rely on bus interchange or walk further than 800m to reach their destination in the study area. Figure 10 indicates the areas that are served by each station assuming a maximum catchment area of 800 metres from each station.

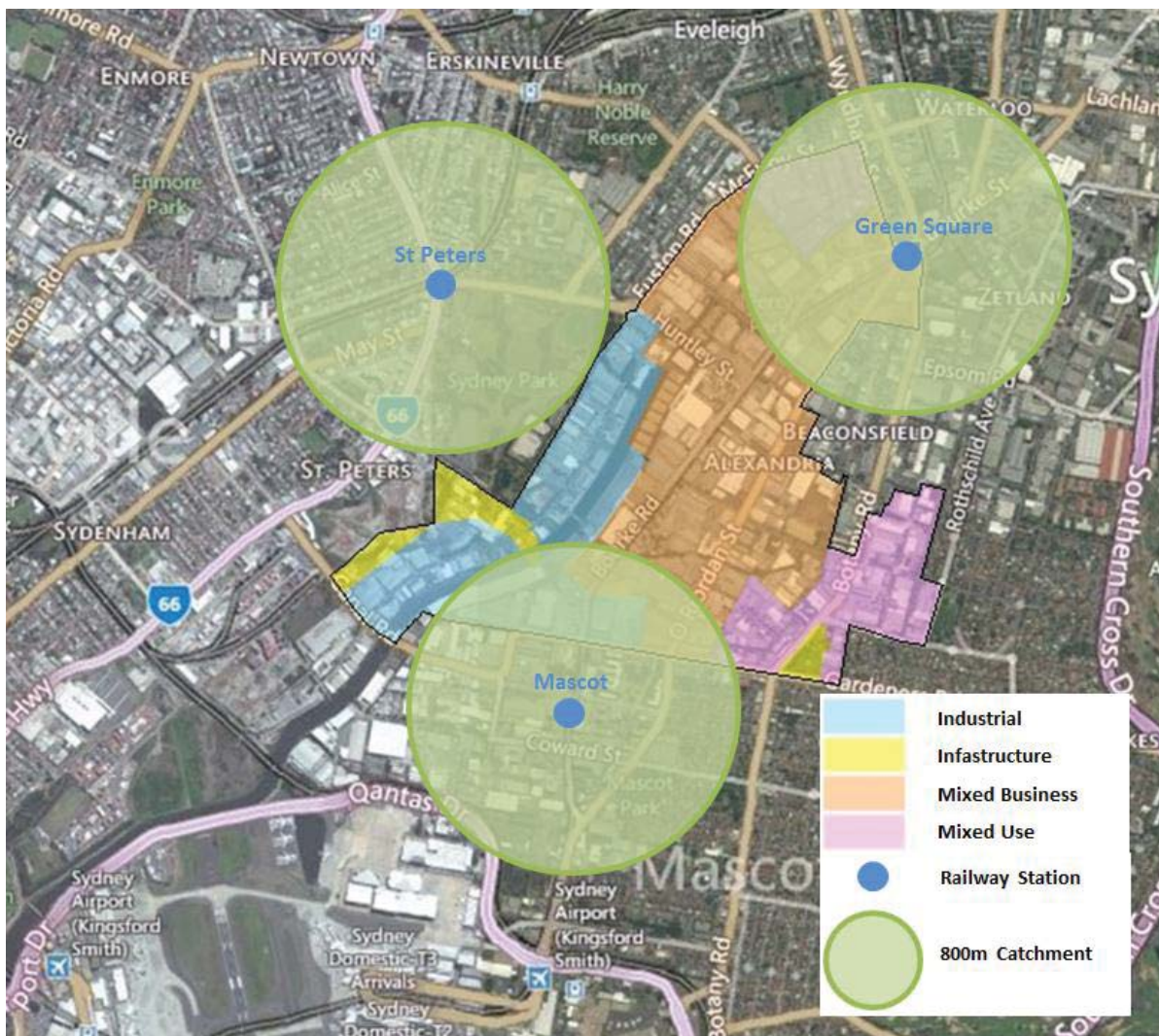


Figure 10: Train station locations

2.6 Walking and cycling

Pedestrian facilities in the study area include footpaths and dedicated crossing facilities. The majority of footpaths are sufficiently wide and located on both sides of the road. Footpaths are often separated from the kerbside by trees, shrubs or grass areas. A number of dedicated crossing facilities (traffic signals, zebra crossings) are provided but long stretches of key connections are lacking crossing facilities. This includes the following:

- Bourke Road only provides formal crossing facilities in three locations: Gardeners Road, Huntley Street and Collins Street. The distance between Gardeners Road and the next formal crossing facility at Huntley Street is approximately 1.2 km. No facilities are provided on Bourke Road at Green Square, however it is understood that these works are currently under investigation by Road and Maritime Service (RMS) and will be completed in the near future.
- O'Riordan Street only provides formal crossing facilities in three locations: Gardeners Road, Doody Street and Collins Street. At the Collins Street intersection, crossing facilities are provided for east-west pedestrian movements only. Similarly to Bourke Road, no facilities are currently provided at Green Square; however, as with Bourke Road above, this should be rectified in the near future.
- McEvoy Street / Euston Road provide formal crossing facilities at four locations: Botany Road, Wyndham Street, Maddox Street (three legs only) and near Hartley Street.

- The large roundabout at the intersection of Euston Road and Sydney Park Road is particularly poor in terms of pedestrian amenity; no formal pedestrian refuges are provided on any leg of this intersection. The nearest safe crossing options are located approximately 200 metres to the north and west of the roundabout.
- Burrows Street provides pedestrian crossing facilities at Canal Road only. These are limited to the north and west legs of the intersection.

Overall, the study area cannot be considered to be well integrated into the surrounding pedestrian network.

In its current configuration, the Green Square Town Centre intersection is particularly difficult for pedestrians to negotiate. For example, approaching Green Square from Bourke Road, pedestrians are required to either attempt risky crossings or undertake long detours to access Green Square Station and future Green Square Town Centre. From O'Riordan Street and Botany Road access is marginally better but major improvements are still required. This has been identified in the Green Square TMAP and these works are currently under investigation by RMS. The City is working with the RMS to ensure that pedestrian amenity and safety is significantly improved.

The City's cycling network reaches to the study area, and provides a mix of on-road and off-road cycle routes, the most notable being the central spine of the Bourke Road cycleway. The majority of existing routes run in a north-south direction. Dedicated east-west connections are generally poor, with cyclists having to cycle on-road. Figure 11 shows the extent of the cycle network in the study area. On-road cycling is necessary along key roads with high traffic volumes (e.g. Botany Road) and shared paths along other key roads.

With its current pedestrian and cycling facilities, the study area provides a reasonable level of permeability in a north-south direction. However, east-west permeability requires significant improvement to encourage active transport choices for those moving in or through the study area. There are some good east-west connections along Maddox Street, Huntley Street, Reserve Street, Collins Street and Doody Street but distances between these connections, especially in the southern end of the study area, are large, often exceeding 500 metres.

The Alexandra Canal acts as a significant barrier in the study area, impeding east-west access from the majority of the study area east of the canal, to Sydney Park west of the canal. A number of crossing points would be desirable. It is noted that a bridging structure owned by Transgrid currently spans the Canal, but its suitability as a pedestrian/cycling link is not known. The structures on the site preclude an easy landing solution at this time. However, this could be investigated as an opportunity to improve links to Sydney Park and St Peters Station.

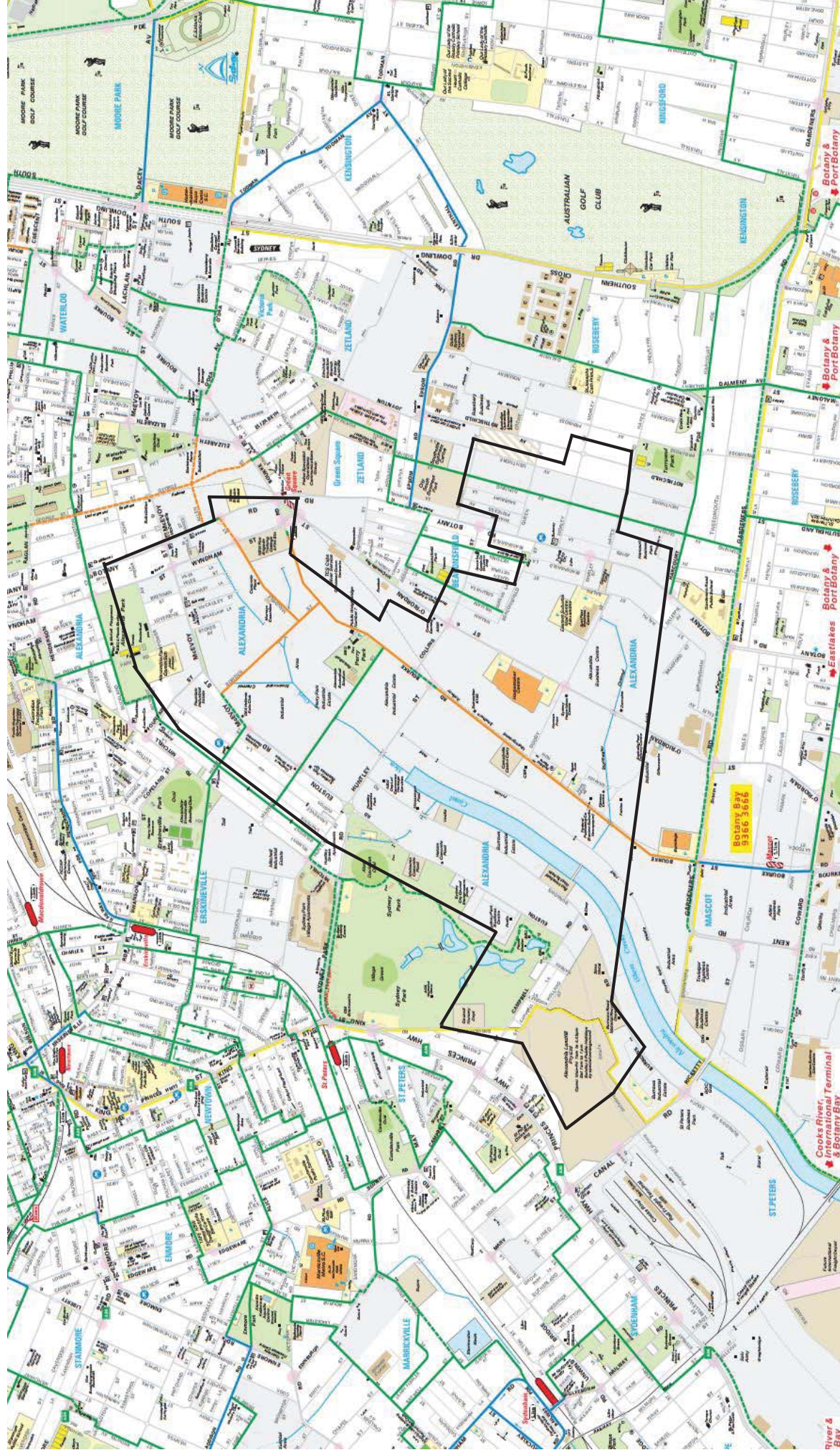


Figure 11: Existing cycle network

Source: <http://sydneycycleways.net>

2.7 Parking access

The study area has a variety of parking provisions – approximately 15% is on-street and 85% is off-street. Large areas of unrestricted on-street parking are available in less busy streets. Along main roads, such as Botany Road and O’Riordan Street, parking is typically restricted in the form of peak period clearway zones in order to provide additional road capacity during peak periods when traffic demand is at its highest. Outside peak periods, parking is permitted along those sections, despite traffic congestion still being evident during inter-peak periods. The number of on-street parking spaces available in different areas of the study area is shown in Figure 12.

Off-street parking is commonly provided by employers and includes a mix of employee, visitor and service parking spaces. As shown in Figure 13, 14,023 off-street spaces are currently provided in the study area. This number should be considered an approximate given that new development is likely to have occurred since these figures were calculated in 2011.

Table 3 below shows the number of jobs and parking spaces (off-street plus unrestricted on-street parking), and a parking provision ratio. It suggests that more than 70% of all jobs have a parking space provided or available, and in some areas, more parking spaces are provided than jobs. On average, 89% of all jobs in the study area would have an unrestricted car space available. It should be noted that this assessment does not differentiate between employment, residential and retail parking and greater clarity is necessary to make any definitive assessment (e.g. some of the parking spaces would be allocated for visitors/customers). However, the initial assessment indicates that the current supply of parking spaces exceeds the journey-to-work demand (75% car mode share) as detailed in Section 2.2.

Table 3: Ratio of parking spaces to jobs in study area 2013

Area	Jobs	Parking spaces (off-street and unrestricted on-street)	% of jobs with available parking space
IN1 (North)	1,323	1,533	116%
IN1 (South)	1,473	1,025	70%
B6 (North)	2,830	2,789	99%
B6 (South)	8,182	6,807	83%
B4 (North)	1,045	1,222	117%
B4 (South)	3,085	2,608	85%

Based on the information shown in Table 3, it can be assumed that:

- Employers assume a very high proportion of staff and visitors will arrive by car.
- Staff and visitors have become accustomed to the provision of ample parking spaces, although recent developments in the area have only provided limited parking, instead relying on public transport and generic parking provision.

With the proposed and expected growth of jobs in the study area, these patterns of parking expectation and supply, including partial over-supply, are unsustainable. Any decision to encourage mode shift to more sustainable travel modes will need to address the supply of unrestricted parking.

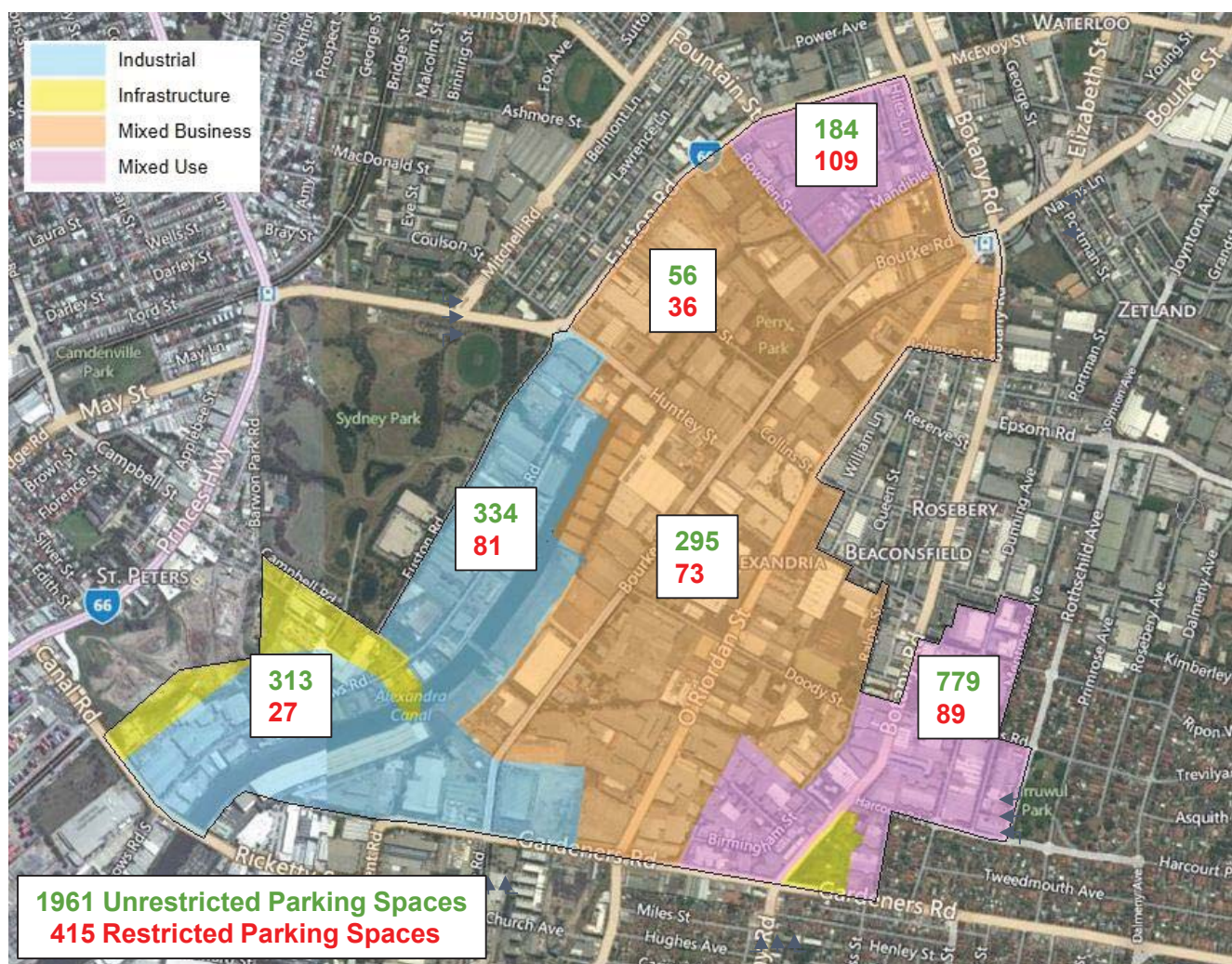


Figure 12: On-street parking supply in study area

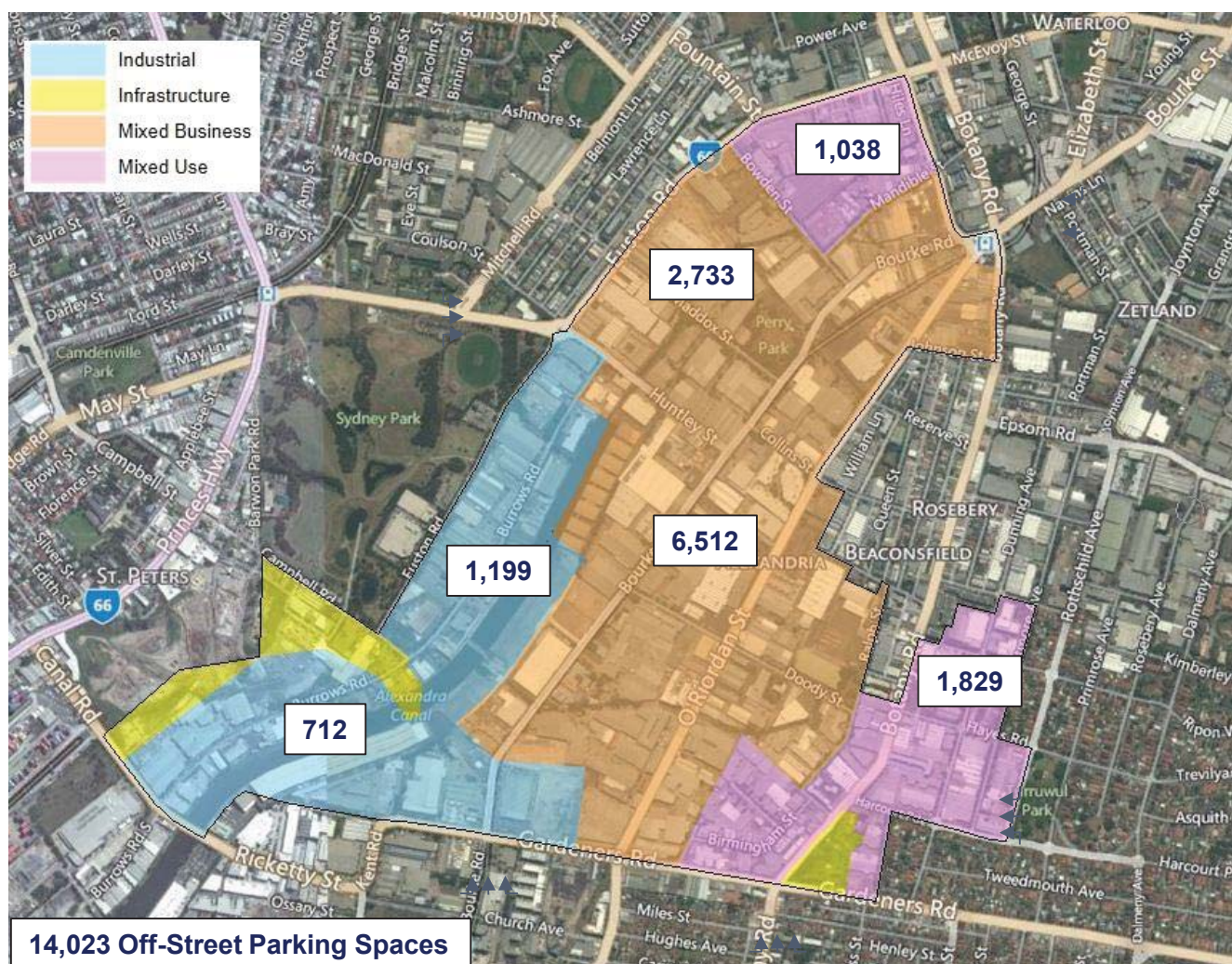


Figure 13: Off-street parking spaces supply in study area

3. Proposed development and growth scenarios

3.1 Proposed land use zoning

The draft Strategy proposes a change to the land use zones that currently apply in the study area (see Figure 14).

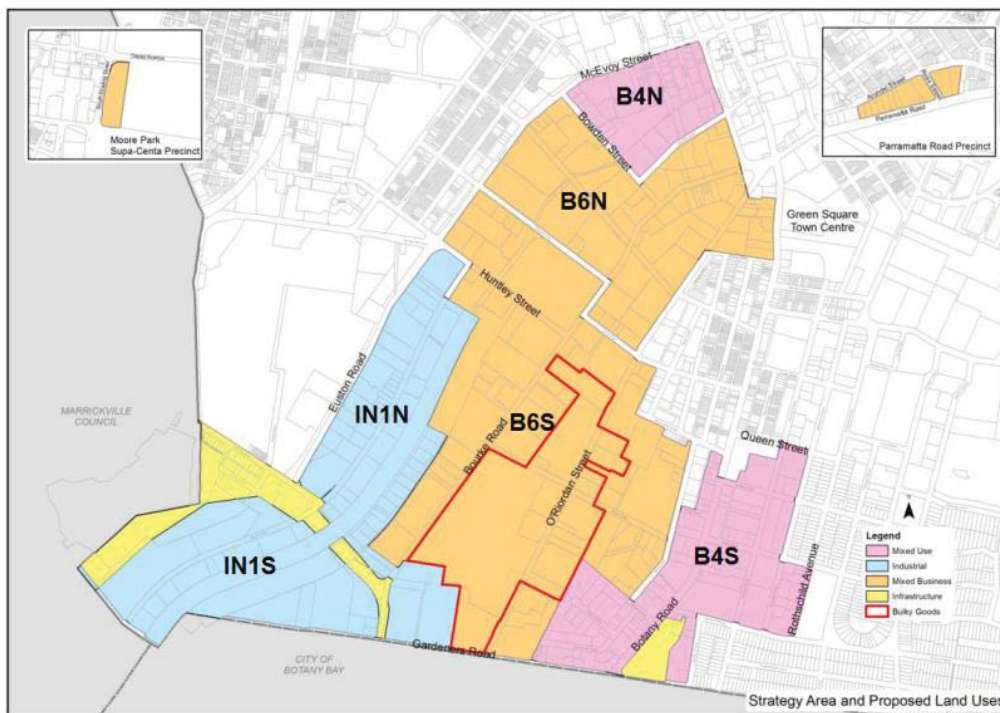


Figure 14: Proposed zones

The City's vision for the proposed land use zones is:

- IN1S and IN1N – a “pure industrial” zone with minimal ancillary uses to support industrial uses and employment in the zone. Only small increases in the working population are envisaged in these areas in the long term.
- B6N and B6S – a mixed business precinct (no residential) facilitated by a flexible approach to land use. The zone should continue to support warehouse and light industrial uses but also facilitate higher value employment such as offices where appropriate. Moderate growth is expected in the B6S in the medium to long term and moderate to high growth in the medium to long term in the B6N.
- B4N and B4S – a mixed-use precinct supporting a relatively even mix of employment-generating uses and residential development. High growth is expected in the short to medium term.

3.2 Growth scenarios

For the purpose of undertaking technical studies, of which this Study is one, the City has identified three potential growth scenarios for the study area: low growth, medium growth and high growth, shown in Table 4.

Table 4: Growth scenarios to 2030

		Low Growth		Mid Growth		High Growth	
		Jobs	Dwellings	Jobs	Dwellings	Jobs	Dwellings
Area	Development staging	Increase from current to 2030 (jobs growth relative to current in brackets)					
IN1 (North)	Limited change. Some change in built form to facilitate introduction of new uses	1257 (95%)	Nil	2119 (159%)	Nil	3411 (257%)	Nil
IN1 (South)		604 (41%)	Nil	1292 (88%)	Nil	2324 (159%)	Nil
B6 (North)	High growth in the medium to long term, with relatively slow growth in the short term	3622 (128%)	Nil	4428 (157%)	Nil	5637 (199%)	Nil
B6 (South)	Moderate growth is expected in the medium to long term, with relatively slow growth in the short term	4991 (61%)	Nil	6865 (84%)	Nil	9676 (119%)	Nil
B4 (North)	High growth is expected in the short to medium term.	-648 (-62%)	980	-529 (-51%)	1359	-450 (-43%)	1692
B4 (South)		-2622 (-85%)	3195	-2490 (-81%)	3830	-2401 (-78%)	4388
Total		7204 (+40%)	4175	11685 (+65%)	5189	18197 (102%)	6080

As can be seen from Table 4, the proposed changes would result in significant changes to the number of jobs and residents in the study area by 2030. While the highest growth rate is in the IN1 areas in terms of percentage, the biggest increase in number of jobs will be experienced in the B6 areas, and the highest increase in number of dwellings will be in the B4 areas. However, the B4 areas also have a reduction in employment, resulting in lower net increase trips from these zones. In addition, a switch from employment to residential zoning also implies a change from inbound journeys-to-work trips to outbound journeys-from-home. The proximity of B4 North to Green Square would also likely switch alightings at Green Square station for employment purposes in the proposed B4 North, to additional boardings for outbound journeys, likely to be predominantly City bound.

The study assumes that these projections will be achieved by 2030 with various areas progressing at different rates.

- To 2021, it is assumed 30% of projected growth will be achieved in the IN1 and B6 zones and 60% of projected growth will be achieved in the B4. It is noted that the growth profile is uneven across the zones reflecting an appreciation of market forces.
- To 2030, the remaining 70% of projected growth will be achieved in the IN1 and B6 zones and 40% of projected growth will be achieved in the B4.

3.3 Proposed network additions

The City is proposing some modifications and additions to the current indicative road network identified in its current development control plan. A proposed road network is shown below in Figure 15:

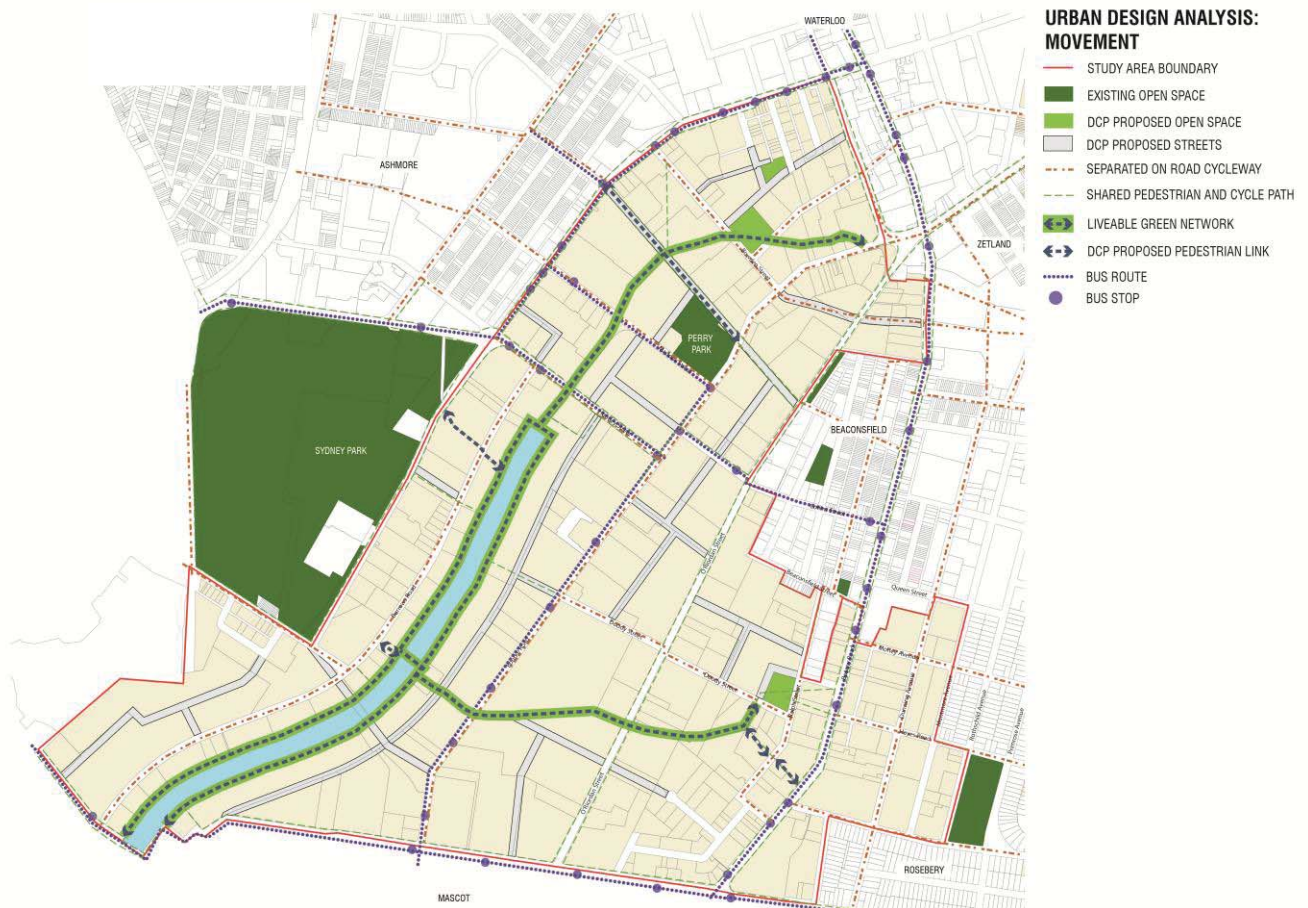


Figure 15: Proposed network additions to study area

These proposed network additions will improve the permeability of the study area while retaining the functionality of the study area to accommodate a range of employment generating uses from warehousing to retail. The new east-west connections in particular, including the potential for a new crossing of the Alexandra Canal near Campbell Road, will improve overall connectivity of the study area. The creation of new smaller blocks increases the permeability of the area, providing more direct access to bus stops along the arterial roads. The newly created intersections would also increase the opportunity for new pedestrian crossing facilities on Bourke Road and O'Riordan Street.

The proposed road network additions provide an opportunity to distribute traffic more evenly throughout the study area, and increase accessibility into and through the precinct. This may encourage rat-running from the congested Bourke Road and O'Riordan Street and would need to be managed carefully by local area traffic management.

The proposed network will create opportunities to improve the pedestrian and cycling environment and promote modal shift. They will also improve local connections to key destinations in and around the study area.

The new roads will potentially create additional kerb-side parking, depending on their design. Unless overtly managed, this will further exacerbate the oversupply of parking supply in some areas, making policy initiatives to encourage mode shift to more sustainable modes difficult to realise.

4. Future transport demand

4.1 Approach

The flow chart provided in Figure 16 outlines the methodology used to assess the impacts of the 2021 and 2030 growth scenarios on the study area network. Initial data supplied by the City included existing employment, residential and traffic data.

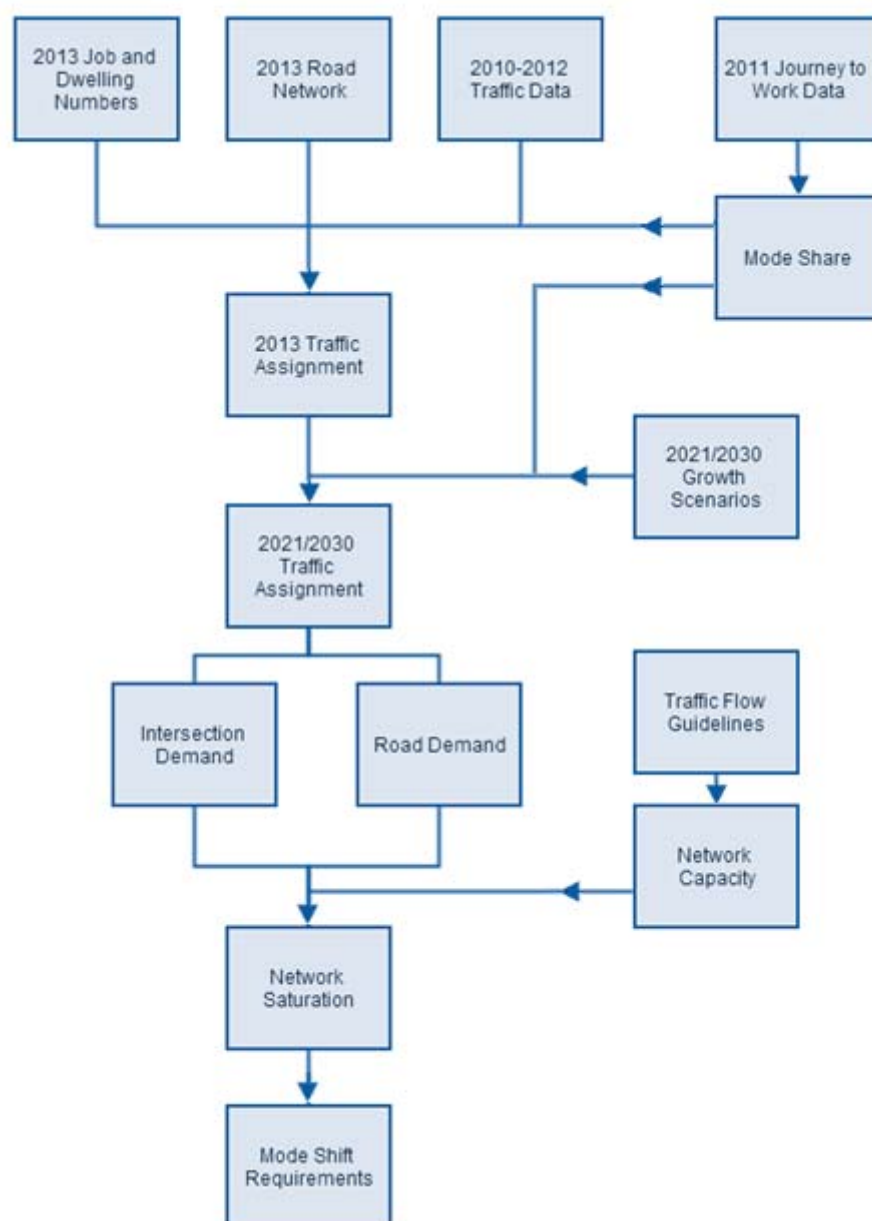


Figure 16: Methodology for calculating future traffic demand

The 2011 Journey to Work data was obtained from the BTS and analysed in order to provide the existing mode share for trips into the study area. For each land use zone, the prevailing BTS travel zone was used and assumed to be indicative of the mode share for the corresponding land use zone. Figure 17 displays the BTS Travel Zones overlayed with the Employment Lands land use zones. Generally, there is sufficient continuity between BTS travel zones and land use zones to ensure that mode share assumption to use BTS travel zone

mode share for the land use zone is appropriate at a strategic level. The occupancy rates of dwellings were provided by the City, whilst employment rates were taken from the BTS website.

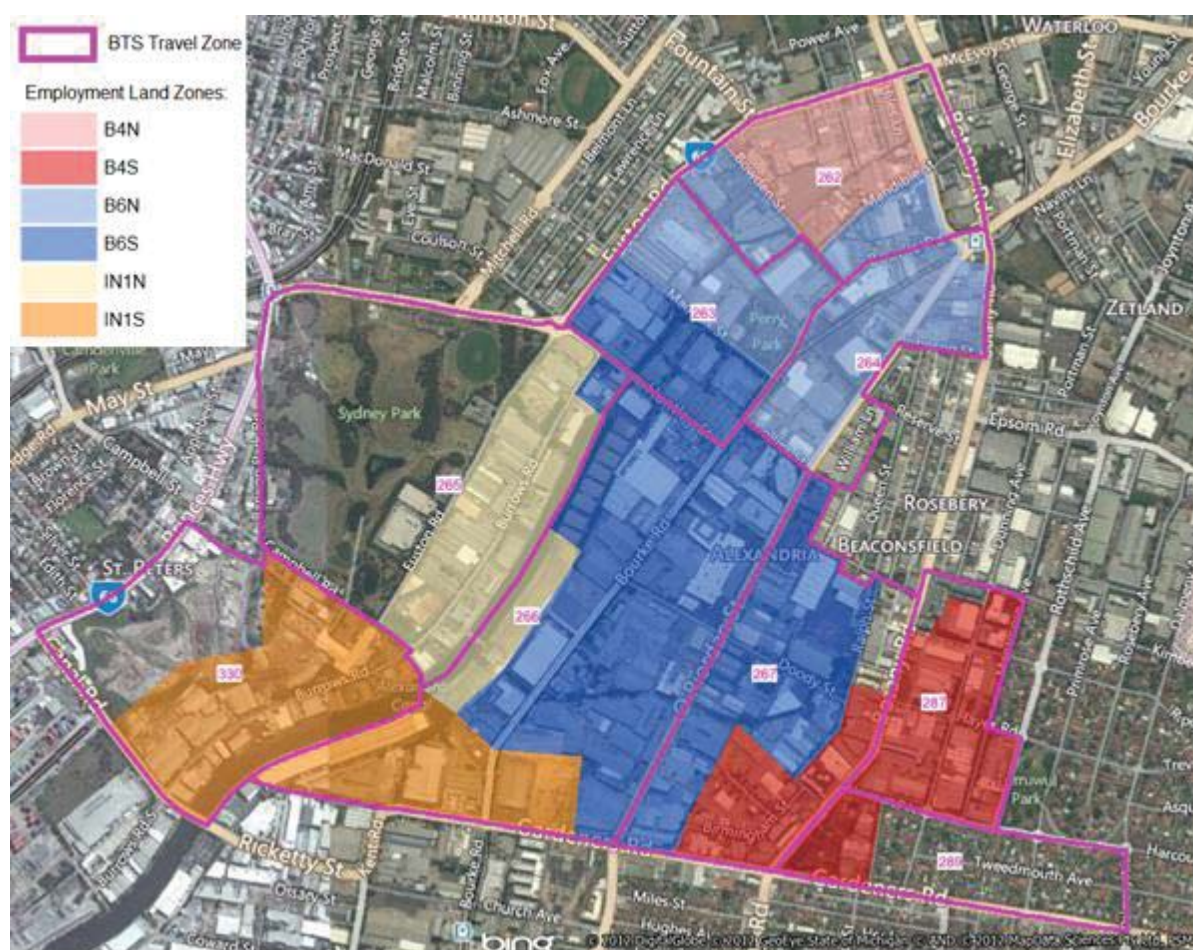


Figure 17: BTS Travel Zones and Employment Lands land use zones

The current effective mode share was determined as the relationship between existing trip generators (i.e. jobs and dwellings) and existing traffic. As a worst case, it was assumed that this relationship would continue through until 2030 to demonstrate the effect of a “business as usual” scenario. This scenario does not take into account any potential future mode shifts due to parallel developments in the surrounding areas.

For any employment area, there are opportunities for local residents to find employment within the area. The nature of the employment mix and the socio-demographic profile of the adjacent residential areas are significant factors, and will predominantly affect local transport options (walking, cycling and local bus services). The predominance of current trips from the southwest reflects the socio-economic profile of the industrial/warehousing employment current in the study area. Trip containment, or Journey-To-Work trips from within the area to employment also within the area has not been assessed for the study area.

A manual traffic assignment process was used for this desktop study. Traffic data included vehicle volumes at key intersections. These vehicles were assigned to each of the City’s land use zones, reflecting the likelihood of using a particular access route, based on distance to the zone and existing job numbers. Route choice assumptions were then used in order to allocate traffic to individual roads and intersections. The result of this initial process was a 2013 strategic assignment model.

Combining these assumptions, along with the 2013 assignment model and expected growth rates, it was possible to estimate the expected traffic volumes in each of the land use zones as well as major roads and intersections. The capacity of the network was evaluated at a strategic level and compared to the forecast traffic demand in order to determine the feasibility of accommodating the growth scenarios under existing mode split

conditions, based on the 2011 BTS Journey to Work Data (see Section 2.2). Consequently, trends of mode shift and changes in mode split have not been taken into account in estimating the future traffic volumes. The model also calculated the expected number of train, bus, cycling and walking trips for each land use zone across all growth scenarios.

It should also be noted that this forecast is focussing on the additional future traffic volumes generated by the developments in the study area. Through traffic is assumed at linear 2% annual growth, this being consistent with other studies undertaken by Jacobs SKM in the area for TfNSW. The overall traffic volumes in and around the study area, including the developments of neighbouring areas/ projects such as the Green Square Town Centre, require a much more detailed and complex traffic study.

The model outputs show the additional demand on the road network and the existing road capacity was assessed at key locations to identify where it would not be sufficient to service the expected growth in employment and residential dwellings.

4.2 Future traffic demand

The methodology explained above has been used to estimate the trip demand entering the study area for all three growth scenarios in 2021 and 2030. The assumption was made that 85% of the inbound trips would use one of the identified key intersections. This approach reflects the lane capacity at all intersections and land uses on the boundary. Some other access routes exist (e.g. via Johnson Street or Reserve Road) which have also no traffic count data available. Figure 18 shows the calculated percentage increase in vehicular traffic demand for the three growth scenarios in the 2021 AM peak period and Figure 19 in 2030 AM peak period.

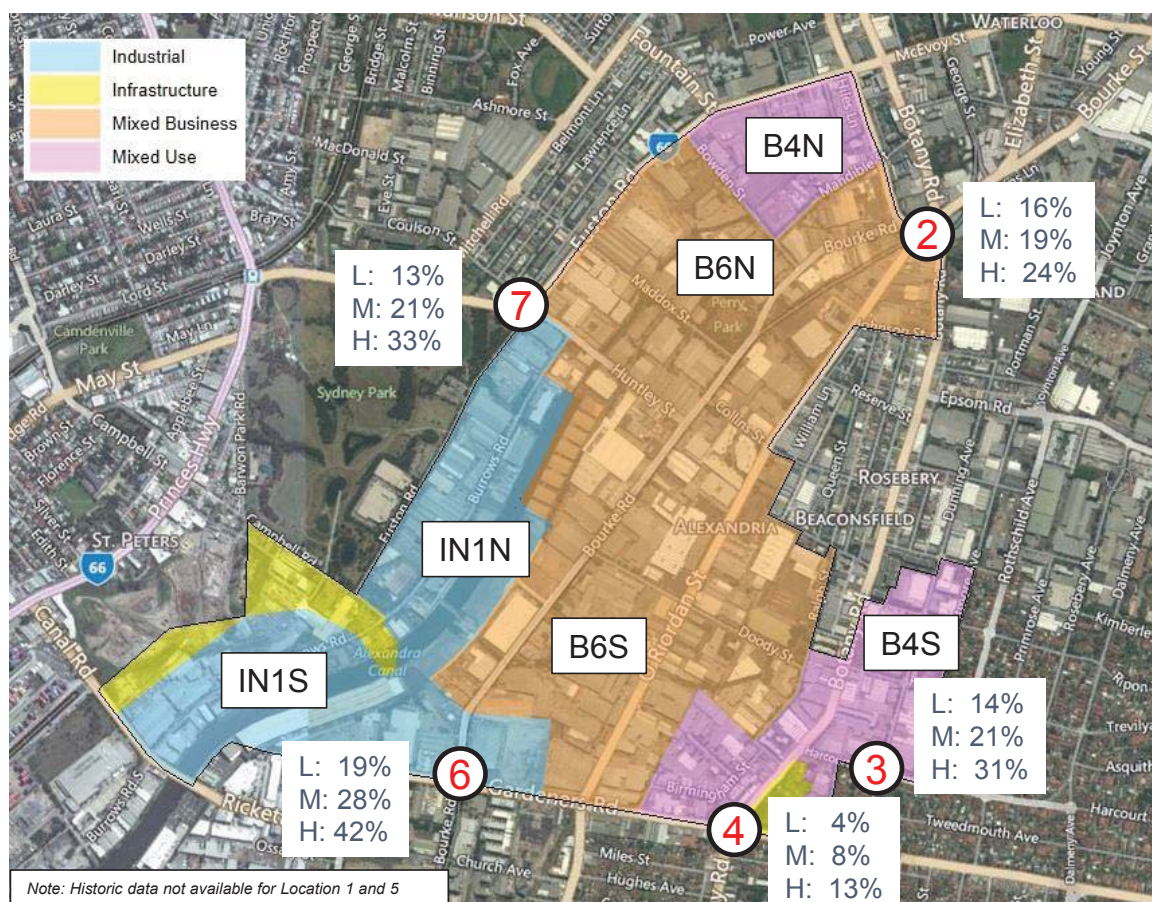


Figure 18: Increase in vehicular traffic demand for the three growth scenarios in the 2021 AM peak period 2-hours

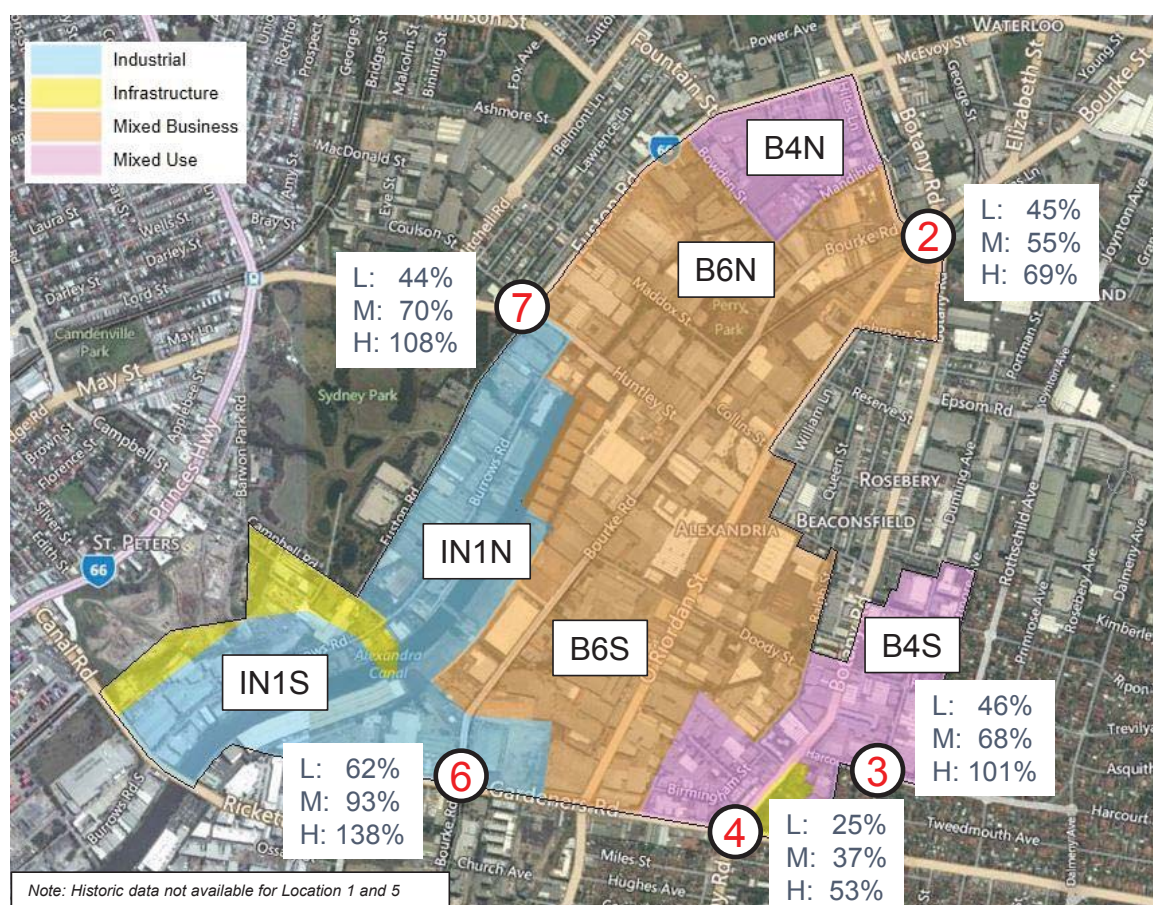


Figure 19: Increase in vehicular traffic demand for the three growth scenarios in the 2030 AM peak period 2-hours

The calculations indicate, in lieu of any mode shift, significantly increased traffic demand in all three growth scenarios for 2021 and 2030. As shown in Table 5 overall AM peak period increase by 2030 will be between 40% (low growth scenario) and 110% (high growth scenario) at key intersections. This will have a significant impact on the level of service of key intersections and could also compromise the throughput of key roads in the study area.

Table 5: Total inbound demand at key intersections in AM Peak period

Site	No development: thru-traffic growth only			Low growth		Medium growth		High growth	
	Existing	2021	2030	2021	2030	2021	2030	2021	2030
2. Green Square	3,260	3,670 (+13%)	4,114 (+26%)	3,793 (+16%)	4,737 (+45%)	3,892 (+19%)	5,055 (55%)	4,035 (+24%)	5,523 (+69%)
3. Dunning Rd/Harcourt Parade	500	544 (+9%)	591 (+18%)	572 (+14%)	749 (+46%)	606 (+21%)	839 (+68%)	656 (+31%)	1,004 (+101%)
4. Gardeners Road/Botany Road	6,239	6,676 (+7%)	7,151 (+15%)	6,474 (+4%)	7,806 (+25%)	6,717 (+8%)	8,529 (+37%)	7,038 (+13%)	9,539 (+53%)
6. Bourke Rd/Gardeners Rd	825	843 (+2%)	863 (+5%)	978 (+19%)	1,339 (+62%)	1,056 (+28%)	1,592 (+93%)	1,169 (+42%)	1,967 (+138%)
7. Euston Rd/Sydney Park Rd	1,696	1,715 (+1%)	1,735 (+2%)	1,922 (+13%)	2,448 (+44%)	2,055 (+21%)	2,884 (+70%)	2,251 (+33%)	3,531 (+108%)
Total	12,520	13,447 (+7%)	14,454 (+15%)	13,739 (+10%)	17,079 (+36%)	14,326 (+14%)	18,899 (+51%)	15,149 (+21%)	21,564 (+72%)

When comparing the inbound demand across the three growth scenarios, a stronger growth can be observed in the period 2021 to 2030. This is due to the different growth rates in the zones. Zones IN1 and B6 have a slower initial growth whilst zone B4 has a stronger growth until 2021. At the same time, zone B4 is substituting job numbers with new dwellings whereas in zones IN1 and B6 new jobs are created. The lower growth in inbound AM peak period traffic demand in 2021 shows the effect of newly created jobs in zones IN1 and B6 being largely off-set by reduction in jobs in zone B4.

An indicative capacity calculation at the identified key intersections has been undertaken. This approach uses the current road capacity and calculates the degree of saturation for all three scenarios in 2021 and 2030. It is strictly an assessment of mid-block capacity, i.e. the road capacity between two intersections, not the intersection capacity. To calculate the intersection capacity a much more complex approach is required. The example of the intersection of Gardeners Road and Botany Road is used below to explain and demonstrate the calculations.

The Gardeners Road/ Botany Road intersection, currently the busiest intersection in the study area, demonstrates the level of impact the future traffic demand could have:

- The current traffic volume just north of the intersection is 6,239 vehicles during the peak 2-hour period, or 3,120 vehicles per 1-hour. All calculations have been undertaken for the AM peak 1-hour, using the simplified approach that this represents 50% of the AM 2-hour peak.
- Typically, the maximum capacity of one traffic lane has been assumed as 1,800 vehicles per hour consistent with professional practice. For planning purposes, a degree of saturation of 90% is deemed as acceptable, saturation above 90% indicates potentially high levels of congestion and saturation above 100% is unacceptable and represents lack of capacity.
- Botany Road has two northbound lanes equalling a capacity of 3,600 vehicles per hour and currently experiences a degree of saturation of 87% (3,120/ 3,600 vehicles/hr) which is acceptable.
- The calculated 2021 demand requires a capacity of 3,276 (low growth) - 3,519 (high growth) vehicles per hour, and the calculated 2030 demand a capacity of 3,888 (low growth) - 4,770 (high growth) vehicles per hour. This indicates that while the intersection is moderately congested at present, under the low growth scenario demand will moderately exceed capacity and under the high growth scenario, demand will substantially exceed capacity, resulting in significant and unreasonable levels of congestion.

Table 6 shows the degree of saturation for key intersections in all growth scenarios 2021 and 2030.

Table 6: Degree of saturation at key intersections during AM peak 1-hour

Site	Existing capacity	Low growth		Medium growth		High growth	
		2021	2030	2021	2030	2021	2030
2. Green Square (Botany Rd/ Bourke Rd/ O'Riordan St)	9,000 ¹	21%	26%	22%	28%	22%	31%
3. Dunning Rd/ Harcourt Pde	1,800	16%	21%	17%	23%	18%	28%
4. Gardeners Rd/ Botany Rd	3,600	91%	108%	93%	118%	98%	132%
6. Bourke Rd/ Gardeners Rd	1,800	27%	37%	29%	44%	32%	55%
7. Euston Rd/ Sydney Park Rd	1,800	53%	68%	57%	80%	63%	98%

Note: A degree of saturation of 90% is deemed as acceptable, saturation above 90% indicates potentially high levels of congestion and saturation above 100% is unacceptable and represents lack of capacity.

The location with the highest degree of saturation in all growth scenarios is Gardeners Road/ Botany Road. In all future scenarios, the saturation exceeds 90%, indicating capacity issues. Location 7 (Euston Road/ Sydney Park Road) will have a potential capacity issue in the high growth scenario for 2030. While this strategic assessment does not identify critical concern at other locations, specific intersection analyses are necessary to confirm performance.

Those trips exceeding 90% saturation would need to be shifted to other modes in order to maintain an acceptable degree of saturation without undertaking any infrastructure upgrade.

In summary, all development scenarios at existing mode share will exceed network capacity at the Gardeners Road / Botany Road intersection, albeit the low growth 2021 scenario will be at the margin of acceptability. The high growth scenario will exceed reasonable network capacity at the Euston Road / Sydney Park Road intersection. Clearly, some mode shift will be necessary to support the development proposal if a reasonable level of capacity at these intersections is to be maintained.

4.3 Future public and active transport demand

The overall increase in jobs and residents will increase the demand for public and active transport in the study area. The total number of trips for each of the growth scenarios was calculated using the existing mode share (see Figure 3). Those numbers combine inbound and outbound trips in the AM 2-hours peak period as shown in Table 7.

¹ This represents the combined capacity of Botany Road, O'Riordan Street and Bourke Road southbound from Green Square

Table 7: Public and active transport trips in AM 2-hour peak period

	Existing capacity	Low growth		Medium growth		High growth	
		2021	2030	2021	2030	2021	2030
Train	2,874	3,780	5,271	4,192	6,332	4,688	7,720
Bus	693	938	1,287	1,043	1,533	1,159	1,834
Walking	546	727	1,019	807	1,216	899	1,468
Other (incl. cycling²)	363	475	658	528	794	592	973

The capacity of the public transport networks to accommodate these demands is a critical issue.

Jacobs SKM is aware of concerns about potential lack of future inbound capacity at Mascot and Green Square Stations once Green Square Town Centre is fully developed. As an employment zone, potential rail passengers would be predominantly alighting at the precinct's stations.

Of particular focus however, is the largely residential precinct in the north of the study area. Increased densities in this precinct along with its switch from receiving inbound alightings to outbound boarding journeys would need to be absorbed into the boarding capacity at Green Square.

A qualitative analysis of line capacity and simplistic assumptions of train loading broadly support the perspective of potential capacity constraints for trains arriving at Mascot and Green Square Stations in the AM peak period. However, no detailed capacity analysis is available at this stage to quantify this issue.

² Cycling mode share has recently increased in response to City cycling initiatives. No analysis is available on the continuation of this pattern, but would suggest a higher mode share may be sustained.

5. Mode shift opportunities

5.1 Overview

The demand forecasts for 2021 and 2030 indicate that the study area will see a significant increase in traffic volumes following the development of the area. Based on a “Business as Usual” approach adopting the current mode share, Table 8 shows the expected total trips and the total expected car trips in the area, for all growth scenarios.

Table 8: Total future trips in study area

	Existing capacity	Low growth		Medium growth		High growth	
		2021	2030	2021	2030	2021	2030
Total trips	18,129	23,774	32,919	26,407	39,716	29,586	48,627
Car trips at current mode share	13,629	17,826	24,650	19,807	29,797	22,212	36,571

The indicative capacity calculations in Table 6 indicate that this level of traffic generation will create capacity issues at some key locations. To alleviate capacity issues alternatives to car use will need to be developed.

In order to develop future transport strategies for the study area, it is important to establish a growth vision and mode share targets based on it.

The Green Square TMAP 2008 proposed a “No Car Growth” vision and described a number of planning measures and a mode share target to achieve this. If this vision were adopted for the study area, it would require all new trips associated with the area to be made by non-car means. Given the potential scale of employment increase contemplated (up to doubling employment levels in the high growth scenario), this vision is presented as one bookend.

An alternate, less onerous, vision might be to allow increased trips within the available road network capacity, a “No Road Capacity Increase” vision. This would allow car trips to grow until the road network capacity is exhausted but would generally not upgrade the road network infrastructure to create additional capacity. Any trips above the road network capacity would have to be shifted towards public and alternative transport modes. Strategically, this would allow increased traffic growth at those locations not presently capacity constrained, and provides an alternate bookend.

A third option is to overtly embrace public and active transport as vital elements in providing a sustainable transport future. Setting mode share targets then becomes an issue of identifying available capacity, and identifying possible constraints to future provision. The qualitative assessment of the Green Square line capacity identified previously gives a systemic approach to evaluating mode shift opportunities. This avenue is problematic in the absence of any quantitative assessment of railway capacity.

In either “No Car Growth” or “No Road Capacity Increase” scenario, the trips that exceed current mode share need to be accommodated by non-car modes. Mode shift towards these is consistent with the City’s sustainable travel objectives and provide adequate travel opportunities to support the proposed level of development in the study area.

More detailed analysis is necessary of available network capacity to reflect cumulative impacts of adjacent developments and transport infrastructure initiatives, in order to fully articulate the “No Road Capacity Increase” vision. However, it is noted that there is substantial uncertainty about key transport drivers in the subregion at this time, such as WestConnex and the Mascot Town Centre. Until planning is more progressed, it is premature

to undertake detailed modelling and assessment of cumulative transport impacts associated with subregional growth at this time.

The following analysis is intended to indicate the range of mode shift that might be necessary under the “No Road Capacity Increase” vision.

A substantial mode shift away from car travel and towards active and public transport emerges as a necessary solution to provide sustainable access to the study as part of its future growth and development. Both growth visions would require more detailed analysis but indicative mode share targets can be calculated from the future traffic demand (see also Section 4.2 and Section 4.3).

5.2 Indicative mode share targets

The future traffic demand is calculated at a strategic level. The cumulative impact of major developments in the area cannot be integrated within this desktop assessment, and requires recourse to subregional modelling. The following mode share targets are indicative, providing a ballpark figure, rather than detailed advice, to inform the direction of future strategies and studies. They were calculated using 2011 mode split data that was then applied to future total traffic volumes in order to generate mode share. While recent changes in mode share are recognised, their sustained change is problematic at the level of this study, requiring greater recognition of demand profiling and emergent transport constraints and initiatives.

Two scenarios are provided:

- A “No Car Growth” vision would assume that no additional car trips would be made in the future, “locking” the existing car trips as the upper limit for the future.
- A “No Road Capacity Increase” vision in which only car trips that would exceed the current capacity of the road network would have to be shifted to alternative modes.

For the “No Car Growth” scenario, Table 9 shows the calculated future total trips and car trips in the study area for all growth scenarios, the number of car trips to be shifted and the indicative car mode-share targets.

Table 9: Indicative mode share targets under a “No Car Growth” vision

	Existing capacity	Low growth		Medium growth		High growth	
		2021	2030	2021	2030	2021	2030
Total trips	18,129	23,774	32,919	26,407	39,716	29,586	48,627
Car trips at existing mode share	13,629	17,826	24,650	19,807	29,797	22,212	36,571
Future excess over current car trips	-	4,197	11,021	6,178	16,168	8,583	22,942
Car Mode Share Target for “No Car Growth”	75%	57%	41%	52%	34%	46%	28%
Total trips	18,129	23,774	32,919	26,407	39,716	29,586	48,627

For a “No Road Capacity Increase” vision, the calculations in Section 4.2 showed that the intersections Gardeners Road/ Botany Road and Euston Road/ Sydney Park Road would require mode shift in order to maintain a maximum of 90% saturation. Table 10 shows the number of car trips to be shifted and the consequential mode share targets.

Table 10: Indicative mode Share targets under a “No Road Capacity Increase” vision

	Existing capacity	Low growth		Medium growth		High growth	
		2021	2030	2021	2030	2021	2030
Trips exceeding 90% saturation		6	1,326	238	2,050	558	3,352
“No Road Capacity Increase” Indicative Car Mode Share Targets	75%	75%	71%	74%	70%	73%	68%

While the “No Car Growth” vision requires significant mode shift from car trips to public and active transport modes (a change from an existing 75% mode share to 34% for medium growth by 2030), the alternate “No Road Capacity Growth” vision is achievable; but still requires deliberate modal change (to 70% for the same medium growth by 2030 scenario). Either scenario requires increased public transport to cater for natural increase in bus patronage for maintenance of mode share plus the mode shift (see Section 4.3). However, this “No Road Growth” scenario merely consumes the available road capacity with no recognition of community or environmental sustainability.

5.3 Potential bus services

The increase in employees and residents following development in the study area will lead to an increase in demand for public transport. The Green Square TMAP highlights the need for a significantly higher non-car mode share to accommodate additional traffic volumes, and identifies public transport in general and bus services in particular as a key option.

As detailed in Section 2.5.1, route coverage of the study area is currently lacking along O’Riordan Street, there are no regular (cross-regional) east-west services, and no connecting services with the closest railway stations. To overcome these deficits, bus connections between the study area and nearby railway stations, as well as direct bus services to neighbouring residential areas and key destinations such as the Sydney CBD could be provided.

Opportunities for routing through the study area would be subject to the LTTMP’s theme of a one-way pairing of Bourke Road/ O’Riordan/ Botany Street. However, no timeframe for this has been identified and additional transport capacity will be necessary to satisfy short-term projections under all growth scenarios.

To improve accessibility for the study area and identify likely service capacity, three indicative new bus routes are suggested. These routes reflect proposed development densities and absence of available services. They would improve accessibility from the railway stations in and around the study area by providing services between stations through the area. The indicative routes are shown in Figure 20 below, in addition to existing services.

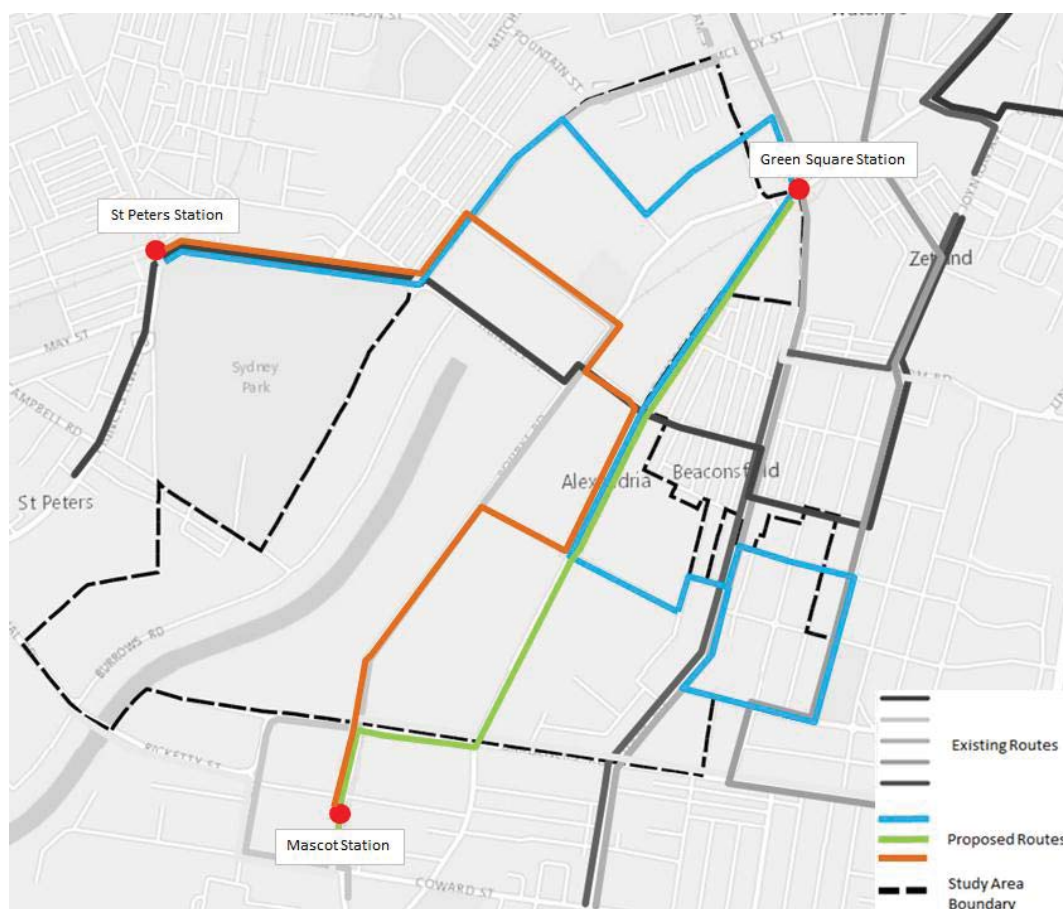


Figure 20: Indicative new bus routes

Assuming such routes operate at 10-minute headways during the peak periods (and 15-minute headways off peak) this would deliver additional 18 buses per hour in the peak periods. Based on the average standard bus size operated by Sydney Buses (55 passengers capacity per bus), each of these routes would be able to carry 330 passengers per peak hour/ 220 passengers per off-peak hour into the study area. This could accommodate 1,980 trips in total per AM peak 2-hour period.

To evaluate whether these additional bus services could accommodate increased future demand, the additional bus demand under current mode share and the number of trips to be shifted from car under the growth visions were estimated.

Table 11: Additional bus capacity for growth visions

	Low growth		Medium growth		High growth	
2 hour volumes	2021	2030	2021	2030	2021	2030
Additional future bus trips required to maintain current mode share	245	594	349	839	466	1,141
“No Road Growth” Mode shift from cars	6	1,326	238	2,050	558	3,352
Total additional future bus trips required to achieve “No Road Growth” mode share	251	1,920	587	2,889	1,024	4,493
“No Car Growth” Mode shift from cars	4,197	11,021	6,178	16,168	8,583	22,942
Total additional future bus trips required to achieve “No Car Growth” mode share	4,442	11,615	6,527	17,007	9,049	24,083

The capacity of the postulated bus services is shown above at 1980 trips in total per AM peak 2-hour period. Table 11 shows that under the “No Road Growth” vision, all growth scenarios could be accommodated to 2021 entirely by additional buses, but only low growth beyond to 2030. Other initiatives would be required for Medium and High Growth scenarios to 2030. That said, the actual route for the services would depend on the pace and distribution of the growth.

Postulated buses alone would be inadequate for all growth scenarios under a “No Car Growth” scenario. The number of trips to be shifted under a “No Car Growth” vision is significantly higher in all growth scenarios than the additional capacity that could be provided by the three indicative bus routes. Significant additional mode shift is required to other forms of sustainable transport options to achieve any of the scenarios.

It is important that all new services are operational as new users enter the study area. This is necessary to encourage the adoption of public transport as the preferred travel means from the outset, rather than trying to alter travel patterns once they have been established.

5.3.1 Potential service operations

There are three different themes for operating additional bus services:

- Embed within existing services.
- Operate services by the City.
- Provide opportunity for community development of services, such as through a Transport Management Association (TMA) for the precinct to supply and manage appropriate services.

Embed within existing services

The proposed bus routes could be embedded into the existing bus network, operated by Sydney Buses, either as new routes or as add-ons to existing bus routes. As the existing routes already serve a range of existing travel demand, modifying the route to service the suggested loops would undermine their attractiveness for the wider markets they are serving. All changes would have to be agreed with Sydney Buses and TfNSW.

Services operated by the City

The City might choose to operate the bus services themselves. There are a number of Council initiated bus services in Sydney that provide precedent for such an approach, including:

- The Artarmon Loop (Willoughby City Council) – <http://www.willoughby.nsw.gov.au/community/Traffic---Transport/Artarmon-Loop/>
- The Mosman Rider (Mosman Council) – <http://mosmanrider.net/>
- Hop Skip Jump Bus Manly (Manly Council) - <http://www.manly.nsw.gov.au/attractions/transport/hop-skip-jump-bus/>
- Top Ryder (City of Ryde Council) – <http://www.ryde.nsw.gov.au/Living+in+Ryde/Getting+Around/Top+Ryder+Community+Bus>

Those services are usually provided as a free service for passengers. They are operated on regular frequencies throughout the day using small buses. While the Mosman, Manly and Ryde services dominantly operate between residential and retail areas, the Artarmon Loop service operates between a rail/bus transport node and an employment zone, and was established prior to major commercial/industrial development as a condition of planning consent. It embraced the need to generate a viable service prior to the rezoned employment increase, and thus stimulate low car use at the outset.

Transport management associations

Transport Management Associations (TMA) are public/private partnerships (PPP) between state and local government and local businesses. They are formed to enable employers, developers, building owners, and government entities to work collectively to establish policies, programs and services that address local transportation issues and foster economic development. These could include tailored transport strategies and communications, transport services, workplace policies, parking policies and end of trip facilities.

TMA's are established within a limited geographic area to address the transportation management needs of their members and are typically non-profit organisations. They require multiple funding sources including government grants, developer funding and membership fees.

TMA's have been formed successfully, particularly in the United States since the 1990s. The first TMA in NSW, "Connect Mac Park", was introduced in 2013 following the success of the Optus Travel Plan. The TMA is funded by the New South Wales government, the City of Ryde, participating employers and institutions.

Whilst the concept of TMA's is relatively new to NSW, they may provide a good opportunity for the City to partner with relevant stakeholders to approach potential access and mobility challenges in the study area. It is recommended that a feasibility study be undertaken to assess the suitability of a TMA in the area, particularly given the diversity of land ownership and the difficulty of property consolidation.

5.3.2 Service funding

Options for how services might be funded could include:

- Absorb the operational costs within the Sydney Buses operating framework.
- Where there is potential, fund the services through a contribution plan.
- Fund the bus services using local parking revenue or similar sources.
- Outsource operations to the TMA.

In all cases, seed funding would be necessary to support the services in the beginning and ensure that the services are available for users to change modes.

5.4 Parking management

Chapter 2.7 describes existing parking access within the study area, which is comprised of approximately 2,400 (15%) on-street and 14,000 (85%) off-street parking spaces. It also highlights the high ratio of unrestricted parking spaces per job, averaging 89% across the study area. Whilst increased roads in the study area will increase permeability, they will also further increase kerbside parking if not designed appropriately.

Parking management is a key element in influencing a shift to modes other than the private car, a shift that is necessary to support the envisaged development potential. Parking management options include adjustment of parking rates associated with development approval, which could be reviewed as accessibility by public transport improves over time, and implementing time restrictions to new and existing parking that would provide for visitors but discourage employee parking so long as alternatives travel exist.

These need to be implemented in consort with improved alternatives to private car trips.

5.4.1 Consideration of parking rates

The City uses a “maximum provision of parking spaces” approach in Sydney Local Environment Plan 2012 (LEP). The approach categorises sites based on their accessibility to public transport and/or service and prescribes a parking rate for a range of land uses based on the accessibility categorisation.

In the main, the study area is currently identified as Category C on the Land Use Transport Integration Map (LUTI map), which guide parking rates for residential development, and Category F on the Public Transport Accessibility Level Map (PTAL map), which guides parking rates for non-residential development. Category C and Category F, having the lowest accessibility ratings, allow for the highest parking rates available in Sydney LEP 2012.

With the proposed significant increase in job numbers in the study area, it is important that opportunities to discourage relatively high amounts of parking being provided with new development be explored. As accessibility improves in the study area, the accessibility categories prescribed to the study area should be reviewed with a view to applying higher accessibility ratings. As existing parking supply is high (both in real numbers and as a percentage / ratio), this approach may result in a more moderate growth of overall parking spaces as new development comes online.

While parking rates for retail premises in Sydney LEP 2012 do not currently distinguish between parking for employees and parking for customers, there is potential to explore this. This could enable the turnover of employee parking to visitor parking. This may encourage mode shift for employees without diminishing the attractiveness of the area for retail. There is also potential to explore how time limited visitor parking might be encouraged.

Irrespective of the parking rates however, as part of the planning application process, developers should continue to be encouraged to offer sustainable transport options for employees and visitors, such as is the case in the City's current development control plan that requires the preparation of Green Travel Plans.

Current parking policy reflects a paradigm that off-street residential parking provision implies commuting car trip generation. Lower trip generation from higher density, transit-oriented developments confirm that this paradigm may no longer be an appropriate benchmark. Parking management systems are a common element in residential building design. Time-of-day parking access management can control time of access, and divorce parking space from peak period trips. Thus, peak-period commuting can be restricted, while not curtailing non-peak travel. In considering parking rates, this paradigm change should be recognised.

Car share schemes also provide reduced parking requirements while supporting accessibility. Provision of car-share spaces within new developments, as currently required under the City's development control plan, is an appropriate support for this emerging access approach. Similarly, car-pooling initiatives reduce parking requirements, as well as reducing trip demand. Preferential carpooling parking needs to be integrated within reconsideration of parking rates.

Similarly, retail outlets might require less parking if served by local or community bus services. Delivery of purchased product does need to be catered for, such as through home delivery services, to ensure retail viability. In this context, accessibility needs to embrace both people and product. An integrated approach to parking provision and accessibility would need policy development.

These non-traditional approaches to parking provision clearly support the City's sustainable travel objectives, but require ongoing policy development.

5.4.2 Investigation of on-street parking restrictions

The study area already provides around 2,400 on-street parking spaces and the proposed road network additions provide further kerb space with the potential for additional parking spaces. As on-street parking is generally free and only partly restricted, the City has the opportunity to review current parking restrictions and make changes. The City's draft Neighbourhood Parking Policy recommends on-street controls of "2P 8am-8pm Monday to Friday" in standard residential areas and ticketed parking in commercial, office and showroom areas.

Changes to the existing parking restrictions should be made in consort with the introduction of initiatives to incentivise mode shift (e.g. additional or upgraded infrastructure, additional public transport services etc.).

5.5 Pedestrian and cycle network

The current mode share of walking and cycling is around 5% and offers potential for mode shift away from car travel, either by trips undertaken exclusively by walking or cycling or in combination with a public transport trip. In order to achieve this, the pedestrian and cycle network in the study area requires some improvements to improve amenity for walkers and provide better access to and within the study area as well as to public transport interchanges.

The current cycle network into and through the study area provides excellent conditions along Bourke Road, Bowden Road and Mandible Street where separated bike lanes have been installed. The area is also well connected with other destinations via dedicated cycle routes. The network's main limitation is the lack of permeability in an east-west direction, with the Alexandra Canal, for example, acting as a significant barrier.

Access to railway stations for pedestrians and cyclists are difficult. This has been recognised for Green Square Station and Mascot Station. The Green Square TMAP specifically identifies the need to improve pedestrian access to the station and requests more prominent bicycle parking facilities. The suggested intersection upgrades and realignment of Bourke Street would help to achieve this. The Mascot TMAP does not specifically identify the need to improve pedestrian and cycling accessibility to the station.

Regular pedestrian crossing facilities at key roads should be available throughout the study area. In Section 2.6, a number of key connections and locations have been discussed regarding crossing facilities, including:

- Bourke Road.
- O'Riordan Street.
- McEvoy Street/ Euston Road.
- Green Square Station.
- Roundabout Euston Road/ Sydney Park Road.
- Burrows Street.

Regular crossing facilities should be made available to all these, especially in the southern section of the study area where distances between crossing facilities can exceed 600m. Appropriate locations for such crossings would be at the intersections with east-west connections. Whilst blocks along Bourke Road and O'Riordan Street are often large, the newly proposed road network additions would also provide an opportunity for new crossing facilities at the created intersections. In addition to this, appropriate mid-block locations should also be evaluated.

Any additional pedestrian crossing facilities at signalised intersections would require the introduction of a new phase. This might have an impact on the performance and the Level of Service of the intersection and requires further investigation and negotiation with relevant authorities to ensure sufficient operating capacity on key roads is maintained.

The City's Cycle Strategy and Action Plan already address the lack of east-west connections by proposing a number of new links through the study area. Whilst it is important to provide cycling facilities within the study area to facilitate cycling, it is equally important to ensure the study area is well connected to the wider cycling

network and provides good cycling links. Figure 21 shows the existing cycling facilities and links in the vicinity of the study area. There are some facilities provided for cyclists, however, the majority of these links are shared paths (e.g. along Gardeners Road or Canal Road/ Ricketty Road), not separated and dedicated cycle paths.

To improve linkages into the study area and facilitate a higher mode share for cycling, the City's existing work to establish the following connections should continue:

- Extension of the Alexandra Canal Cycleway northbound into the study area
- Extension of Bourke Street Cycleway southbound to connect with Bourke Road.
- Link into Eastern Suburbs across Eastern Distributor either along Gardeners Road or Epsom Road.
- Link towards Erskineville/ Newtown via Huntley Street/ Sydney Park Road.

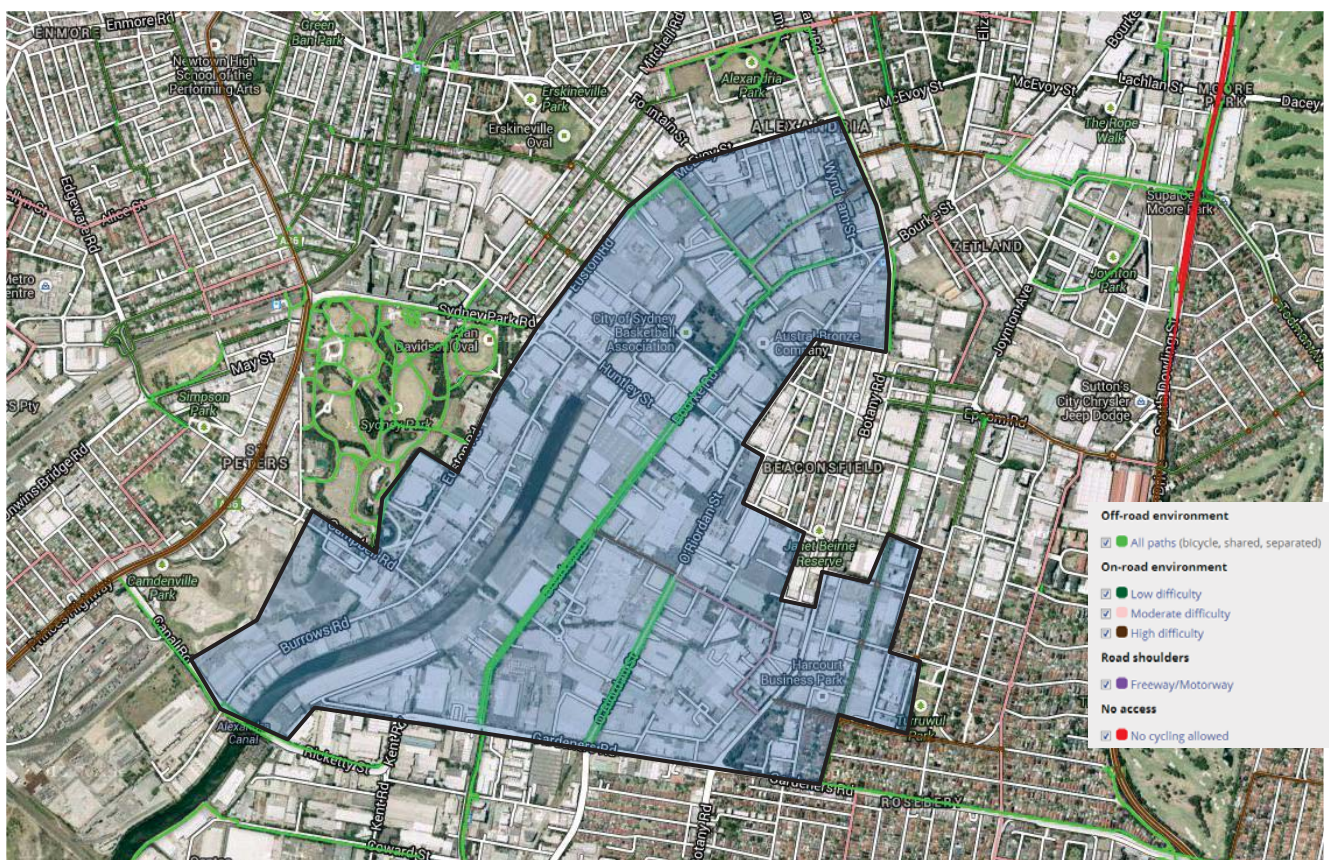


Figure 21: Cycling links into study area

Source: http://www.bicycleinfo.nsw.gov.au/maps/cycleway_finder.html

6. Recommendations

This transport assessment has been conducted as a desktop analysis. As such, it is unable to accurately quantify impacts on traffic and transport as a result of the proposed rezoning. Rather, it aims to provide an indication of the scale of the impact and the necessary mode shift required to accommodate the travel demand from the proposed development scenarios.

6.1 Determine appropriate development controls recognising achievable mode share targets

In order to successfully develop future transport strategies, it is important to establish a growth vision that relies on achievable mode share targets. In Section 5.1 two growth visions were discussed, a “No Car Growth” vision and a “No Road Capacity Increase” vision. The “No Car Growth” vision is consistent with the current Green Square TMAP approach and the most sustainable in the long term. However, the mode share targets associated with this “No Car Growth” vision would require significant mode shift. Achieving this mode shift will be challenging and require substantial local and state policy intervention, even for the low growth scenario. Transport infrastructure and significant alternate services would be required, as well as improved pedestrian and cycling infrastructure.

By comparison, the “No Road Capacity Growth” vision is only suitable in the short-term, and has no long-term sustainability.

On a strategic level, appropriate development controls (land use and density) should be developed recognising achievable mode share targets. While the mode share targets suggested by this study are provided in the absence of quantitative information on rail and bus spare capacity servicing the study area, they are appropriate to guide policy development in the short term. Longer term, as more information becomes available about the key transport drivers in the area, it is recommended a review of the mode share targets be undertaken. The review should incorporate a quantitative capacity assessment of available bus and rail services serving the study area. Any long-term development that is greater in the study area than the postulated Low Growth scenario will require re-evaluation in the light of such mode capacity assessment.

6.2 Immediate considerations

This study also recommends a range of immediate considerations to guide appropriate development controls in the area, including:

- Explore the potential for TMAs and other forms of transport servicing models that promote mode shift.
- Undertake a review of accessibility categories to inform parking rates in the study area.
- Explore mechanisms for differentiation between employee/visitor current parking supply.
- Undertake assessment of local area traffic management needs and development of a local area traffic management plan.
- Advocate to the state government the provision of suitable sub-regional transport infrastructure, to accommodate growth in the study area and the adjoining new growth centres.
- Explore the potential for additional crossings over Alexandra Canal.
- Review on-street parking management.

6.3 Provision of additional bus transport

Additional bus services to serve the study area will be essential to serve the increased travel demand arising from the increased employment and residential density. This would involve introduction of additional cross-regional bus routes that serve the spine of the study area better, and allow interchange at railway stations.

Seed funding of improved bus services will be necessary to ensure that the services are available as new and changed development comes on stream, providing employees and residents with viable choices at the outset.

Bus operational aspects need to be reviewed, including funding and seed funding strategies.

6.4 Encourage walking and cycling

To increase the mode share of walking and cycling, the following recommendations are made:

- Create additional road connections, particularly in an east-west direction to improve the permeability of the study area and reduce the impact of local traffic on the main roads in and bordering the study area. This may include investigating a new crossing facility over the Alexandra Canal.
- Improve access to public transport interchanges and bus stops.
- Introduction of new cycle way connections and the extension of existing cycleways to improve connecting the study area to the wider cycling network.
- Implement pedestrian facility improvements at the intersection of Bourke Road/ O'Riordan Street at the Green Square train station (as planned), and the roundabout at Sydney Park Road/ Euston Road.
- Introduce improvements to amenity to encourage walking and cycling, for example by widening footpaths or providing a cycle/pedestrian path along the City's Liveable Green Network.

6.5 Transport management association

Investigate the feasibility of a transport management association (TMA) in the study area. Whilst a TMA could potentially not be established until significant parts of the development are underway, the elements required to underpin its successful introduction can start now.

6.6 Parking

Parking management initiatives need to be implemented within a revised policy frame. Initiatives to be considered for the study area include:

- Consideration of parking rates to encourage mode shift, including periodic review of LUTI/PTAL accessibility categories and the potential for greater time managed visitor parking for retail developments.
- Consideration of on-street parking restrictions, potentially introducing new parking restrictions and managed parking.

6.7 Future analysis

As recognised by this Study, the study area is in a strategic location that is impacted by major trip generators. There remains varying levels of uncertainty about how these substantial traffic and transport drivers might impact the area in the future, for example:

- WestConnex, and the location of its entry and exit portals, will likely have a profound impact on the study area. While it is understood RMS are modelling the likely outcomes of various scenarios, no information is available to the City at this time.
- The Mascot Town Centre, which is currently on hold until the WestConnex is more certain, will affect both market development and transport access. Whether the study area or Mascot Town Centre takes precedence is a matter for the City to initiate.
- The development of the Western Sydney Airport will likely impact on the function and transport demands on Sydney Airport and by extension the study area.
- Growth at Sydney Airport.
- A second rail crossing of Sydney Harbour will be required to alleviate capacity pressures at Green Square and Mascot train stations.

- Take up of development opportunities in the study area itself as rezoning is introduced.
- Potential introduction of a one way pairing on Bourke Road and O'Riordan Street, as identified in the LTTMP.

It is premature to undertake detailed modelling and assessment of cumulative transport impacts of subregional growth until at least most of these factors have been resolved. As more information becomes available, more nuanced modelling should be undertaken to establish long-term mode share targets and strategies to achieve mode share targets. Any future model should provide a sound basis for the City to make independent planning decisions. It is noted that much of this modelling is currently underway by RMS and will closely inform future modelling for the area.