Figure 4-4 Sydney Bus services adjacent to key sites

Table 4-5 State Transit bus routes in Study Area

Route No.	Origin and Destination	AM Peak Frequency (services / hour, 8-9 am)
352	Marrickville Metro – Bondi Junction	3
308	Marrickville Metro – Millers Point	3
309	Port Botany – Circular Quay	4
310	East Gardens – Circular Quay	4
422	Tempe – Circular Quay	4
423	Kingsgrove – Circular Quay	6
426	Dulwich Hill – Circular Quay	5
428	Canterbury – Circular Quay	6
370	Leichhardt – Coogee	6

The bus passengers are predominantly through passengers to the CBD, but heavy interchange with rail does occur here, particularly for employees travelling to the South Central Industrial areas between Redfern and the airport, such as Beaconsfield, Mascot and Botany. The peak movement is quite early, between 7 and 8 AM. The road network, however, is not well suited for interchange or the convenient placement of bus stops for passengers. Over the years, several proposals have been put forward to improve transfer conditions for passengers, but cost, lack of suitable land and a falling demand for interchange as areas redevelop have lead to few improvements. As well as the CBD, major destinations served by the buses in the strategic bus corridor include the Rocks, Newtown, Marrickville, Eastgardens, Mascot, and Port Botany. Along Cleveland Street, there is service to East Sydney and Bondi Junction, Newtown and Marrickville. City Road/King Street contains services to Coogee, UNSW, Glebe, Leichhardt, Kingsgrove, and Canterbury.

This area is well served by transit services, although the passenger facilities are generally poor for waiting and identifying service points. Considerable passenger benefits could be achieved by looking at the passenger infrastructure, as the service levels are already in place. Traffic demands have caused some stops to be poorly placed for safe pedestrian access, especially in regard to crossing streets. Splitting the buses between Gibbons and Regent Streets does reduce the legibility of the system. There are connecting laneways, and distances are not burdensome, but identifying how to reach stops can be difficult.

4.5.3 Taxis

Taxis are easily obtained in the area during business hours, although it can be difficult to hail one at night. Due to the number of demands on kerbspace close to the Station, taxis are difficult to flag close to the station exits.

4.6 The pedestrian network

The structure and coverage of the pedestrian network is good and highly accessible, and the main routes are likely to remain as they are. Lawson and Redfern Streets are the main east/west links, as the rail lines curtail any others. Gibbons Street's western footpath carries a heavy volume of pedestrians to the Station and bus services. Because of the low activity level along the rail side of Wilson Street, pedestrians are more likely to use Abercrombie Street to get to the University, Newtown or Macdonaldtown. Pedestrians heading to Redfern are more likely to use the signals at the closed portion of Redfern Street than Lawson Street, apparently due to the dogleg at Regent Street which is heavily dominated by vehicular traffic. This causes most pedestrians to cross Regent Street to the south side of Redfern Street.

Approaching the Redfern Railway Station, there is little shelter for pedestrians from wind, rain or sun. Pedestrian connections to North Eveleigh from the Station are indirect. Footpaths along Regent Street have more active frontages than those on Gibbons Street.

4.7 Bicycle networks

The sites are well located to major centres of population and employment to be within a feasible length for good levels of bicycle travel. There is a good bicycle network, in terms of coverage and directness, despite the divisiveness of the rail lines. In fact, the rail line does provide some benefits by cutting cross-traffic along routes like Wilson Street and Henderson Road. This is shown in Figure 4-5 (overleaf). Most cycle routes are on-road, so there can be conflicts with on-street parking movements and large vehicles as lanes can be less than best-practice widths. There is a long stretch of off-road route through the ATP. Given the bus and parking activity in Redfern Street, alternate cycle routes have been proposed along parallel lane ways, but the issues of how cyclists would cross the arterial roads has not been addressed.

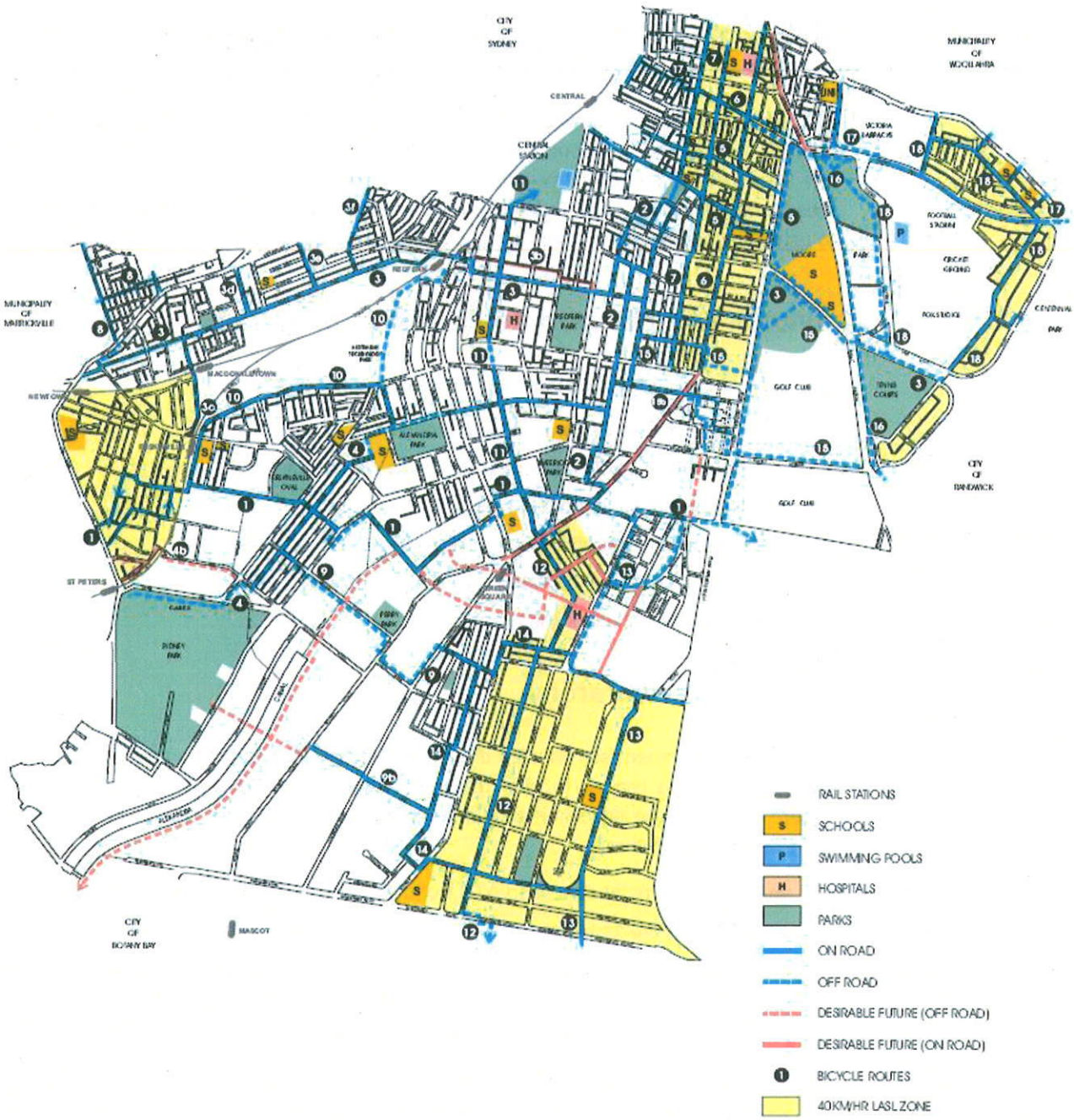


Figure 4-5 Local Bicycle Network as developed by South Sydney Council

5. Proposed transport and traffic strategy

The key elements of the proposed strategy follow, but the formula of calculated provision of on-site facilities and contributions to off-site facilities will be subject to negotiation on each site based on its merits. The points of consideration are likely to be the significance of these large blocks of urban redevelopment and the relatively large differences in propensity to use public transport that even small differences in access distance can generate.

5.1 Aims of the transport and traffic strategy

Key aims of the strategy, as indicated in the draft BEP are:

- redevelopment of Redfern Railway Station
- management of traffic generated from new development
- improved connections to bus services
- improved traffic operations along Regent and Gibbons Streets
- improved connections between ATP and North Eveleigh
- safe and easy cycling in the area.

5.2 Future road hierarchy

The road environment surrounding the RWA strategic sites is stable and established. There appears to be no reason to alter the road hierarchy in the area from what is shown in Figure 4-1, but there are some supplementary links proposed for the future that need to be considered in the future:

- an additional, major access to ATP from Henderson Road, which is under construction.
- a more direct link between the ATP and the CBD via Boundary Street.
- a potential vehicle tunnel linking ATP and North Eveleigh that would cater to local, circulating traffic as it would not be well connected to the arterial system
- restrictions on parking to increase the traffic capacity of Shepherd Street.

Some of the benefits of the existing hierarchy are that it would:

- restrict bus services to the arterial road network, and concentrate them whenever possible in the Strategic Bus Corridor so services become more frequent
- Gibbons and Regent Streets to remain as arterial roads regardless of any traffic measures
- encourage marked cycling routes on direct, connector streets for the convenience and safety of cyclists, although all public thoroughfares may be used by cyclists
- all the streets in the area are urban and must accommodate pedestrians in safety and without capacity restrictions. Walking conditions should be enhanced by lighting, set backs from fast moving traffic and improved weather protection, especially at areas where pedestrians congregate to cross a street.

The City of Sydney works along Redfern Street to improve amenity and the streetscape present an opportunity for the area. Integrating transport planning initiatives from RWA to reinforce this upgraded pedestrian corridor will be pursued, but so will maintaining the performance of the route for bus services.

5.3 Public transport improvement program

The key public transport initiative is the proposed future upgrade of Redfern Railway Station and its improved accessibility to surrounding sites so they can be transit oriented and low in their generation of car traffic. The investment will not only improve the attractiveness of rail travel, but interchange trips will benefit and pedestrian conditions will improve. This process has started with the appointment of the design team, but the decisions of this effort will guide the supporting public transport services.

The RTA has indicated its future role to upgrade Gibbons and Regent Streets as bus routes, as it rolls out the strategic bus corridor program. It is recommended that this program should not only look at the more efficient movement of buses, but the more efficient movement of passengers to and from buses. This would make buses and rail trips more attractive and pedestrian trips more direct and safer for all walkers, not just passengers. Given the closeness of the station to the CBD, a major interchange is not warranted so close to Central Interchange, but a more direct interchange with fewer road crossings should be considered.

Taxis need to feel operations are safer in the area at night. Actions to address this issue should be worked out through the Taxi Council, MoT and RWA. Careful placement of taxi stands and extending security from sites to their adjacent footpaths may be explored.

Coach use should be encouraged for visiting groups to the area, with door-to-door drop off, but long term parking could be considered at ATP.

5.4 Pedestrian and cycle networks

All roads in the areas should be available to cyclists and pedestrians as this is a highly dense urban environment. Trip distances to major employment and residential areas are conducive to walking and cycling, and the infrastructure networks should support this. High capacity/profile routes are still going to be identified for each mode, to capitalise on directness, activity levels, security and grade.

To capture the full community development benefits of the Redfern Street upgrade by the City of Sydney, the Redfern Street axis has to be strengthened. Ideally, it would extend directly over the rail lines and become the core pedestrian thoroughfare serving all major destinations in the northern part of the RWA area. Until then, Lawson Street will remain the hub of pedestrian movement. In the longer term its role may be diminished, but it will remain an important connector, especially for pedestrian destinations north of the Station.

While the improvement of the Station is likely to enhance pedestrian accessibility to all the key sites, full advantage cannot be achieved until there is a comprehensive directory information system. This would have a static sign core program, but may be supplemented with variable message signs that could also carry transit information and means of enhancing perceptions of personal safety.

Off-road cycling opportunities would be enhanced through North Eveleigh as they have been through the ATP. A shared zone concept connecting through the North Eveleigh site would be a successful link for pedestrians and cyclists. Upgrading these areas' connections to the local road network would also benefit cyclists, as well as motorists. The major east/west route of Wilson-Lawson-Redfern Streets may be enhanced through minor infrastructure treatments improvements in the short term. In the longer term, this route might be improved by any local direct traffic connections between North and South Eveleigh which could reduce traffic flow across the Lawson Street Bridge, or offer pedestrians and cyclists an alternative link that was more direct to Redfern Street.

Supplementary connection for cyclists should be sought in the upgraded vehicle-free rail crossings to be associated with the redevelopment of Redfern Railway Station. Secure bicycle parking can encourage cycle/transit interchanges in the Lawson Street area.

5.5 A traffic model

In the intermediate period, the RTA's South Sydney Paramics traffic model will be available to the RWA to calibrate to its forecast development levels so it may test a variety of options for changing and improving the road network. This would provide a consistent assessment basis to look at suggested projects such as a Gibbons Street underpass at Lawson Square, altering directions of traffic flow, adding or removing connections and intersections into the road hierarchy and altering on-street parking controls.

5.6 Draft parking policy

State Regional Environmental Plan 26 - City West applies to the Eveleigh precinct and encourages the use of non-car modes such as public transport, walking and cycling. New developments in the Eveleigh precinct were directed to take advantage of Redfern Railway Station as the major regional access point to public transport. The provision of on-site car parking within the precinct was strictly controlled to shift travel to public transport. Land use zonings in the area were set to provide employment and facilities to encourage people to work and live in the same community, and to ensure re-development was compatible with the traffic capacity of the precinct.

The area's most recent controls on parking are embodied in the former South Sydney Council's DCP 11 which aimed to reduce the level of vehicular travel in the area by reducing parking requirements within developments and improving facilities for pedestrians, cyclists and public transport users. On-site parking was only permitted at levels to control parking demand overflowing into surrounding streets. Provision of on-site parking above the rates was not permitted, while under-provision was considered where sustainable.

The City of Sydney is preparing a revised Parking Code, due for release in 2006. Limited information was available on this process, but the approach was expected to be similar to the former South Sydney code. Council's intentions on parking may be inferred from the Sydney Local Environmental Plan, 2005. Chapter 2, Part 5 – Car Parking, stated that encouragement of private vehicles for commuting to Central Sydney was inconsistent with its ecologically sustainable development objectives, and the environmental amenity of the city and its region. The parking provisions in the LEP were intended to discourage commuter parking by restricting the supply of tenant and public parking facilities, while parking levels to facilitate business and residential activities were maintained at a reasonable level.

It is recommended that the principles within DCP 11 be adopted for setting parking levels within the key strategic sites, but that each site be considered on its own merits for alternative transport access and how it would fit within the overall parking supply for the area. This approach would be consistent with the approach we understand being considered in the Metropolitan Parking Policy.

5.6.1 On-site Parking requirements

The following policies/documents present information regarding car parking provisions and calculations applicable to the RWA's strategic sites:

- South Sydney Council DCP 11 - Transport Guidelines for Development
- RTA's Guide to Traffic Generating Developments
- Eveleigh Carriageworks TMP
- Australian Technology Park: ATP Parking Policy and Management (quoting the revised ATP Master plan 1998)
- City of Sydney Council – Sydney LEP 2005. Chapter 2, Part 5 – Car Parking.

The specific calculations regarding car parking were extracted to the following tables. The rates in these tables only relate to the land uses proposed for the RWA strategic sites.

5.6.2 Comparison of Parking Rates

A number of potential parking codes could be applied to this site in the future as they have been applied in the past. These rates are discussed below with the intent of discovering which would best address the objectives of the transport strategy. The first is discussed is the DCP that applied under the former South Sydney Council. This code set a maximum level that could be accommodated on site, and allowed proponents for individual sites to argue for a lower provision if there were circumstances where fewer parking spaces could be supported with out leading to local parking problems.

Table 5-1 South Sydney Council DCP 11 - Transport Guidelines for Development

DCP 11-Table 1. Residential and Casual Accommodation	
Domestic Dwellings	**Car Parking**
Single dwelling houses and terraces	1 / dwelling
Buildings with more than 2 individual dwellings	1 / dwelling
Residential Units and Town Houses	**Car Parking**
1 Bedroom Units and Bedsitters	0.5 / unit
2 Bedroom Units	0.8 / unit
3 or More bedroom Units	1.2 / unit
Separate visitor parking	1 / 6 units near entrance

DCP 11-Table 1. Residential and Casual Accommodation	
Tourist Accommodation	**Car Parking**
Tourist and private hotels, serviced apartments. Refer food, entertainment and health (table 3) for ancillary bar and dining facilities, and pub hotels	¼ rooms (1st 100), then 1/5 rooms + ¼ staff
Backpacker hotels	Greater of 1/15 beds or 1/5 rooms
Motels	1/room
DCP 11 Table 2. Office, Commercial & Industry	
Office & Commercial	**Car Parking**
Office & Commercial	1 / 125 sqm GFA, 20% allocated to visitors
Retail Developments	**Car Parking**
Auction Rooms	Greater of 1/3 seats or 1/10 sqm GFA + pre-auction storage treated as warehouse
Shopping centres	Survey based assessment needed
Markets	1/stall (stall-holders) + 1.2/stall (patrons)
Small shops	1/50 sqm GFA
DCP 11 Table 3. Food, Entertainment & Recreation	
Food & Beverage	**Car Parking**
Cafes	1/50 sqm (1st 100 sqm), then 1/18 sqm
Hotel (pub)	1/25 sqm GFA
Reception Premises	1/18 sqm GFA
Restaurants	1/50 sqm (1st 100 sqm), then 1/18 sqm
Take-away food shops (with seating of up to 20)	1/50 sqm (1st 100 sqm), then 1/18 sqm
Sport and Recreation	
Cinemas, Theatres	Greater of 1/12 seats or 1/30 sqm GFA
DCP11 Table 4. Community, Education & Health Facilities	
Adult Education and Enlightenment	**Car Parking**
Art Galleries	1/200 sqm GFA
Cinemas, Theatres	Greater of 1/12 seats or 1/30 sqm GFA
Tertiary education establishments, TAFES etc	½ staff + 1/20 effective full-time students

The CarriageWorks Contemporary Performing Arts Centre introduced an entirely different land use into the area, and one where there was no empirical basis for estimating parking demand. In the transport management plan that accompanied the proposal, the following parking provision was suggested for any future residential components.

Table 5-2 Eveleigh CarriageWorks TMP

Residential
0.5 space per 1-bedroom unit
1 space per 2-bedroom unit and
1.5 spaces per 3-bedroom unit.

Australian Technology Park (ATP) Parking Policy and Management

The ATP is a business employment site. The 1998, revised ATP Master Plan called for on-site parking to a maximum of 1 car parking space per 125 sq m of gross floor area (GFA) of proposed building. That total included a fixed rate of 20% that would be reserved for visitors. Given the projected maximum floor area of around 200,000 sq m of GFA across the ATP, the revised rate would generate a maximum provision of 1,600 car spaces at the ATP, of which 320 spaces would be reserved for visitors. Applying standard conversion factors, this revised parking rate for the ATP equated to 1 car parking space per 104 sq m Net Leasable Area, as some parking codes present their requirements.

City of Sydney Council – Sydney LEP 2005, Chapter 2, Part 5 – Car Parking

While the actual parking codes for the new boundaries of the City of Sydney are under development, the LEP of 2005 does contain several references to parking. In Clause 65 on Tenant car parking provisions it says '(1) Car parking provided in connection with a building must not result in any maximum set out in the following Table being exceeded, except in a case to which subclause (2) applies and results in a greater number:

Table 5-3 Maximum car parking under Sydney LEP

Type of proposed use	Maximum parking on site spaces permitted
Dwelling-houses	2 spaces per dwelling-house
Residential buildings (including housing for aged persons):	
Studio apartments /bedsitters	1 space per 4 studio apartments/bedsitters
1 bedroom apartments	1 space per 2 apartments
2 bedroom apartments	1 space per apartment plus 1 additional space per 5 apartments
Apartments with 3 or more bedrooms	2 spaces per apartment
Hotels and clubs	1 space per 5 bedrooms 4 spaces per 100 square metres of function room area
Cinemas, theatres and recital halls	1 space per 7 seats
Serviced apartments	1 space per 4 studio apartments/bedsitters 1 space per 2 one-bedroom apartments 1.2 spaces per two or more bedroom apartments
Other uses	$\text{Maximum number} = \frac{\text{Total other FSA}}{\text{Total FSA within development}} \times \frac{\text{Site area}}{50}$

Note. Parking for service and delivery vehicles, motorcycle parking, bicycle parking and car parking for people with mobility impairment should comply with the provisions of the relevant development control plan.

(2) The number of tenant car parking spaces that will be available for use in connection with an existing building to which a development application relates is not to exceed the total of the maximum amounts allowed for each particular use that will be allowed in the building, in accordance with the following:

$$\text{maximum number of car parking spaces for a particular use} = \frac{\text{FSA to be allowed for that use}}{\text{Total FSA to be allowed for all uses}} \times \text{Total number of lawful existing car parking spaces for all uses}$$

5.6.3 Preferred Parking Strategy

The analysis of parking policies in the Redfern area showed a consistent intent to restrain parking supply to encourage the utilisation of public transport services such as those available at Redfern Railway Station. The policies also aimed to discourage car use and acknowledge the strong influence that limiting and managing car parking in the area could contribute towards these objectives. This draft RWA parking policy might also adopt these objectives. We recommend the urban policies incorporated into DCP 11 and the CoS parking codes should form the basis of the RWA approach to parking control.

As the Carriage workshops and ATP parking schemes have set provision at levels slightly higher than DCP11, it will be necessary to restrict sites closer to the transport hubs to a lower provision to achieve the target mode share of 60% for non-car travel across the RWA area. The city's LEP contains some provisions that are more restrictive than DCP 11, and for the sites closest to the station, these should be applied when they are more restrictive, and relaxed to levels closer to the ATP approach the further the subject sites are from the station.

Confirmed Parking Strategy Objectives

- encourage the use of non-car modes, such as public transport, walking and cycling by giving access priority for those modes rather than for parking to activities, with the exception of parking for people with mobility impairments
- target of 60% non-car use for journey to work trips over the combined RWA strategic sites
- utilise Redfern Railway Station as a major transport/interchange node for rail, bus, taxi and pedestrian trips
- limit on-site car parking to levels below anticipated demand if no restraint were applied
- apply effective parking management techniques to discourage uneconomic car use
- ensure overflow car parking from the site is appropriately controlled on surrounding local streets in order to minimise impacts on residents in Darlington and Redfern
- manage the use of public parking in a zone over time of day to maximise the productivity of each parking space. For instance, performance demand should not coincide with peak commercial visitors and operators should try to share the occupancy of spaces between the demands

- until the Metropolitan Parking Policy is released, and the City's parking codes finalised, RWA should generally apply the provisions of DCP 11 as its parking code as a maximum to on-site provision. If any bonus floor space is allowed, it would not be considered in the parking requirement or lead to an increase the maximum on-site provision. It should be up to a developer to demonstrate that it is entitled to the maximum allowable on its site because it has done all the required tasks to encourage achievement of the parking code's objectives. Appropriate actions that could be part of a subsequent transport management plan in the project application might include:
  - new facilities for pedestrians, cyclists and transit users on site. These might include footpaths, secure parking, leaning bars, resident/worker showers and lockers, public seats, directional signs to bus stops and station with destinations noted, i.e. –city-bound, or airport, Bondi Junction
  - residential bodies corporate not allowing ownership of car parking spaces, but managing their allocation for a fee and not allowing them to be enclosed. Sub-leasing would be prohibited
  - corporate building owners being responsible for managing all parking spaces and allocating them separately in each lease to a maximum share determined by the floor space leased
  - commercial vehicles being managed as described in the next section
  - provide for commercial management of parking within the Carriage workshops, so when the car parking spaces are not required for performances, they may support other activities in the area.

5.7 Commercial Vehicle Policy

The section above talked about managing the on-site parking for residents and businesses that will be developed in the RWA strategic sites, but there is another important aspect of parking management and that covers visitors to the sites. There will be residential visitors, but the largest class of visitors to the area will be commercial vehicles supporting the business activities that must succeed to reach community development targets. There has to be a balance between the ease of carrying out business in the area and discouraging the inefficient use of commercial vehicles and limiting space to accommodate them.

Some ideas about the management of commercial traffic are reviewed in the following section.

South Sydney Council DCP 11 – Transport Guidelines for Development, 1996

Extract from Section 3.4.2 on Coaches and Car/Taxi Set-down

Taxi, private vehicle and coach drop-off/set-down areas should be provided for larger developments in a convenient off-street location close to pedestrian entrances, with consideration given to the design of the front of the building, safety and interruption to traffic. Desirably, the drop-off/set-down point should be in a porte cochere, designated short stay area or indented parking arrangement to suit the site

Extract from Section 3.5 on Garbage and Service Vehicles

Garbage storage and collection areas should be conveniently located and designed so as not to cause unacceptable on-street conflicts. The servicing area should be designed to suit the projected needs of the development...All vehicles are required to leave a site in a forward direction.

Extract from section 5.4: on Delivery and Service Vehicles: Strategy

Adequate on-site provision for delivery and service vehicle access should be made to facilitate the efficiency of the commercial, retail and other functions of Central Sydney.

Objectives

- *to ensure the appropriate on-site provision for parking of service vehicles*
- *to reduce the use of on-street parking for service and delivery vehicles.*

Provisions

5.4.1 The following requirements apply to new development for the provision of parking spaces for delivery and service vehicles:

(i) Commercial premises	*1 space/3,300 sq m FSA or part*
(ii) Retail	*1 space/350 sq m FSA or part*
(iii) Residential buildings and Serviced Apartments	*1 space for first 50 dwellings/ serviced apartments 0.5 spaces for every 50 dwellings/apartments thereafter.*
(v) Hotels	*1 space/50 hotel bedrooms*
(vi) Wholesale, industrial	*1 space/700 sq m FSA or part*
(vi) Other uses	*1 space for 1,750 sq m FSA or part*

5.4.2 The requirements for commercial premises apply to the first 50,000 square metres FSA of any development. Between 50,000 and 100,000 square metres FSA, the requirements for the balance above 50,000 square metres FSA may be reduced by 50%. For areas exceeding 100,000 square metres FSA, the requirements may be reduced by 75%.

5.4.4 Provision is to be made for courier parking spaces (including bicycle parking facilities) near vehicle entry points and near lifts.

5.4.5 Well positioned signs to parking facilities are to be provided for all couriers, including bicycle couriers.

These control measures are consistent with the intents of the RWA traffic strategy and should be adopted, again as a maximum, in the RWA parking controls.

Innovative proposals for commercial vehicle control in RWA's strategic sites

DCP 11 contained some strong principles which are recommended for application to the key sites. Some additional provisions that could be incorporated into later development applications might be:

- unified dock/receiving areas, especially in mixed use developments, so out of hours deliveries are facilitated, aggregated to cover the largest area possible, including residential uses in a mixed environment
- identified taxi collection points to make use of taxis easier, more secure and space efficient. These are not ranks, but development specific locations for transient use near main doors, near shelter and easily found by taxis
- RWA establishing a Transport Management Board, which it would turn over to be run by the new residents and businesses in the area. The Board would prepare TravelSmart material, tailored for user groups such as new residents, workers, delivery services and visitors. Service providers, such as the station manager from Redfern, the Taxi Council and the Port Botany Depot of Sydney Buses, should also be involved in providing information and in service improvement.

5.8 Recommendations on parking control

The parking controls within DCP11, which was prepared by the former City of South Sydney, contain relevant objectives and codes which are recommended for application to the RWA strategic sites. As the Metropolitan Parking Strategy is under development by the Department of Planning and the City of Sydney prepares its new parking codes, RWA should use DCP11 and the precepts of CoS' LEP. By applying controls to each site to match its particular access characteristics, RWA should be able to achieve its target of 60% non-car journeys-to-work. RWA should also promote these constraint and access to public transport considerations in parking provision to these other agencies as they develop their parking policies.

The control of visitor parking, particularly commercial vehicles, also needs to be managed if traffic impacts are to be minimised in the surrounding communities. Again, the provisions of DCP 11 seem to align with RWA objectives. There may be some opportunities, as well, to look at innovative management methods to further control commercial traffic such as:

- consolidated delivery/dispatch facilities which become more efficient as developments are larger, or act more cooperatively across mixed uses
- clear delineation of public vehicles zones for deliveries, taxis, buses, coaches, etc in common areas to serve multiple demands
- RWA to establish a Transport Management Group to be run by residents and business on the strategic sites once they are occupied.

A related aspect of traffic and parking management is a comprehensive directional system which would minimise circulating kilometres of travel and reduce motorist and pedestrian uncertainty.

6. Application of strategy to North Eveleigh, Redfern Railway Station, Gibbons and Regent Streets sites

6.1 The sites

The first application of the transport and traffic strategy will be to two of RWA's strategic sites. The principles that have been developed through this report will be taken through the traffic impact assessment process on these two sites.

North Eveleigh Site

The North Eveleigh site is bounded by Wilson Street to the north, railway lines to the south, residential and commercial developments to the east and Iverys Lane and a residential area to the west. In the north, it is located within 50m from the Redfern Railway station. The site area is approximately 11 hectares, and has been split into three sections for general land use planning consideration. The eastern section, which has some buildings, zoned for mixed uses, commercial and residential use. The central section contains the heritage rail buildings being reused for cultural and artistic, and training uses. It will contain some off-street parking. The southern zone is proposed for housing. Figure 6-1 shows the site and proposed land uses indicated in the draft BEP.

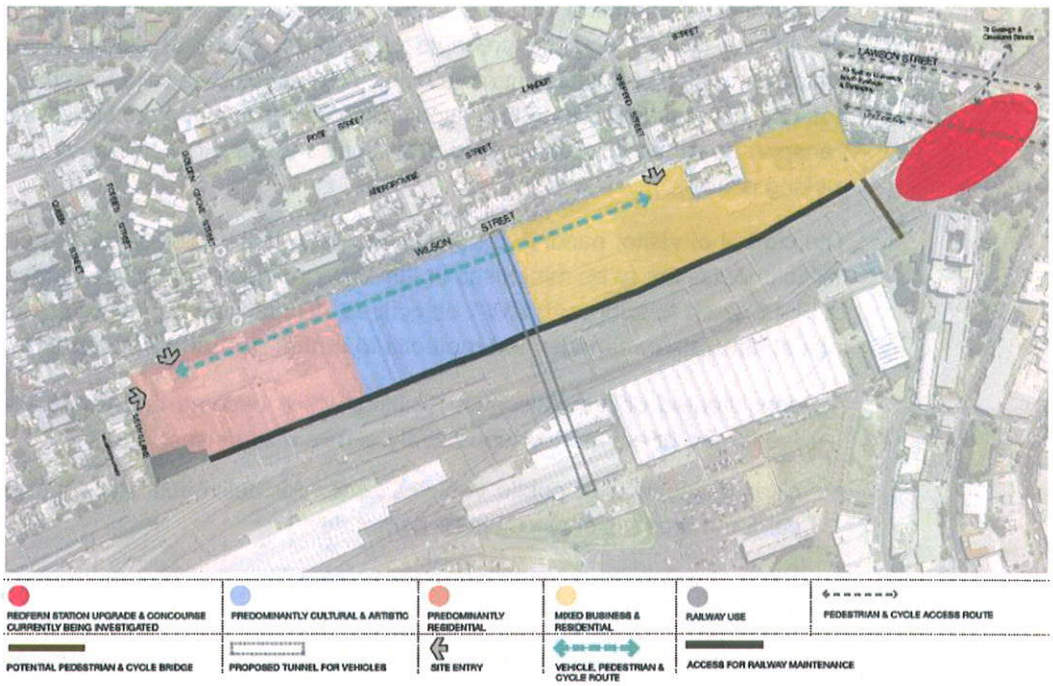


Figure 6-1 North Eveleigh Site with proposed land use zones

Redfern Railway Station, Gibbons and Regent Streets site

This site which contains Redfern Railway Station and its environs, Gibbons and Regent Streets, is bounded by Lawson Street to the north, Margaret Street to the south, Regent Street to the east and railway lines to the west. The City of Sydney's upgrade of Redfern Street project terminates in this site. The proposed redevelopment by RWA would comprise commercial and residential, which is consistent with the current land uses. The site area is approximately 2.2 hectares.

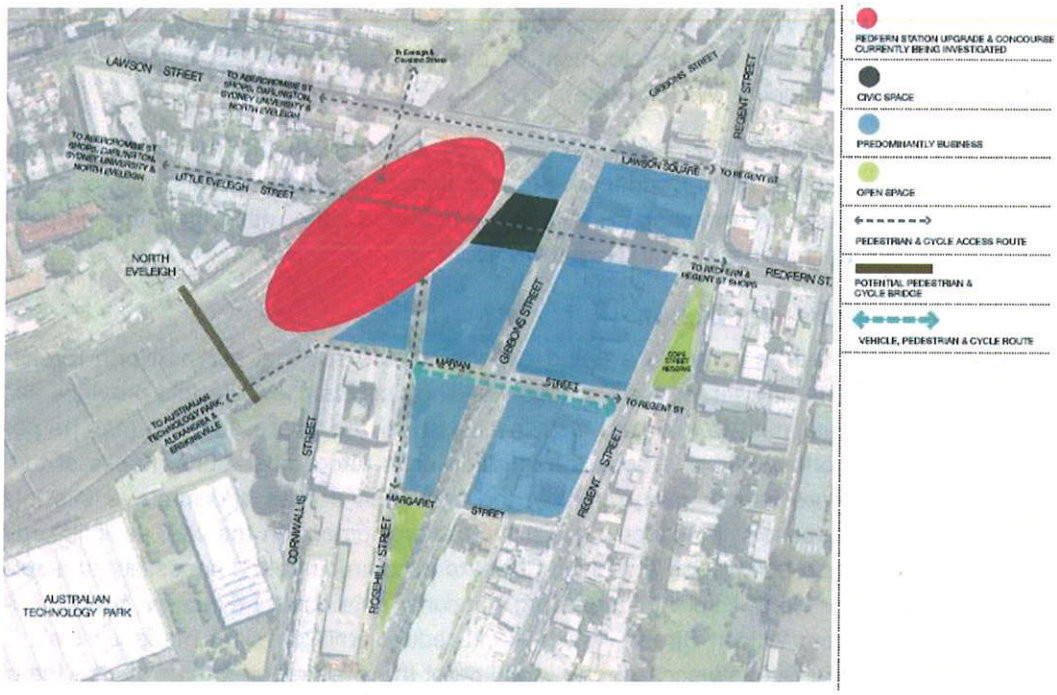


Figure 6-2 Proposed land use zones for Redfern Railway Station, Gibbons and Regent Streets

6.2 Access to North Eveleigh and Redfern Railway Station

6.2.1 North Eveleigh

There is no developed internal roadway through this site, and a formal structure is needed to accommodate existing and proposed development. One of the most important links within the site will be parallel to Wilson Street and the rail lines. In the central section of North Eveleigh, a shared zone is being established between Carriageworks Contemporary Performing Arts Centre and the Blacksmiths' shop In this context, such a design treatment makes traffic and safety sense, but it does leave some hierarchy and circulation issues still to resolve. In the remainder this report, this new connection through North Eveleigh will be referred to under a working title of Blacksmiths' Lane.

In terms of a road design standard, V60kph is suggested at points where the network intersects with Wilson Street. On the site, a low speed of V40kph is recommended. These design speeds will provide a safe and self-enforcing design, although posted speed limits could be less, as Wilson Street is posted presently as 50 kph.

Wilson Street is the frontage street for the site. It provides considerable on-street parking for community, and the University of Sydney students. The traffic strategy would be to minimise loss of on-street parking as it is a community resource, it acts as a traffic buffer to the footpath and it helps to slow traffic speeds. For the entire site, only two vehicle access points are definitely proposed, with a third under further consideration. The existing entrance/exit near Forbes Street would be reinforced and upgraded as the main access for the residential and performing arts space. It would remain a t-junction style intersection with Wilson Street. The mixed business precinct would primarily be served by a new access onto Wilson Street, joining the roundabout at Shepherd Street. Depending on the design of the proposed development in this area, a further left in/left out only access could be provided to Wilson Street.

A barrier-free pedestrian and cycle entrance to the site at Wilson Street, opposite the roundabout at Codrington Street is under construction. This will provide direct access to the Carriage workshop area, join to the shared zone within the site, and perhaps link to future upgraded access to Redfern Station.

Western section

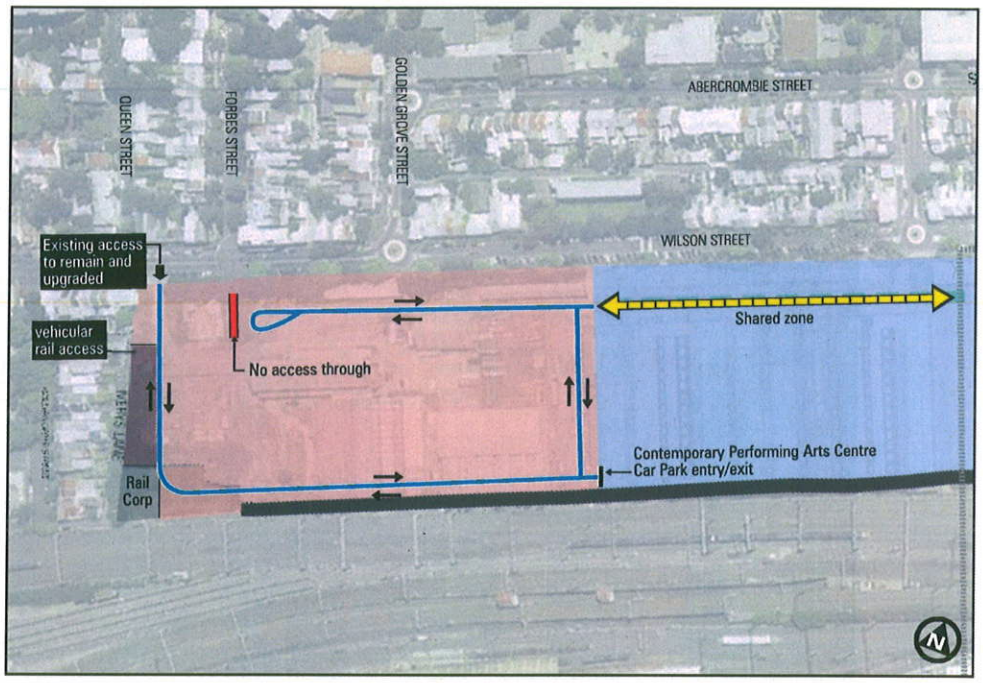
There is currently a gated entrance to the site that serves North Eveleigh. This entrance currently serves the Carriage workshop construction site and provides access to RailCorp's easement to maintain their facilities near the tracks. While it may be possible to separate North Eveleigh's access from RailCorp's future operational needs at this point, it appears more beneficial to maintain the combined access and improve this intersection for both purposes. This would assist the redevelopment on the site, as RailCorp's easement could then be crossed at Wilson Street to accommodate the necessary turn splay at the entrance for North Eveleigh. RailCorp's security gate could be located closer to the rail lines (away from Wilson Street), which would reduce RailCorp's maintenance task. This would ensure that the new access road would meet the site's requirements and be the correct standard of road for the heavy service vehicles that may need to access the rail facilities.

If Blacksmiths Lane is to be a shared zone near the Carriage workshop, the western access to Wilson Street would need to cater for vehicles generated by the residential development proposed in the western section and vehicle access the entertainment precinct in the middle section. With that level of future traffic there were only two feasible access locations; opposite Forbes Street or at the existing entrance to the site. The existing location was preferred as it would be safer for pedestrians, maintained current arrangements as much as possible, and would not present as steep a grade within the site for vehicles to climb. The costs associated with utility relocation should also be minimised by remaining in a similar alignment for the upgraded access.

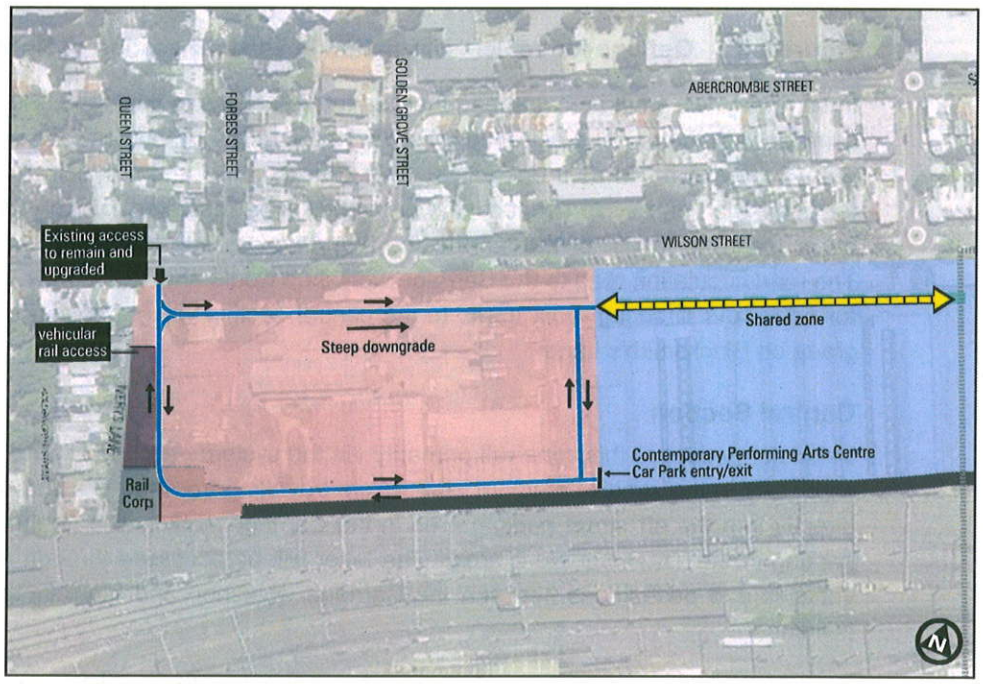
From this access point, there were three options for traffic circulation through the western section of the site generated. They are shown in Figure 6-3.

We did not recommend a full t-junction at Blacksmiths Lane and the access road because:

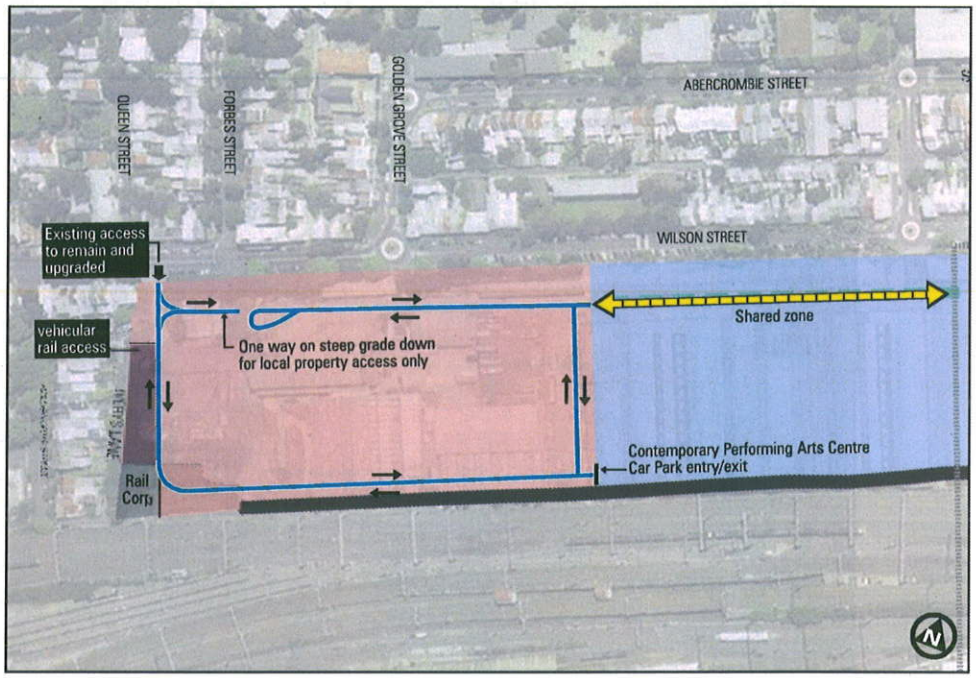
- Blacksmiths Lane traffic could conflict with through traffic too close to a graded access
- the speed differential of entering vehicles and those leaving the shared zone
- vehicles climbing the grade would generate noise in the residential area, particularly after evening performances.



Option 1 - Two way circuit



Option 2 - One way circuit



Option 3 - Hybrid

Figure 6-3 Options for vehicle circulation in western section of North Eveleigh

In summary, we would recommend that the future access to this zone and the Middle Zone coincide with the existing entrance driveway and that the circulation road sweep down to the rear of the site much as it does now. Also Blacksmiths Lane may join the circulating road for pedestrian and cycle connectivity, but vehicles be restricted to one way eastbound flow for at least the length of the lane to the first driveway into parking in the redevelopment. The road circulation road to the Carriage workshop would abut the railway, acting as a buffer for noise and directing most traffic to the central section without having to use the steeper grade on Blacksmith's Lane.

Central Section

Vehicular access to this zone will primarily via the system described in the previous section, especially in the short to medium term. Cars travelling from the Western Section will enter directly into the off street parking area in the Carriage workshop or to surface-level, visitor parking in the Traverser No 2 area. The latter will be accessed through a shared zone for vehicles and pedestrians between the Carriage workshop and Blacksmiths' Shop heritage buildings.

A pedestrian access that can be used by persons with mobility impairments is being constructed in the central section opposite Codrington Street. This access will assist the many local patrons expected to use the entertainment and training facilities on this site. Passengers being dropped off would be expected to use the areas adjacent to this access.

Eastern Section

Access to the eastern section of North Eveleigh (second vehicular access point to the site) could be at two locations:

1. Opposite Shepherd Street - the level difference from Wilson Street is about 4 metres and there should be no difficulty grading from Wilson Street to the lower levels or to a podium level. Shepherd Street has parking on both sides leaving a narrow width for two way traffic. Consideration would need to be given to either banning parking on one side, both sides of the streets, or perhaps just clearway style arrangements during the peaks between Wilson Street and Abercrombie Street. The first option would be the safest, although it would reduce local parking supply. There is good connectivity to Abercrombie Street via a signalised intersection and thence to the wider regional network. The roundabout could be retained and an extra leg installed with relative ease. Large vehicles would have no trouble turning right, although left turn paths would need to be checked in the final design. As this project is not expected to generate many large vehicles wanting to turn left, and there is no current prohibition on doing so, this should not present too many difficulties for this option.
2. At the eastern end near Ivy Street – an access here could be designed here for left turn out only, or to allow all movements, ie. straight in from Ivy Street, right in from Wilson Street, and left out to Wilson Street. The existing grading indicates that a suitable vertical geometry could be achieved. Near this location there is also a (currently disused) pedestrian access to Redfern Railway Station that could be reactivated if it suits the future layout of the station. As future access to Redfern Station would be elevated over the rail lines, there is also an opportunity to work with structure levels to achieve an integrated pedestrian and traffic solution at a podium level and then transition down to the Carriage workshop level at the southern end of the this site.

In summary, Shepherd Street would be the main vehicle access to the eastern section of North Eveleigh. It has the best options for connections to the road network. Accessibility preferences would recommend consideration of a podium level connection between the southern Station pedestrian access and Wilson Street at Shepherd Street, as that would attract many pedestrian to activate the frontage of the area. It appears that a minor access could be developed from Ivy Street, but as it is one way, you would probably use it as an access only. This option, too, works best at a podium level as there is more scope for circulation and activity. The main constraint to a full podium over the site may be the natural ventilation wall for the residential parking on the existing residential building on Wilson Street. The ramp taking traffic down to the Carriage workshop level may need to be at the lower level before abutting that existing residential building.

Redfern Railway Station, Gibbons and Regent Streets

The arterial roads should not be used for direct access to the future development whether the roads remain one-way or become two-way. The laneways should continue to offer access between the arterial roads and the developments

6.3 Pedestrian and cycle requirements

Designing for ease of pedestrian movement around the site is essential to realise the transit orientation of the site. The hub for pedestrian demand will be Redfern Railway Station. RailCorp and RWA have are undertaking a concept design study with a focus on increasing pedestrian accessibility. It is possible to create new pedestrian links to Station that also act as links between the communities on both sides of the rail lines. The pedestrian axis between Redfern Station and Redfern Street is a feature of the City of Sydney's Redfern Precinct upgrade works and should be reinforced in this study by linking that access through to the western section

6.4 Implications of proposed development on traffic

Traffic modelling methodology

The first step in looking at future impacts was to expand the present traffic volumes shown in Figures 4-2 and 4-3 to 2016 levels. Although the historical traffic data between 2001 and 2006 and RTA traffic volumes between 1999 and 2002 show either decreased or no significant change in traffic volumes in the vicinity of the proposed development (refer Table 4-3), a conservative approach was adopted to assume a higher trend for planning purposes. A growth rate of 0.5% per year was applied to the arterial roads forecast flows in a future design year of 2016.

PB developed a spreadsheet model to assess the traffic impact of the proposed developments. The spreadsheet model was used to estimate the trip generation rates for the developments and the trip assignment of the generated trips to the surrounding road network. The analysis was performed for the morning and afternoon peak hours, and added to the projections from 2006 traffic counts.

Due to the proximity of proposed development at Australian Technology Park (ATP), this traffic assessment includes traffic that would be generated by ATP.

6.5 Trip generation

Traffic generation for the proposed development has been estimated based on employment trips generated by residents from residential development and for commuter/ work-related trips attracted to the commercial development. Table 6-1 shows the indicative development levels used as the basis for generating future residential and commercial activity.

Table 6-1 Indicative development estimates the proposed developments

Proposed developments	Residential floor area (m^2)		Commercial floor area (m^2)	Total new floor areas (m^2)
North Eveleigh	72,000*		81,000	153,000
Redfern Railway Station, Gibbons & Regent Streets	85,300		95,600	180,900

Source: RWA correspondence *Excludes existing floor area of CarriageWorks and Blacksmiths Shop

The RTA trip generation rate of 0.24 trips per unit per peak hour for high density residential flat buildings in CBD was adopted for estimating residential trips.

A number of different traffic generation rates for commercial development have been tested:

- RTA – using RTA traffic generation rates for office and commercial developments according to the Guide to Traffic Generating Developments (Version 2.2) October 2002
- Assumption 1 – using 'Eveleigh Carriageworks Transport Management Plan' assumption i.e. 41% car driver/passenger for the mode split
- Assumption 2 – using the assumption from various Traffic Management Plans for Australian Technology Park i.e. 45% car driver/passenger for the mode split
- Assumption 3 – using the mode split assumptions provided by Redfern-Waterloo Authority i.e. 30% car driver/passenger mode split. In addition, there is also evidence that car occupancy rate in the inner city areas is higher than 1.19 (RTA assumptions) according to Sydney Transit & Bus Lane Survey 2005. The vehicle occupancy rate for Broadway, between Regent Street and Shepherd Street is as high as 1.60. The average value of 1.41 has been assumed for the vehicle occupancy rate in the inner city area. Table 6-2 shows the vehicle occupancy rate for the inner city area on non-bus/transit lanes.

Table 6-2 Assumed vehicle occupancy rate for the inner city area

Road	Peak period	Vehicle occupancy rate*
Broadway between Quay Street and Shepherd Street	Morning	1.41
	Afternoon	1.45
Oxford Street, between Jersey Street and College Street	Morning	1.35
	Afternoon	1.44
Average		**1.41**

Source: Sydney Transit & Bus Lane Study March 2005 (Annual Performance Survey–Travel time, Vehicle occupancy & illegal usage) * - vehicle occupancy rate for non-bus and non-transit lanes

Table 6-3 summarises different assumptions used to estimate trip generation rate for the commercial development.

Table 6-3 Different assumptions for trip generation rates

	RTA	Assumption 1	Assumption 2	Assumption 3
Mode split for car driver/passenger (for peak hour)	0.62	0.41	0.45	0.30
Car occupancy rate (persons/ vehicle for peak hour)	1.19	1.19	1.19	1.41
Number of employees per $100m^2$	4.75	4.00	4.00	4.00

Using the assumptions shown in Table 6-3, the discounted traffic generation rates can be calculated for the proposed developments. Table 6-4 shows the discounted traffic generation rates and the corresponding estimated traffic under different assumptions.

Table 6-4 Comparison of traffic generation approaches

	Traffic generation rates (trips per $100m^2$ gross floor area)	Estimated traffic per peak hour	
		Redfern Railway Station, Gibbons & Regent Streets	North Eveleigh
Residential			
RTA	0.24*	143	205
Commercial			
RTA	2.00	1,619	1,912
Assumption 1	1.11	902	1,065
Assumption 2	1.22	990	1,169
Assumption 3	0.75	604	713
Total			
RTA	-	1,762	2,117
Assumption 1	-	1,045	1,269
Assumption 2	-	1,133	1,373
Assumption 3	-	700	862

NOTE: * - trips per dwelling for residential development

The traffic generation rate of 0.75 trips per $100m^2$ (Assumption 3) was adopted for the commercial development for the following reasons:

- low mode split of 0.30 for car driver and passenger due to its close proximity to Redfern Railway Station and Sydney CBD. Also the existing population in Redfern-Waterloo has almost half the car ownership and uses public transport at double the rate of the Sydney metropolitan region
- higher vehicle occupancy rate is observed in the inner city area as shown in Table 6-2. The average value of 1.41 has been adopted compared to the RTA assumption of 1.19
- Redfern-Waterloo Authority assumes 4 employees per 100m2 gross floor area compare to the RTA assumptions of 4.75 employees per 100m2 gross floor area. Hence, the further discounted traffic generation rate was necessary.

For residential development, it was assumed for the subject sites that during the morning peak hour 80% of trips would be outbound and 20% of trips would be inbound. For the evening peak hour, it was assumed that 20% of trips would be outbound and 80% of trips would be inbound for the residential development.

For commercial development, it was assumed for the subject sites that during the morning peak hour 20% of trips would be outbound and 80% of trips would be inbound. For the evening peak hour, it was assumed that 80% of trips would be outbound and 20% of trips would be inbound for the residential development.

Table 6-5 shows the number of trips generated by the proposed developments during the morning and afternoon peak hours for inbound and outbound trips.

Table 6-5 Estimated inbound and outbound peak hour trips for proposed developments

Developments	Morning peak hour trips			Afternoon peak hour trips		
	Inbound	Outbound	Total	Inbound	Outbound	Total
Residential						
North Eveleigh	41	164	205	164	41	205
Redfern Railway Station, Gibbons & Regent Streets	29	114	143	114	29	143
Commercial						
North Eveleigh	604	259	862	259	604	862
Redfern Railway Station, Gibbons & Regent Streets	490	210	700	210	490	700
Total	1,163	747	1,910	747	1,163	1,910

6.6 Trip distribution

A spreadsheet model was developed to assess the traffic impact of the proposed developments. The indicative lot yield for each residential and commercial developments were input in the spreadsheet model which in turns converts into trips generated from the proposed developments and assigned to the surrounding road network.

The directional distribution was adopted from the Journey to Work (JTW) dataset from Transport Population Data Centre (TPDC) and summarised in Table 6-6. The directional distribution has been modified to account for the increasing demand from the east direction by increasing 5%, and decreasing the north direction by 5%.

Table 6-6 Directional distribution

Direction	Inbound	Outbound
East	23%	15%
West	34%	26%
North	27%	52%
South	16%	8%
Total	100%	100%

Source: Journey to work (JTW) data from Transport Data Centre (TDC) 1996

While Table 6-6 shows the regional distribution of traffic in the surrounding area, Table 6-7 and Table 6-8 show the assumed route choice and distribution from the proposed development sites, North Eveleigh and Redfern Railway Station, Gibbons & Regent Streets, respectively.

Table 6-7 Trip assignment for North Eveleigh site

Direction	Distribution	Route choice
East	40%	Cleveland St
	60%	Redfern Street via Lawson St
West	30%	King St via Wilson St
	70%	Parramatta Rd via Cleveland St
North	20%	City Rd via Cleveland St
	80%	Gibbons/Regent St via Lawson St
South	60%	Botany Rd via Lawson St
	40%	Botany Rd via Wilson St

Table 6-8 Trip assignment for Redfern Railway Station, Gibbons & Regent Streets sites

Direction	Distribution	Route choice
East	50%	Cleveland St
	50%	Redfern Street
West	100%	Cleveland St
North	100%	Regent St
South	100%	Botany Rd via Gibbons/Regent St

In addition to the proposed developments, the estimated trips generated from the ATP were added to the background traffic.

The traffic that would be generated by the proposed developments during the peak hours in 2016, using the trips generation rates and distribution assumptions at the eight key intersections is shown in Figure 6-4.

The predicted traffic shown in Figure 6-5 was superimposed on the traffic for the design future year of 2016. As discussed in Section 4.3, a growth rate of 0.5% per year has been applied to the arterial roads. The post development traffic volume forecasts are shown in Figure 6-5.

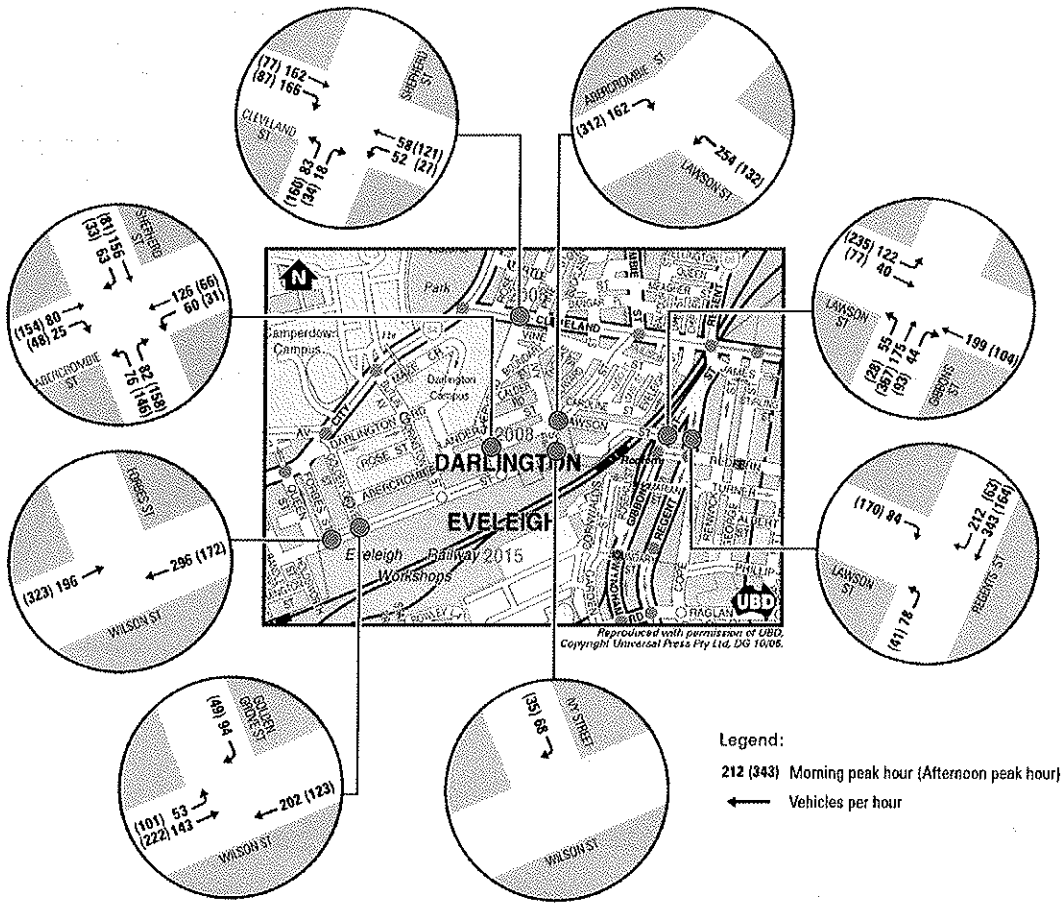


Figure 6-4 Predicted peak hour generated traffic (vph)

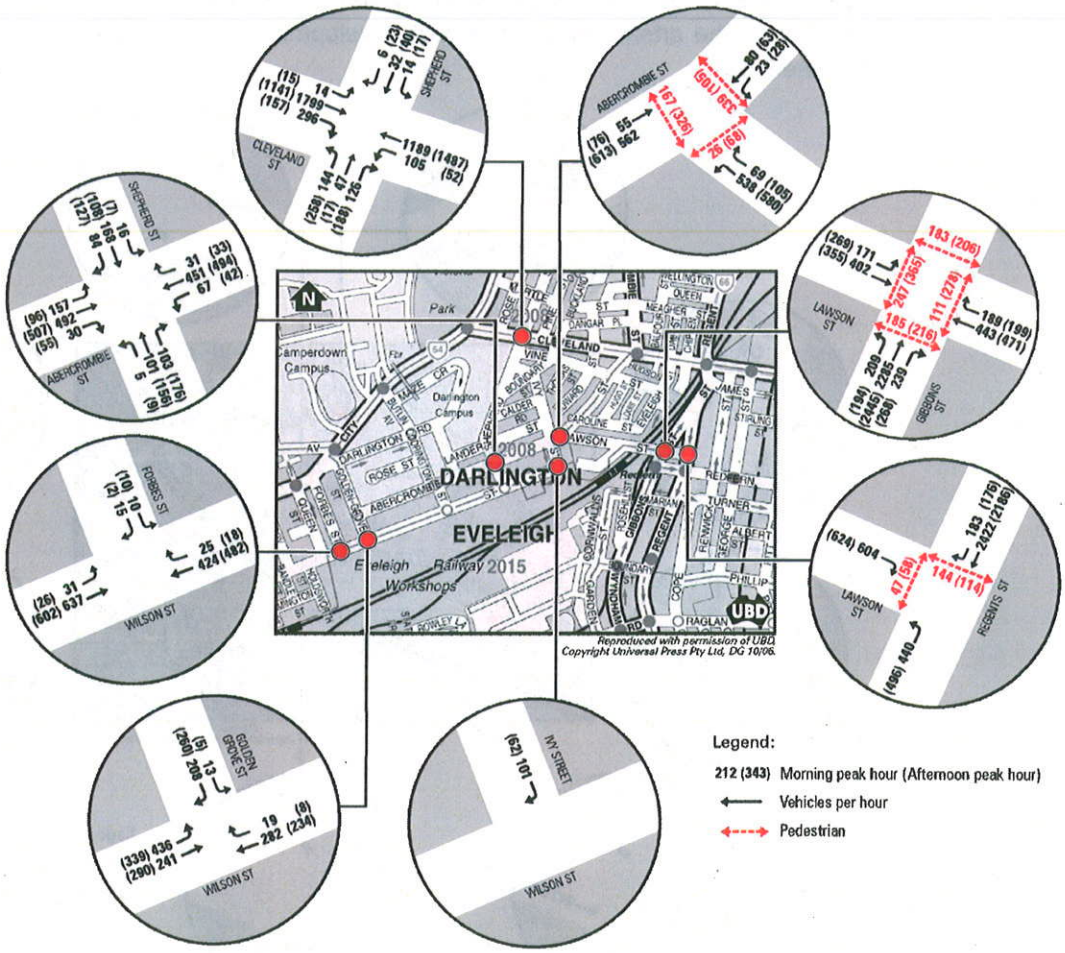


Figure 6-5 Post development peak hour intersection volumes (vph)

6.7 Intersection assessment criteria for simulations

The operation of key intersections within the vicinity of the sites was assessed using the aaSIDRA (SIDRA) intersection modelling software. SIDRA calculates intersection performance measures including:

- level of service, from A to F
- degree of saturation, as a ratio of demand to capacity
- average vehicle delay, in seconds
- maximum queue length, in metres.

6.7.1 Level of service

Level of service (LoS) is one of the basic performance parameters used to describe the operation of an intersection. The levels of service range from A (indicating good intersection operation) to F (indicating over saturated conditions with long delays and queues). At signalised and roundabout intersections, the LoS criteria are related to average intersection delay (seconds per vehicle). At priority controlled intersections, the LoS is based on the average delay (seconds per vehicle) for the worst movement. See Table 6-9.

Table 6-9 Level of service criteria for intersections

Level of service	Average delay (seconds per vehicle)	Traffic signals, roundabout	Give way and stop signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity. At signals, incidents will cause excessive delays. Roundabouts require other control mode	At capacity; requires other control mode
F	Greater than 71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Source: RTA Guide to Traffic Generating Developments, October 2002

6.7.2 Degree of saturation

Degree of saturation (DoS) is defined as the ratio of demand flow to capacity, and therefore has no unit. As it approaches 1.0, extensive queues and delays could be expected. For DoS greater than 1.0, a small increment in traffic volumes would result in an exponential increase in delays and queue length. For a satisfactory situation, the DoS should be less than the nominated practical degree of saturation, usually 0.9. The intersection DoS is based on the movement with the highest ratio for all types of intersection.

6.7.3 Average delay

Delay is the difference between interrupted and uninterrupted travel times through the intersection and is measured in seconds per vehicle. The delays include queued vehicles decelerating and accelerating to and/or from stop, as well as delays experienced by all vehicles negotiating the intersection. At signalised and roundabout intersections, the average intersection delay is usually reported and is taken as the weighted average delay by summing the product of the individual movement traffic volume and its corresponding calculated delays and dividing by the total traffic volume at the intersection. At priority controlled intersections, the average delay for the worse movement is usually reported.

6.7.4 Maximum queue length

Queue length is the number of vehicles waiting at the stop line and is usually quoted as the 95th percentile back of queue, which is the value below which 95% of all observed queue lengths fall. It is measured as the number of vehicles per traffic lane at the start of the green period at a signalised intersection, when traffic starts moving again after a red signal. For an unsignalised intersection, it is measured during the unblocked period i.e. when queued vehicles on the minor road can enter the major road when a gap is available in the major traffic stream. The intersection queue length is usually taken from the movement with the longest queue length.

6.8 Intersection analysis results

6.8.1 Pre development conditions

The 2016 volumes shown in Figure 6-4 and Figure 6-5 were used to assess the performance of the seven key intersections under existing conditions, or the pre development scenario, using SIDRA. The intersection analysis results from SIDRA are summarised in Table 6-10.

From Table 6-10, it can be seen that all intersections analysed are expected to operate at LoS B or better during both the morning and afternoon peak periods without the traffic contributions from the key strategic sites. Traffic travelling through these intersections can be expected to experience delays in the order of 25 seconds or less at each intersection for both the morning and afternoon peak periods. The majority (all but one) intersections currently operate with an acceptable degree of saturation, less than 0.7 (i.e. there is some spare capacity).

Table 6-10 Pre-development intersection performance

Intersection Name	Ints Control Type	Peak period	Ints DoS	Ave delay	Ints LoS	Queue (m)
Wilson St-Forbes St	Priority	Morning	0.24	17	B	7
		Afternoon	0.19	17	B	13
Wilson St-Golden Grove St	Roundabout	Morning	0.32	8	A	18
		Afternoon	0.20	9	A	10
Wilson St-Ivy St/	Priority	Morning	0.02	9	A	0
		Afternoon	0.02	9	A	0
Abercrombie St-Shepherd St	Signals	Morning	0.70	18	B	111
		Afternoon	0.66	20	B	94
Abercrombie St-Lawson St	Signals	Morning	0.60	23	B	74
		Afternoon	0.66	22	B	92
Lawson St-Gibbons St	Signals	Morning	0.70	25	B	188
		Afternoon	0.63	24	B	159
Lawson St-Botany Rd	Signals	Morning	0.53	18	B	129
		Afternoon	0.54	16	B	130
Cleveland St-Shepherd St	Signals	Morning	0.61	20	B	175
		Afternoon	0.68	22	B	208

6.8.2 Post-development conditions

Intersection analyses for the seven key intersections were repeated for the post development traffic volumes shown in Table 6-11. The results from the 2016 forecasts with the additional traffic from the key strategic sites are discussed below.

Table 6-11 shows that only one intersection; Abercrombie Street-Shepherd Street, is forecast to perform unacceptably, and then, only in the PM peak, as it is currently structured. Abercrombie Street-Lawson Street and Cleveland Street-Shepherd Street intersections would be operating at the LoS D for at least one of the peak periods. These three intersections would be experience more demand than they have capacity for with the degree of saturation greater than one.

All other intersections would be operating acceptably at LoS C or better for both morning and afternoon peak periods. Traffic travelling through these intersections can be expected to experience delays in the order of 40 seconds or less.

Table 6-11 Post-development intersection performance

Intersection Name	Ints Control Type	Peak period	Ints DoS	Ave delay	Ints LoS	Queue (m)
Wilson St-Forbes St	Priority	Morning	0.34	23	B	30
		Afternoon	0.33	22	B	33
Wilson St-Golden Grove St	Roundabout	Morning	0.46	9	A	34
		Afternoon	0.41	9	A	29
Wilson St-Ivy St/	Priority	Morning	0.06	9	A	0
		Afternoon	0.04	9	A	0
Abercrombie St-Shepherd St	Signals	Morning	1.02	51	D	288
		Afternoon	1.13	>70	F	369
Abercrombie St-Lawson St	Signals	Morning	1.01	39	C	209
		Afternoon	1.03	44	D	243
Lawson St-Gibbons St	Signals	Morning	0.84	31	C	272
		Afternoon	0.91	38	C	353
Lawson St-Botany Rd	Signals	Morning	0.69	18	B	188
		Afternoon	0.65	18	B	168
Cleveland St-Shepherd St	Signals	Morning	1.00	40	C	354
		Afternoon	1.00	45	D	421

As indicated previously, the intersection of Abercrombie Street-Shepherd Street, Abercrombie Street-Lawson Street and Cleveland Street-Shepherd Street would require some adjustments to increase capacity in order to accommodate the anticipated traffic that would be generated by the proposed developments. The results are summarised in Table 6-12.

Table 6-12 Post-development intersection performance with improvements

Intersection Name	Ints Control Type	Peak period	Ints DoS	Ave delay	Ints LoS	Queue (m)
Abercrombie St-Shepherd St	Signals	Morning	0.87	30	C	199
		Afternoon	0.89	36	C	238
Abercrombie St-Lawson St	Signals	Morning	0.87	35	C	176
		Afternoon	0.90	41	C	218
Cleveland St-Shepherd St	Signals	Morning	0.83	26	B	255
		Afternoon	0.85	30	C	298

Table 6-12 shows that the Abercrombie Street and Shepherd Street intersection has improved with the cycle time being modified from 60 seconds for both the morning and afternoon peak periods to 70 and 80 seconds for morning and afternoon peak periods, respectively.

As can be seen from Table 6-12, the performance of Abercrombie Street and Lawson Street intersection has improved with the traffic signal cycle time being modified from 60 seconds for both the morning and afternoon peak periods to 80 seconds and 90 seconds for morning and afternoon peak periods, respectively. In addition, the 30m left turn bay at the Lawson Street approach has been modified to a full left turn lane with the 30m right turn bay. Under this modified configuration which involves some adjustment to parking and re-linemarking, Abercrombie Street and Lawson Street intersection would operate with LoS C at either peak periods analysed.

Cleveland Street and Shepherd Street intersection could be improved with extending the left turn bay at Shepherd Street (south approach) from 30m to 70m. Under this modified configuration, Cleveland Street and Shepherd Street intersection would operate with LoS C or better at both peak periods.

6.9 Mid-block capacity

Table 6-13 below shows the uni-directional peak hour flows and the corresponding level of service for six key road sections in the vicinity of the subject site for the post development condition. These road sections would be classified within AUSROADS as urban roads with interrupted flows for benchmarking purposes.

Table 6-13 Mid-block volumes at key road sections

	Morning peak hour		Afternoon peak hour	
	NB/EB	SB/WB	NB/EB	SB/WB
Wilson Street, east of Golden Grove Street	250 (B)	300 (B)	300 (B)	240 (B)
Abercrombie Street, west of Lawson Street	620 (D)	620 (D)	690 (D)	640 (D)
Lawson Street, east of Abercrombie Street	590 (C)	610 (D)	640 (D)	690 (D)
Gibbons Street, south of Lawson Street	2730 (D)	-	2910 (D)	-
Regent Street, south of Lawson Street	-	3030 (D)	-	2810 (D)
Shepherd Street, south of Cleveland St	320 (B)	430 (C)	460 (C)	250 (B)

Note: NB/EB – Northbound/Eastbound, SB/WB – Southbound/Westbound, and (B) – Level of Service

All but Gibbons Street and Regent Street have one through lane for each direction. Gibbons Street and Regent Street, south of Lawson Street have three through lanes.

The AUSTROADS Guide to Traffic Engineering Practice – Part 2 indicates that typically one-way mid block lane capacity on interrupted urban roads would be in the range of 900 to 1,000 vehicles per hour (vph) per lane, which could increase to 1,200 to 1,400 vph under ideal conditions (no on-street parking, few driveways, etc).

From Table 6-13, it can be seen that the roads have sufficient capacity to operate acceptably during both morning and afternoon peak hours. The existing road sections would have sufficient capacity to accommodate the future traffic demand from the proposed developments in 2016.

6.10 Summary of impacts of proposed development on traffic

The proposed development at North Eveleigh and Redfern Railway Station, Gibbons & Regent Streets sites are expected to generate approximately 1,560 vehicle trips during the peak hour. Applying the general RTA rates would yield 3,800, which we have demonstrated is not applicable for this area. The traffic generation rate of 0.75 trips per $100m^2$ was adopted for the commercial development on the RWA key strategic sites for the following reasons:

- a higher mode share was assumed for public transport due to the sites' proximity to Redfern Station and also the short distance to the Sydney CBD. Also the existing population in Redfern-Waterloo has almost half the car ownership and uses public transport at double the rate of the Sydney metropolitan region. This reduced the share of generated traffic that would be car driver or passenger to 30%
- a higher vehicle occupancy rate is observed in the inner city area as shown in Table 6-3. An average value of 1.41 was adopted for the proposed developments from surveys, which is 18% greater than the default RTA guideline of 1.19
- Redfern-Waterloo Authority assumes 4 employees per 100m2 gross floor area compared to the RTA assumptions of 4.75 employees per 100m2 of gross floor area. Hence, a further reduction in the traffic generation rate was warranted.

In addition to the proposed developments, the estimated trips generated from the Australian Technology Park were added to background traffic.

The trips generated from the proposed developments were then added to the background traffic for the future year of 2016. A growth rate of 0.5% per annum has been applied on the arterial roads to the base volumes now experienced. This is conservative as actual trends in the area, due to fuel costs and parking control, have been less.

The intersection modelling software, SIDRA has been used to analyse the performance of key intersections under pre-development and post-development conditions in 2016. The intersection analysis results for the pre-development condition show that the intersections are to operate at level of service of B or better during both the morning and afternoon peak periods in 2016. The intersection analysis results for the post-development condition however, showed that intersections such as Abercrombie Street-Shepherd Street, Abercrombie Street-Lawson Street and Cleveland Street-Shepherd Street would be operating at the level of service D, the lowest acceptable level, for at least one of the peak periods without modification. These three intersections would experience demand in excess of supply, indicated by a forecast degree of saturation greater than one.

These intersections were slightly modified and modelled again in order to accommodate the anticipated traffic from the proposed developments. The slight modification of the cycle time in the traffic signals and with some minor changes to the intersection's configurations, the forecast performance of all the intersections improved to level of service C, or better, during both morning and afternoon peak periods. The modifications were to signal phase timings, or through lengthened turn bays and lanes created with some restrictions in on-street parking and adjusted line marking.

Furthermore, the peak hour flows and the corresponding level of service for six key road sections in the vicinity of the subject sites were assessed for the post development capacity. The results show that all six road sections would operate at level of service D or better for both morning and afternoon peak hours. The existing road sections would have sufficient capacity to accommodate the future traffic demand from the proposed developments at an acceptable future performance level.

7. Further Investigations

7.1 Proposed traffic control measures to accommodate growth

The traffic engineering investigations forecast that the proposed levels of development in the RWA key strategic sites of North Eveleigh and Redfern Station could be accommodated on the existing roadways, and with only some limited modification to intersections in the area. The modifications proposed to achieve acceptable intersection performance under full development in 2016 were:

- Abercrombie Street/Shepherd Street: modify 60 sec cycle time to 70 sec in AM peak and 80 in evening peak. This requires cooperation with the RTA to achieve
- Abercrombie Street/Lawson Street: modify the 60 sec cycle time to 80 sec in the AM peak and 90 sec in PM peak. This required cooperation with the RTA to achieve. Also the 30m left turn bay would be converted to a full left turn lane with a 30m right turn bay to adopt to the rebalancing of traffic travelling south through this intersection. This would require the cooperation of the City of Sydney and RTA through the City of Sydney traffic committee when development applications are submitted on the sites
- Cleveland Street/Shepherd Street: in 2016, this intersection would perform acceptably if the left turn bay approaching from the south was extended from 30m to 70m. This would entail the loss of approximately 6 on-street car parking spaces. This, too, would need to be forwarded with the assistance of the City of Sydney as developments are preparing to open.

7.2 Improvement in pedestrian connections between Redfern Street and Redfern Station and North Eveleigh

The City of Sydney is investing in a major upgrade in the streetscape and pedestrian environment along Redfern Street as the main street of the local community. As well as pedestrian links, this is an important route for buses into the city and a continuation of the Lawson Street bicycle route. Redfern Station is the anchor of pedestrian desire line as both a generator and attractor of trips and as it also bridges the rail lines. While RailCorp and RWA are looking at the upgrade of the station as a catalyst for future development, there are other traffic investigations that could also rebalance the road corridors for pedestrian improvements.

7.2.1 Investigation of a Gibbons Street underpass

One means of creating a better environment for pedestrians while maintaining the traffic and bus transit role of Gibbons Street, would be to take advantage of the levels in the area, and construct a new underpass for through traffic underneath a podium for pedestrians at the current level of the street. Constraints on such a proposal would be that it could not acquire much, if any, additional land as the rail lines and substantial private property front the road corridor.

The provision of a cut and cover underpass with a podium would involve a cutting approximately two traffic lanes wide, with vertical retaining walls and a roof slab to carry pedestrians and local traffic over the top. The cutting would be graded to pass under Lawson Street and regain the surface of Gibbons Street to the north. A design objective would keep the cutting cover to 60 metres or less so that the facility would be defined as a short underpass. A longer facility would be considered a tunnel, which would require ventilation and other safety-based infrastructure

Since much of the construction work would be below ground there may be significant utilities affected by the proposal, both in Gibbons Street and in Lawson Street that will need to be relocated. Rail utilities are particularly difficult to locate without pothole testing.

Due to the significance of Gibbons Street in the road network, all construction work would have to be performed while keeping traffic moving as much as possible. Even with great care in traffic management, construction could result in the loss of up to two traffic lanes in Gibbons Street for some periods of time. This is likely to lead to traffic impacts for some distance from the site, particularly in the morning peak.

Given the land tenure constraints, the basic set up of the underpass would be expected to be two through traffic lanes in the underpass and one traffic lane coming up to the surface, and possibly one leading back down. While one through traffic lane would be lost, the capacity of the road is not expected to be diminished because the grade separation of the intersection would remove impedance to the through traffic. This assumption would need to be tested, however, through traffic modelling to the satisfaction of the RTA.

Within these constraints, there are 4 potential options for an underpass that the RWA may wish to investigate. All would provide two through northbound lanes in the underpass:

- Option 1 – would have a north bound exit ramp to Lawson Street on the west side of the underpass structure, and entry ramp from Lawson Street for city-bound traffic. All turns that can currently be made at Lawson and Gibbons would remain. Pedestrians crossing Gibbons Street would have to cross the ramp traffic, but the crossing distance would be shorter (either one or two lanes). Some on-street parking would be lost in Gibbons Street so vehicles could move to the left for the exit ramp to Lawson Street. Peak hour queuing could make weaving difficult to get to the lanes for turns. With the fast, through traffic pushed to the east, property access could be difficult for frontage properties on the eastern kerb
- Option 2 – would have a north bound exit ramp to Lawson Street on the east side of the underpass structure, and an entry ramp to Gibbons Street for city-bound traffic. The network is just a mirror image of Option 1, but it does have more difficulty with getting entry ramp traffic to be able to turn left at Cleveland Street. More conflicts between entry ramp traffic and traffic trying to use the U-turn facility to get to Regent Street would be expected, but it would be easier to provide access to eastern frontage properties
- Option 3 – is the same as Option 1 but without the City oriented entry ramp. This option would ensure there is no additional pressure put on the left turn queue for Cleveland Street which is congested currently during the AM peak

- Option 4 – this option would not provide any ramps between Gibbons Street and Lawson Street, so pedestrians would not have to cross any traffic lanes. Gibbons Street traffic wanting to get to Lawson Street would go through the underpass on the right lane, then use the U turn roadway to Regent Street and then either turns left to Redfern Street or right into Lawson Street. This would add around 440 vph, in both peaks, (based on current traffic volumes) to the U turn move. It is likely that some of this traffic would divert to other routes given this indirect path. City bound traffic from Lawson Street might turn left at Regent Street, left at Marian Street and then left onto Gibbons Street (Traffic signals may need to be considered at this intersection). Access to the properties on the east side could probably be retained through the laneways.

Table 7-1 compares the features of the Options.

Table 7-1 Differences between the Options

Design point	Option 1	Option 2	Option 3	Option 4
Same turns at Lawson Street?	Yes	Yes	No	No
Keeps buses next to station?	Yes	No	Yes	No
Keeps arterial, through capacity?	Yes	Yes	Yes	Yes
Do pedestrians cross traffic?	Yes, ramp	Yes, ramp	Yes, ramp	No
More traffic in Regent Street?	No	No	Yes	Yes
Impact on access to property?	Yes	Less	Yes	Yes
Impact left turn into Cleveland St?	Yes	For Lawson Street traffic	No	No

The extent of these impacts would require analysis through a simulation model testing each of the options to see how they perform in traffic terms and if the benefits can be demonstrated to outweigh the project costs.

7.2.2 The future of the one-way arterial pair

Another future investigation could examine the traffic impacts of changing the current arterial pair of northbound traffic in Gibbons Street and southbound traffic in Regent Street. RTA has had a scheme for a southern arterial that maintained this separation for much of the distance between the CBD and the Airport, and it has not committed to a single future upgrade plan for this corridor (refer Section 3.3.1). In the short term, it wants to see the arterial capacity of the routes remain. Other stakeholders in the area have raised questions about the commercial and amenity benefits of reverting to two-way traffic in both streets, or in just Regent Street.

There are some benefits to one way traffic operation:

- fewer conflicts for pedestrians when crossing streets and fewer, less severe crashes
- greater traffic capacity from the same number of lanes due to reduced turning conflicts at intersections
- more on-street parking capacity as there is less pressure for turning bays.

And there are some consistent disadvantages due to one-way streets:

- greater distances for local circulating traffic to travel to reach the same destination. This is especially true in urban networks where there can be turn bans, too
- more confusion on how bus services operate and bus stop locations.

If there is a desire to assess this option further, there will be a number of issues that require investigation.

Regional issues:

- less road capacity
- additional cost of new traffic signal arrangements, directional signs and line marking
- more congestion between the CBD and the Airport.

Local issues:

- if the roads are to be reconfigured to attract additional car traffic from the surrounding retail catchment, where are those cars going to park
- if Regent Street is converted to two-way, and Gibbons Street remains one-way and arterial in nature, there will be no improvement in access to Redfern Railway Station for pedestrians crossing Gibbons Street
- if bus routes are consolidated in a two-way Regent Street, they will be quite removed from convenience interchange at Redfern Railway Station
- if bus routes are consolidated in a one-way or two-way Gibbons Street, bus stops will be closer to the station, but more stops will impede the flow of through traffic
- if southbound bus stops are put into Gibbons Street, pedestrian safety will need to be carefully managed at the crossing into the Station
- if buses operate two-way in one of the streets, that street will lose on-street parking to accommodate the new bus stops.

With the traffic, and bus operational impacts on the Strategic Bus Corridor, any further consideration of options to alter the traffic directions on Gibbons and Regent Street will require area-wide traffic simulation modelling to address some of the impacts listed above.

7.2.3 Other measures

As the planning for an upgraded Redfern Railway Station progress, it may be possible to combine new access arrangements proposed through that proposal with streetscape improvements in Gibbons Street to obtain an improved pedestrian connection. This may involve improvements to the public domain that leave the capacity of the road system with little to no change.

If the station upgrade contained a more direct pedestrian connection between Redfern Street and the University of Sydney precinct, there would be a substantial strengthening of links between Darlington and Redfern, and a major redistribution of traffic on Lawson, Wilson and Abercrombie Streets.

The restructuring of new development on the key strategic sites to be more transit oriented is expected to enhance the activity and vitality of the area, and reinforce the Redfern Street upgrade program.

7.3 Traffic impact assessment modelling

While the traffic assessment of the key strategic sites in this report demonstrated sufficient capacity existed for development with only minor adjustments to the road network, that conclusion was based on the road network remaining the same as at present. The study area is a dense, urban traffic environment Any significant changes to the network, or even traffic signal timing, may require a more comprehensive analysis, which is usually done through the application of an area-wide traffic simulation model to identify the complex interaction of traffic flows through the local network.

Advancing the design of some of the network changes described above will require a traffic modelling capacity that conforms with road authority (RTA and City of Sydney) requirements. Such a model would measure the impact of proposed road network changes on road network performance or the sensitivity of forecast traffic outcomes under different growth scenarios, or the impacts of particular proposals on the traffic system and how their contribution might be assessed for traffic improvement fees. A model would be only one of the inputs into planning decisions, but it would be critical in examining and justifying any changes to road operations.

Appendix A

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