Existing Transport Conditions Summary

St Leonards and Crows Nest Station Precinct Transport Study

80017028

Prepared for
Department of Planning and Environment

24 May 2017
Executive summary

Precinct context

This Existing Transport Conditions Summary is the first step into the investigation of the transport network in the St Leonards Crows Nest precinct (precinct) and its potential to support development uplift. The precinct is shown in the following diagram.

The need for this study has come about by the high developer interest in the precinct. The precinct is located at the convergence of three local government areas. This creates complexities in terms of facilitating land use and transport network development in a coordinated approach that considers each development in the context of the whole precinct instead of just one local government area.

Planned transport initiatives

Transport initiatives for the precinct are already planned and these will support a general increase in residential and employment population. These include a range of other minor transport network improvements to roads and further development of the cycling network.

A major transport initiative by the state government is the Sydney Metro North West, City and South-West. Sydney Metro North-West is currently being constructed and Sydney Metro City and South-West is currently being planned and expected to be completed by 2024. As part of this, the proposed Crows Nest Metro Station provides the opportunity to support development uplift in the station catchment.

Existing population and travel behaviour

In 2016 there were approximately 15,500 residents living in the precinct and 43,800 employees working in the precinct.

A large proportion of residents who live in St Leonards travel to work via train 48%, 6% catch a bus and 15% walk. For residents in Crows Nest, 36% commute to work using a private vehicle, 22% use the bus, 19% walk and 17% catch a train. The difference in percentage of train commuters from St Leonards and Crows Nest is indicative of a typical station catchment and the potential for Crows Nest.
In the St Leonards sub-precinct, the majority of workers commute there by private vehicle (53%). Of this, 50% drive and 3% travel as a passenger. Train is the second most popular mode at 32%, followed by bus at 7%. For Crows Nest, 60% of the workers travel to work by private vehicle (4% of which are vehicle passengers). 19% catch a train and 10% catch a bus, whereas only 9% of people walked to work. Most of the workers (75%) in the Artarmon sub-precinct commute by either driving or as a passenger in a private vehicle. 20% of the workers use public transport, 16% by train and 4% by bus. Once again the differing travel pattern between precincts is evident by transport accessibility, job density and parking availability.

Over the 5 year period 2011 – 2015 the following crash incidents were recorded:

- 385 vehicles
- 52 pedestrians, a sub-set of vehicle crashes
- 22 bicycles, 21 with vehicles and 1 with a pedestrian.

Crash clusters are located along Pacific Highway in several location, Herbert Street, Falcon Street, Willoughby Road and Miller Street. These are highest at intersections. The intersection between West Street and Falcon Street had the highest number of reported crashes, 26 crashes.

**Transport network**

**Road**

The road network forms the basis of the transport network. Road reserves through the precinct support access for pedestrians, cyclists, buses, freight vehicles and private vehicles. The road network is generally closely spaced in residential and commercial areas of St Leonards and Crows Nest and more widely spaced in Artarmon.

Daily vehicle volumes from traffic surveys completed on 17th November 2016 at 18 locations throughout the precinct confirm that the Pacific Highway is the main thoroughfare for drivers with over 20,000 vehicles using certain stretches of this road in both directions. There are also high volumes of traffic on Falcon Street, with approximately 10,000 vehicles in both directions. The importance of these roads is already understood by Roads and Maritime Services (RMS) with both these roads having an administrative classification of a state road.

Key distributor roads, providing access to the Pacific Highway currently have a demand of between 4000 – 8000 vehicles per day.

**Pedestrian**

The precinct has a diverse range of land uses and pedestrian facilities vary depending on location and the adjacent land use. Pedestrian facilities are generally best around St Leonards Station and Crows Nest adjacent to retail and commercial land uses. Residential areas are generally well served by narrower paths. Paths are also provided around the employment lands in Artarmon, however the block spacing of the road network reduce the attractiveness of walking. The highest pedestrian demands have been noted around St Leonards Station and the intersection of Pacific Highway, Falcon Street and Willoughby Road.

Key pedestrian desire lines radiate out from St Leonards Station and Crows Nest activity centre. There is a high demand and strong desire between the Royal North Shore Hospital and St Leonards Station and between St Leonards Station and Crows Nest activity centre.

There are many constraints in the pedestrian network. Many signalised intersections in the precinct lack marked pedestrian crossings on all legs of the intersection. The major transport corridors of Pacific Highway and the North Shore Railway reduce pedestrian permeability through the precinct with often relatively long distances between formal crossing opportunities.

**Bicycle**

Cycling volumes are generally low to moderate with the highest recorded daily volume of 500 cyclists along Falcon Street.

The low to moderate cycling demands are indicative of the constraints of the precinct. The precinct features challenging topography and high volume roads reducing the attractiveness of cycling mode option for many users.
There is a general lack of directness and continuity along the existing network routes, as the designated routes avoid arterial road corridors such as the Pacific Highway and Falcon Street; they instead run along local and distributor roads and some just end at Pacific Highway.

**Trains**

St Leonards Station is located at the centre of the precinct. The train services provide a high quality and high capacity transport service for the station precinct.

An average of 35,180 customers used St Leonards Station over a 24 hour period in 2014. During the AM peak hour approximately 18,000\(^1\) people pass through on trains in the Sydney CBD bound direction. This peak volume indicates the line is approaching capacity and more capacity will be required in the rail network.

**Bus**

TfNSW bus services travelling through the precinct provide connections to key centres including Chatswood, North Sydney, Manly, the Sydney CBD and Bondi. They also connect with northern residential areas such as Lane Cove, Epping, the Hills District and as far as Dural. The only direct connection to the Northern Beaches is from Manly bound services.

The Gore Hill Shuttle Bus and Artarmon Loop provide weekday daytime services in the Artarmon employment area and without these services, most of the precinct would be without coverage. It is noted the M20 bus service terminates and begins on Campbell Street near Reserve Road.

During weekdays, eight out of the 21 routes operate until the early evening; seven operate during the peak periods only, and four provide all day services until late in the evening.

The Pacific Highway, along with the North Sydney and Sydney CBD, experiences bus congestion in peak periods\(^2\). The majority of routes that use the Pacific Highway are affected by congestion on the Pacific Highway which can impact services from Chatswood. In the long term, bus capacity in the North Sydney and Sydney CBD may need to be addressed by reshaping the bus network to facilitate greater interchange from bus to railway.

The majority of bus stops are not DDA compliant. Common deficiencies include insufficient circulation space and lack of designated waiting areas for mobility impaired customers, non-compliant seating and missing boarding point tactile ground surface indicators (TGSI).

**Freight**

All freight corridors in this precinct are road-based, there is no freight access via the rail line. The Gore Hill Freeway/ Lane Cove Tunnel provides a bypass route for general road traffic including freight vehicles past the precinct.

Freight movements are essential to support the employment land uses in Artarmon and general deliveries to retail, business and residential land uses throughout the precinct. The precinct's freight network also includes nominated restricted access vehicle routes for larger or higher mass limit vehicles.

**Car and motorcycle parking**

Each Council has a slightly different urban form and different car parking requirements in their respective DCP’s and also their approach to car parking management. As St Leonards is located at the border of three councils, this creates a disjointed approach. In the St Leonards sub-precinct, North Sydney Council and Lane Cove Council have paid parking on the streets that fall within their LGA but Willoughby City Council does not and this results in higher parking demand in the Willoughby LGAs\(^3\). This is noted for a considerable distance from the St Leonards core.

The car parking rates set out are generally similar for residential land uses. Commercial parking rates vary from a minimum rate 1 space per 60sq.m GFA in Lane Cove Council to a maximum of 1 space per 400sq.m of GFA in North Sydney Council.

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\(^1\) March 2014 peak train load survey, TPA, TfNSW
\(^2\) Transport for NSW – Bus strategy meeting, December 2016
\(^3\) Willoughby City Council meeting, November 2016
Car share

Car share is becoming increasingly popular, this is evident by the number of cars located in the precinct. GoGet has the highest number of vehicles provided in the precinct, generally in on-street locations. North Sydney Council has indicated that several body corporates are purchasing their own vehicles to house in the car share spaces provided on their properties.

Opportunities and constraints

The opportunities and constraints applicable to the precinct were determined through the background review and consultation with stakeholders including local councils.

Opportunities

<table>
<thead>
<tr>
<th>Category</th>
<th>Summary of opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel demand</strong></td>
<td>High public transport commuting mode share from precinct</td>
</tr>
<tr>
<td></td>
<td>Demonstrated cycling demand for direct routes</td>
</tr>
<tr>
<td></td>
<td>Popularity of, and support for, car share</td>
</tr>
<tr>
<td></td>
<td>Reduced need for vehicle ownership and parking spaces due to the potential for developments close to major transport interchanges</td>
</tr>
<tr>
<td><strong>Infrastructure and services</strong></td>
<td>Increased and improved pedestrian crossings.</td>
</tr>
<tr>
<td></td>
<td>Comprehensive current and future public transport network</td>
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<td></td>
<td>The introduction of Sydney Metro could be accompanied by optimisation of train and bus services</td>
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<td></td>
<td>Roll out of TINSW Wayfinding Strategy will improve public transport legibility</td>
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<td></td>
<td>The Herbert Street road bridge over the railway line could be extended to Chandos Street to improve permeability for vehicles, pedestrians and cyclists.</td>
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<tr>
<td></td>
<td>Crows Nest Metro Station provides the opportunity for the provision of cycling infrastructure.</td>
</tr>
<tr>
<td><strong>Land use development / design / parking</strong></td>
<td>Proximity to other strategic and district centres</td>
</tr>
<tr>
<td></td>
<td>Freight accessibility to Artarmon from Gore Hill and Warringah Freeways</td>
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<tr>
<td></td>
<td>Urban renewal will allow for street reconfiguration to accommodate walking and cycling facilities, reduce vehicle space, provide new through site links, pedestrianise areas and activate laneways.</td>
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<tr>
<td></td>
<td>Steep grades south of the Pacific Highway support the case for an underpass to the Crows Nest Metro Station</td>
</tr>
<tr>
<td></td>
<td>Diverse land uses support trip containment</td>
</tr>
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<td></td>
<td>Extension of the public transport catchment with the new Sydney Metro station at Crows Nest</td>
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<td></td>
<td>Proposed plazas over the railway line will reduce barriers to movement</td>
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<tr>
<td></td>
<td>Coordinated transport planning approach</td>
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### Constraints

<table>
<thead>
<tr>
<th>ID</th>
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</thead>
<tbody>
<tr>
<td><strong>Travel demand</strong></td>
<td>Railway network at capacity in peak periods</td>
</tr>
<tr>
<td></td>
<td>Traffic congestion and queues on local and distributor roads</td>
</tr>
<tr>
<td></td>
<td>Future traffic growth on the Pacific Highway</td>
</tr>
<tr>
<td></td>
<td>High private vehicle mode share for St Leonards workers</td>
</tr>
<tr>
<td></td>
<td>High demand for on-street parking</td>
</tr>
<tr>
<td><strong>Infrastructure and services</strong></td>
<td>Pedestrian security in some areas</td>
</tr>
<tr>
<td></td>
<td>Lack of pedestrian connectivity between land uses in the west of the precinct</td>
</tr>
<tr>
<td></td>
<td>Lack of pedestrian amenity and inconsistent facilities</td>
</tr>
<tr>
<td></td>
<td>Steep grades on pedestrian routes south of the Pacific Highway</td>
</tr>
<tr>
<td></td>
<td>Poor amenity of grade-separated crossing</td>
</tr>
<tr>
<td></td>
<td>Inconsistent wayfinding</td>
</tr>
<tr>
<td></td>
<td>Lack of cycling infrastructure on direct routes, and cycling network gaps</td>
</tr>
<tr>
<td></td>
<td>Limited TfNSW bus coverage in Artarmon</td>
</tr>
<tr>
<td></td>
<td>Inconsistent and some poorly located bus stop facilities and bus interchange amenity</td>
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<tr>
<td></td>
<td>Lower public transport service frequencies at night and on weekends</td>
</tr>
<tr>
<td></td>
<td>Lack of efficient interchange between modes</td>
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<tr>
<td></td>
<td>Lack of taxi ranks and pick up / drop off zones</td>
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<tr>
<td></td>
<td>Restricted vehicle movements to enter and exit the Pacific Highway.</td>
</tr>
<tr>
<td><strong>Land use development / design / parking</strong></td>
<td>Lack of integrated transport planning</td>
</tr>
<tr>
<td></td>
<td>Lack of pedestrian activity at night-time</td>
</tr>
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<td></td>
<td>Road tolls contribute to through traffic</td>
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</tbody>
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Further details of the constraints and opportunities are in **Section 5**.
# Table of Contents

1 **Introduction**
   1.1 Purpose of this Existing Transport Conditions Report
   1.2 About this Existing Transport Conditions Report
   1.3 The precinct

2 **Future precinct context**
   2.1 Strategic plans
      2.1.1 A Plan for Growing Sydney
      2.1.2 NSW Long Term Transport Master Plan
      2.1.3 Draft North District Plan
      2.1.4 Other relevant State plans and strategies
   2.2 Council Strategic Plans
      2.2.1 North Sydney Community Strategic Plan
      2.2.2 Willoughby City Strategy 2013-2029
      2.2.3 Lane Cove Community Strategic Plan 2025
      2.2.4 Additional documents considered
   2.3 Planned transport initiatives
      2.3.1 Sydney Metro
      2.3.2 Road network changes
      2.3.3 Cycling network changes

3 **Existing travel behaviour**
   3.1 Population and employment
      3.1.1 Population
      3.1.2 Employment
   3.2 Dwelling types
   3.3 Motor vehicle ownership
   3.4 Transport mode share
      3.4.1 Journey to work
      3.4.2 Journey to Work
   3.5 Crash analysis
      3.5.1 Crash clusters
      3.5.2 Crash types
      3.5.3 Crash time of day

4 **Transport network**
   4.1 Major transport corridors
   4.2 Road network
      4.2.1 Warringah/Gore Hill Freeway access
      4.2.2 Pacific Highway
      4.2.3 Falcon Street
      4.2.4 Sub-arterial and distributor roads
      4.2.5 Local roads
      4.2.6 Road network functions
   4.3 Walking
      4.3.1 The pedestrian experience
      4.3.2 Network
      4.3.3 Infrastructure
      4.3.4 Demand
4.4 Cycling

4.4.1 The cycling experience
4.4.2 Network
4.4.3 Infrastructure
4.4.4 Bike parking for developments
4.4.5 Network demand

4.5 Train

4.5.1 Train Network
4.5.2 Infrastructure and services
4.5.3 Demand

4.6 Bus

4.6.1 TfNSW services
4.6.2 Other publicly accessible bus services
4.6.3 Infrastructure and services
4.6.4 Demand

4.7 Freight

4.7.1 Network
4.7.2 Infrastructure

4.8 Private vehicles

4.8.1 Demand and performance

4.9 Parking

4.9.1 Infrastructure
4.9.2 Parking rates for developments
4.9.3 Parking levels
4.9.4 Demand

4.10 Car share

4.11 Ride share

4.12 Transport network summary

5 Opportunities and constraints

Tables

Table 2-1 Forecast trip time from Crows Nest Station to other key stations ........................................ 6
Table 3-1 Population and employment – 2016 .................................................................................. 11
Table 3-2 Dwelling types ............................................................................................................. 11
Table 3-3 Residential motor vehicle ownership per household .................................................. 12
Table 4-1 Road classification comparison .................................................................................. 24
Table 4-2 Sub-arterial and distributor roads ................................................................................ 25
Table 4-3 Summary of two-way pedestrian volumes (2011) ....................................................... 39
Table 4-4 Bicycle parking rates for each Council ....................................................................... 46
Table 4-5 RMS average daily cycling volumes ......................................................................... 46
Table 4-6 St Leonards Station train services ............................................................................. 50
Table 4-7 In and Out volumes at St Leonards Station (2014) ..................................................... 50
Table 4-8 Summary of bus service frequency and coverage ...................................................... 54
Table 4-9 Pacific Highway inbound - Lane Cove to North Sydney ............................................. 60
Table 4-10 Pacific Highway outbound – North Sydney to Lane Cove ..................................... 60
Table 4-11 Off-street car parking in the precinct ................................................................. 62
Table 4-12 Council DCP parking rates .................................................................................. 65
Table 5-1 Precinct opportunities ......................................................................................... 68
Table 5-2 Precinct constraints ............................................................................................. 71

Figures

Figure 1-1 St Leonards Crows Nest Precinct ........................................................................ 3
Figure 2-1 Sydney Metro - Proposed works at Crows Nest Station ................................... 7
Figure 3-1 Sub-precincts and travel zones within the St Leonards / Crows Nest Precinct .... 10
Figure 3-2 Mode split commuting from the precinct ............................................................. 13
Figure 3-3 Mode split commuting to the precinct ................................................................. 13
Figure 3-4 Commuting into the precinct ............................................................................. 15
Figure 3-5 Commuting from the precinct travel zones ....................................................... 16
Figure 3-6 Crash locations ................................................................................................ 18
Figure 3-7 Crash cluster locations ...................................................................................... 19
Figure 3-8 Pedestrian crash type ......................................................................................... 20
Figure 3-9 Vehicle crash type ............................................................................................ 21
Figure 3-10 Cyclist crash types .......................................................................................... 22
Figure 3-11 Road environment ............................................................................................ 22
Figure 3-12 Crashes – time of day ...................................................................................... 23
Figure 4-1 Functional road hierarchy .................................................................................. 27
Figure 4-2 Draft NSW Road Planning Framework - movement and place functions and road categories... 28
Figure 4-3 Road categories across the precinct ................................................................. 30
Figure 4-4 Primary and Secondary walking routes ............................................................. 33
Figure 4-5 Walking catchments ......................................................................................... 34
Figure 4-6 Existing pedestrian crossing facilities ............................................................... 37
Figure 4-7 Distances between formal crossings in the precinct - Pacific Highway and T1 rail corridor .... 38
Figure 4-8 Daily Pedestrian Volumes 2016 .................................................................. 40
Figure 4-9 Existing and proposed cycling routes ............................................................... 43
Figure 4-10 2.5 kilometre cycling catchment ................................................................... 44
Figure 4-11 Daily Cyclist Volumes 2016 ....................................................................... 47
Figure 4-12 30 minute rail catchment .............................................................................. 49
Figure 4-13 Bus Network .................................................................................................. 52
Figure 4-14 Restricted access vehicle routes .................................................................... 59
Figure 4-15 Daily Vehicle Volumes 2016 ....................................................................... 61
Figure 4-16 Off-street parking locations ......................................................................... 64
Figure 4-17 GoGet car share parking locations .................................................................. 67
1 Introduction

The Department of Planning & Environment (DP&E) engaged Cardno to prepare a Strategic Transport Study which will proceed this report. This study will contribute to a Land Use and Infrastructure Strategy for the precinct and help to guide future development and infrastructure investment.

1.1 Purpose of this Existing Transport Conditions Report

The St Leonards and Crows Nest Station Precinct (the precinct) is a major employment centre in Sydney. The precinct is nominated as one of Sydney’s strategic centres and is located in the Global Economic Corridor. There are plans to grow residential and employment populations, and to enhance the health precinct around Royal North Shore Hospital.

A number of recent planning proposals for the precinct advocate for increasing development densities, particularly around the St Leonards Train Station and the future Crows Nest Metro Station.

This Existing Transport Conditions Report describes the transport networks that service the St Leonards and Crows Nest precinct and identifies early opportunities and constraints. It is the first component of the Strategic Transport Study which aims to investigate the transport network and its potential to support additional development.

1.2 About this Existing Transport Conditions Report

This Existing Transport Conditions Report provides

> An overview of existing plans for the precinct.

> A review of the existing residential and employment populations and their travel behaviour. This is based on the collation of existing data sources such as Transport Performance and Analytics population, employment.

> A mode by mode qualitative review of the transport network include its quality, demand.

> A high level identification of opportunities and constraints.

The next stage of this study will include, strategic transport modelling of the existing and future networks based on potential development scenarios and already planned transport network improvements. It will form the basis to identify future network constraints and recommendations will be developed to mitigate the identified constraints.

1.3 The precinct

The St Leonards and Crows Nest Precinct is located on the Lower North Shore, approximately 5km north of the Sydney CBD and 3.5km south of Chatswood. The precinct includes all of St Leonards and parts of Artarmon, Greenwich, Crows Nest, North Sydney and Wollstonecraft. Three local government areas converge on the precinct included Willoughby City Council, North Sydney Council and Lane Cove Council. A map of the precinct is shown in Figure 1-1.

Within the precinct lies a wide range of land uses ranging from industrial and bulky goods in Artarmon, the TAFE, Bradfield High School and Health Precinct including the Royal North Shore Hospital on the eastern side of the railway line, mixed use land uses in close proximity to St Leonards Station, and retail in Crow Nest and along the Pacific Highway.

Low density/ detached housing is the predominant land use in the suburbs of Naremburn, and Crows Nest. Medium to high density residential housing exists in Wollstonecraft and St Leonards and more high density residential uses is developed for St Leonards and Crows Nest.

The area is supported by public transport services including the T1 North Shore and Northern Line and a number of local and suburban bus services providing connections to other areas of Sydney. The precinct is set to change in the future with the development of the metro line providing a station in Crows Nest.
Given the precinct has a relatively high concentration of jobs and its proximity to Macquarie Park, Chatswood, North Sydney and Sydney CBD, it is in a desirable location for further residential and employment growth.

Now is an opportune time to plan for any transport infrastructure to support the urban renewal and take advantage of the existing and planned transport networks. This can include providing more site through links to aid the permeability of the precinct and street reconfigurations to support lower impact transport modes.
Figure 1-1 St Leonards Crows Nest Precinct
2 Future precinct context

2.1 Strategic plans

2.1.1 A Plan for Growing Sydney
A Plan for Growing Sydney (2014) outlines the transport infrastructure actions required to support Sydney’s growing population. St Leonards is identified as a strategic centre for health, education and office-based employment markets, with many new jobs forecast for the precinct. The plan identifies the need to remove pinch points in the transport network to increase accessibility and boost business activity. Further growth in employment and housing opportunities are also considered in association with the plans for a Sydney Metro train station at Crows Nest.

2.1.2 NSW Long Term Transport Master Plan
The NSW Long Term Transport Master Plan (TfNSW, 2012) identifies the need to improve the integration of all transport modes to maintain Sydney’s role as a centre of economic and social activity. Seamlessly connected infrastructure that provides a high level of service is important for all major employment centres, such as St Leonards, to improve accessibility to local services and public transport. The plan notes the importance of a new North West rail link in connecting North West residents to North Shore employment centres like St Leonards. The residential and economic growth of St Leonards as a major employment hub is supported by this plan which mandates customer-focused transport planning practices.

2.1.3 Draft North District Plan
The Greater Sydney Commission’s North District Plan (2016) provides a 20 year vision of northern Sydney's housing and employment growth opportunities and the supporting transport infrastructure plans. The strategic centre of St Leonards forms part of the identified ‘Eastern City’ which stretches from Kogarah and Port Botany through to Macquarie Park and the Northern Beaches Hospital. The plan notes the growing demand for homes in St Leonards which could occur at the expense of additional commercial floor space. These changes in land use perpetuate the need for an improved transport system. The plan identifies St Leonards as a health and education super precinct due to a number of hospitals, and health and education related services. It is also named as a ‘Collaboration Area’ which would benefit from State and Local government partnership. Transport planning for the area should specifically leverage off the new Sydney Metro Station at Crows Nest and reduce the impact of vehicle movements on pedestrian and cyclist accessibility. A principal bicycle route is proposed between Hornsby and North Sydney.

2.1.4 Other relevant State plans and strategies
Other state plans with relevant strategic transport directions for the precinct include the NSW State Infrastructure Strategy and the future modal strategies: Sydney’s Walking Future, Sydney’s Cycling Future, Sydney’s Rail Future and Sydney’s Bus Future.

The NSW State Infrastructure Strategy prepared by Infrastructure NSW presents a vision for NSW in 2031 and makes recommendations for infrastructure investment over the next 20 years, grouped by short, medium and long-term priorities. The 2014 update to the Strategy provides detail of the proposed funding strategy for infrastructure projects, the Restart NSW Fund. The 2014 update identifies additional priorities for transport infrastructure including the need for the metro line and a second harbour crossing.

Sydney's Rail Future notes the importance of enhancing the capacity of the rail network with the second harbour crossing/metro line which will deliver a 60% increase in rail services, and a time saving of up to 8 minutes for commutes from Chatswood to the CBD. Sydney's Bus Future notes that direct links from the Northern Beaches to St Leonards would be assessed to improve access to and from the Northern Beaches. Sydney's Walking Future demonstrates that the lower North Shore has one of the highest walking mode share’s in Sydney at over 25%. St Leonards and Crows Nest also sit within a corridor of centres, from Chatswood to the Sydney CBD. The strategy proposes that walking routes within two kilometres of centres should be prioritised. Sydney's Cycling Future notes the investigation of a North Shore link which passes close to the precinct. As with walking, cycling routes close to centres will be prioritised.
2.2 Council Strategic Plans

2.2.1 North Sydney Community Strategic Plan
The North Sydney Community Strategic Plan (2013) provides a set of directions aimed at addressing prioritised transport issues identified by the community. These issues include the high level of vehicle congestion, lack of on street parking, and reduced pedestrian accessibility and amenity. The directions outlined by Council will promote the use of public and active transport by increasing the street space dedicated to sustainable modes, and integrating them with the network of pedestrian and cycle paths. These plans will also align with Council’s economic direction of supporting employment growth and increasing social vitality by providing accessible transport options for the elderly and people with disability.

2.2.2 Willoughby City Strategy 2013-2029
The Willoughby City Strategy 2013 – 2029 outlines key strategic directions for planning transport infrastructure over the next 16 years. Council presents overarching principles that determine these strategic directions. The principle of improving health and wellbeing, is to be achieved by providing connected walking and cycle paths. The principle of increasing mobility involves improving the level of service of public and active transport, improving integration between modes and managing traffic congestion. Sustainable economic activity in the precinct is a principle to be achieved in part from a sustainable and efficient transport network.

2.2.3 Lane Cove Community Strategic Plan 2025
The Lane Cove Community Strategic Plan 2025 is comprised of goals and strategies to achieve an integrated transport system that will link various centres, facilities and suburbs. The goals are the result of extensive community consultation, and resulting objectives are outlined. The goal of achieving an inclusive, interconnected and active community should be achieved by promoting integrated public and active transport options that link people to employment hubs, services and facilities. Incentives should be introduced that reduce reliance on private vehicles for example for carpooling, and parking supply should respond to parking demand. An improved transport network will also contribute to achieving the goal of creating a vibrant and sustainable local economy by improving access to local business centres.

2.2.4 Additional documents considered
Additional documents considered in the preparation of this report to gather context and gain an understanding of the issues and plans for the St Leonards and Crows Nest transport network include:
> St Leonards and Crows Nest Station Precinct Structure Plan, 2016 (SJB Architects)
> St Leonards Strategy, 2006 (David Lock Associates)
> St Leonards/Crows Nest Planning Study Precinct 1, 2011 (North Sydney Council)
> St Leonards South Strategy Precinct report, 2013 (David Lock Associates)
> St Leonards South Masterplan Draft, 2014 (Annand Associates Urban Design)
> St Leonards Development Capacity, 2015 (Architectus)
> St Leonards Crows Nest Planning Study, 2015 (North Sydney Council)
> St Leonards and Crows Nest Strategic Employment Review, 2016 (SGS Economics and Planning)
> Gore Hill Park Plan of Management, 2016
> Gore Hill Park redevelopment- FAQ, Willoughby City Council website
> Willoughby Street Parking Strategy, Willoughby City Council 2016

2.3 Planned transport initiatives

2.3.1 Sydney Metro
Sydney Metro is Australia’s largest public transport project currently under planning and construction across two stages. The project will comprise of 31 stations across 65 kilometres of dedicated metro rail, connecting
the north-west and south-west suburbs of Sydney with the Sydney CBD. New fully automated single-deck metro trains will operate along the new line every four minutes in the peak, with capacity to move up to 40,000 customers per hour in each direction.

Forecast trip times from Crows Nest Metro Station to other key stations is shown in Table 2-1.

<table>
<thead>
<tr>
<th>Stations north of Crows Nest</th>
<th>Stations south of Crows Nest</th>
<th>Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rouse Hill</td>
<td>Martin Place</td>
<td>7</td>
</tr>
<tr>
<td>Castle Hill</td>
<td>Pitt Street</td>
<td>9</td>
</tr>
<tr>
<td>Epping</td>
<td>Central</td>
<td>11</td>
</tr>
<tr>
<td>Macquarie Park</td>
<td>Sydenham</td>
<td>18</td>
</tr>
<tr>
<td>Chatswood</td>
<td>Bankstown</td>
<td>39</td>
</tr>
</tbody>
</table>

2.3.1.1 Sydney Metro Northwest

Sydney Metro Northwest is Stage One of the Sydney Metro project, currently under construction and due for completion in 2019. Once complete, the project will deliver metro services along eight new stations from Cudgegong Road to Epping, before continuing along the existing Epping to Chatswood Railway and terminating at Chatswood Station.

2.3.1.2 Sydney Metro City and Southwest

Sydney Metro City and Southwest is Stage Two of the Sydney Metro project, currently being planned and expected to be completed by 2024. The project proposes an extension of the Metro alignment from Chatswood through to the City, before connecting to Sydenham Station and proceeding along the current T3 Bankstown Line to terminate at Bankstown. Between Chatswood and the City, new Metro stations will be built at Crows Nest, Victoria Cross (North Sydney), Barangaroo, Martin Place and Pitt Street.

Crows Nest Metro Station

The proposed Crows Nest Metro Station provides the opportunity to support development uplift in its catchment.

The project’s Environmental Impact Statement (EIS) proposes the new Crows Nest Metro Station will be located between the Pacific Highway and Clarke Street. The following supporting infrastructure is proposed in as part of the scope of works for the new station:

> Two pedestrian crossings (zebra) at the intersection of Clarke Street and Hume Street;
> A pedestrian crossing (zebra) across Clarke Street, opposite Kelly’s Place Children’s Centre;
> A pedestrian crossing (zebra) across Oxley Street at the intersection with Clarke Street;
> An additional signalised pedestrian crossing leg across the Pacific Highway (north side) at the intersection with Oxley Street;
> Enhanced pedestrian amenities around the station, with details agreed in consultation with North Sydney Council and RMS;
> Wayfinding signage and Sydney Metro information;
> Kiss and ride and taxi bays on Clarke Street;
> Bike parking at the station entrances;
> On-road cycle facilities on Hume Street and Oxley Street; and
> Existing bus stops on Pacific Highway;
Bicycle parking facilities with 120 spaces are proposed at the Crows Nest Metro Station entrance plazas, located at the corner of the Pacific Highway and Oxley Street, and near the intersection of Hume Street and Clarke Street. A bus integration plan will need to be prepared for the new service.

Crows Nest Metro Station is proposed to be located 25 metres underground with entrances at the intersection of Pacific Highway and Oxley Street, and the intersection of Clarke Street and Hume Street. The proposed features of the Crows Nest Metro Station that will enhance customer accessibility are:

A summary diagram of the proposed works is provided in Figure 2-1.

Figure 2-1 Sydney Metro - Proposed works at Crows Nest Station

Source: Sydney Metro City and Southwest Environmental Impact Statement (May 2016)

Crows Nest Metro Station considerations

Crows Nest Metro Station will increase the proportion of the precinct within a convenient catchment of a high quality and high capacity rail transport infrastructure. This will improve the accessibility of the precinct to other areas of Sydney and could assist to reduce the need for private vehicle ownership and car parking.

2.3.2 Road network changes

2.3.2.1 Lithgow Street

As part of the proposed over-railway plaza and the development on Lithgow Street, the intersection of Lithgow Street and the Pacific Highway will be closed. This will direct traffic (heading outbound along the Pacific Highway) from Lithgow Street to Oxley Street to join the Pacific Highway. A new laneway will be created to the south of Christie Lane to provide vehicle access from Lithgow Street to Christie Street and Nicholson Street.

2.3.2.2 Hume Street

As part of the redevelopment of the Hume Street Park (described in Section 2.3.3.2) North Sydney Council proposed to close Hume Street adjacent to the park (between Pole Lane and Clarke Street) to traffic. Hume Street currently operates as one lane and one direction to the to north.

A pedestrian link will also be created between the Hume Street Park and Willoughby Road for improved permeability.

Transport for NSW – Bus strategy meeting December 2016
2.3.2.3  **Chandos Street / Alexander Street intersection**

North Sydney Council is planning to signalise the intersection of Chandos Street and Alexander Street in Crows Nest. The T intersection currently operates with signed priority control.

2.3.2.4  **Nicholson Street widening**

Nicholson Street will be widened to support the new developments being built on the block between Nicholson Street and the Pacific Highway.

2.3.3  **Cycling network changes**

2.3.3.1  **Lane Cove Council**

The 2013 Lane Cove Council Draft Bicycle Plan provides recommendations based on a review of the 2008 Plan, and the status of works proposed in 2008. In the precinct, three routes were proposed in the 2008 Plan, which remain incomplete.

- Regional Route B3: A shared path along the western side of the Pacific Highway, extending from the intersection of Longueville Road to the intersection with Albany Street;
- Regional Route B4: A shared path along the northern side of River Road, extending from the intersection of Longueville Road to the intersection with Shirley Road; and
- Local Route B18: A combination of shared paths, on-road shoulder lanes and mixed traffic facilities connecting Greenwich Road with St Leonards Station.

An additional route (Route A9) was proposed in the 2013 Plan. This route extends from the intersection of the Pacific Highway with Berry Street, and proceeds via Marshall Lane, Canberra Avenue, Lithgow Street, Christie Lane, Christie Street and Nicholson Street to tie in with existing routes at the intersection of the Pacific Highway with Christie Street, and Oxley Street with Nicholson Street. The primary aim of this route is to complete a missing link in the network on the southern side of the Pacific Highway and facilitate travel across Council LGA boundaries.

Lane Cove Council is also investigating a new east-west cycle link between Greenwich and Wollstonecraft.

2.3.3.2  **Willoughby City Council**

The 2006 Willoughby City Council Bike Plan recommends 27 new routes or network links to be implemented across the Willoughby LGA. The routes were classed as low, medium or high priority, and were designated as either on or off-road facilities. Seven of the proposed routes proceed through the precinct; a 2012 review of the Plan indicated that four of these remain incomplete.

- Route 22: A medium priority off-road route along the eastern side of the Pacific Highway between Longueville Road to Herbert Street;
- Route 23: A high-priority on-road route through the TAFE and Gore Hill precinct (former ABC studio);
- Route 24: A medium priority on-road route through the Royal North Shore Hospital property, between St Leonards Station and Westbourne Street; and
- Route 25: A medium priority off-road route running parallel to the T1 North Shore and Northern Line on the eastern side, between St Leonards Station and the Gore Hill Freeway.

2.3.3.3  **North Sydney Council**

The 2014 North Sydney Council Integrated Cycling Strategy outlines an infrastructure plan with five priority routes for implementation. Two of these routes pass through the precinct:

- Route 1: Sydney Harbour Bridge to Cammeray via West Street (High priority); and
- Route 4: Cammeray to Crows Nest via Willoughby Road and Holtermann Street (Medium priority).

Route 1 is proposed along West Street, on the eastern boundary of the precinct. The street already supports a large volume of cycling traffic. This route is a key north-south corridor, connecting the northern suburbs with the Sydney Harbour Bridge. It will also have connections to St Leonards Station via an existing east-west route along Atchinson Street. Concept plans have been developed for a separated bi-directional facility.
on the eastern side of the road reserve, between the intersections with Church Street and Palmer Street. The road reserve is flat and wide, making it ideal for accommodating a separated bi-directional facility.

Route 4 proposes to connect Chandos Street with the proposed cycleway along West Street via Willoughby Road and Holtermann Street. This route is planned as an on-road mixed traffic facility, with alterations planned for on-street parking and at key intersections.

The Greater Sydney Commission’s Draft North District Plan (2016) outlines an action to develop a Principal Bicycle Network in the region. One of the proposed routes for this region will connect Hornsby to North Sydney; via St Leonards and Chatswood.

A summary map of the existing and proposed bicycle routes is provided in Section 4.4.1.
3 Existing travel behaviour

It is important to understand who is living in and accessing the precinct, and the existing travel behaviour when planning for future movements in the precinct. This chapter provides a summary of the population and employment, dwelling types and motor vehicle ownership, as well as how people are travelling and where they are coming from. Crashes in the precinct are also analysed.

The precinct was divided into three sub-precincts; Artarmon, St Leonards and Crows Nest/Naremburn to acknowledge different travel behaviours in each. Within each of the sub-precincts travel behaviour was analysed by travel zones where possible; the travel zones which make up each of the sub-precincts are shown in Figure 3-1.

![Figure 3-1 Sub-precincts and travel zones within the St Leonards / Crows Nest Precinct](image)

**Base map source:** Transport Performance and Analytics, 2016

### 3.1 Population and employment

This section provides a summary of the existing, population and jobs for the precinct as it has a direct relationship with trip generation. The data is from TfNSW’s Transport and Performance Analytics (TPA) website and uses Travel Zone explorer and Journey to Work data based on the Census by the Australian Bureau of Statistics and further refined by TPA.

#### 3.1.1 Population

Approximately 6,900 residents lived in St Leonards, and 8,600 people lived in Crows Nest in 2016. There are no residents living in the Artarmon sub-precinct, the land use is primarily employment and bulky goods retail. Residential population for the precinct is summarised in Table 3-1.
3.1.2 Employment

There were around 43,800 employees in the precinct in 2016. Most employees worked in St Leonards (56%) while Artarmon represented 21% of workers and Crows Nest 22%. Table 3-1 summarises the number of residents and employees in the precinct.

Table 3-1 Population and employment – 2016

<table>
<thead>
<tr>
<th>Residential</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>Artarmon</td>
<td>0</td>
</tr>
<tr>
<td>Crows Nest</td>
<td>8,625</td>
</tr>
<tr>
<td>St Leonards</td>
<td>6,915</td>
</tr>
<tr>
<td>Total</td>
<td>15,540</td>
</tr>
</tbody>
</table>

Source: Transport Performance and Analytics, Travel Zone explorer

3.2 Dwelling types

All of the suburbs in the precinct have a low number of detached dwellings and a high number of Flats, Units and Apartments (FUA). FUA dwellings typically represent high density residential development.

St Leonards has predominately FUA housing at 92% and less than 10% of housing is detached dwellings or semi. Crows Nest is more diverse in dwelling types with 50% FUA, 22% detached dwellings and 29% semi. The Sydney Metropolitan Area dwelling types are also listed for comparison. Table 3-2 summaries the dwelling types in the precinct.

Table 3-2 Dwelling types

<table>
<thead>
<tr>
<th>Sub precinct</th>
<th>Separate</th>
<th>Semi</th>
<th>FUA</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artarmon</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Crows Nest</td>
<td>394 (22%)</td>
<td>525 (29%)</td>
<td>884 (50%)</td>
<td>0 (0.2%)</td>
</tr>
<tr>
<td>St Leonards</td>
<td>110 (5%)</td>
<td>39 (2%)</td>
<td>1,927 (92%)</td>
<td>9 (0.4%)</td>
</tr>
<tr>
<td>Sydney Metropolitan Area</td>
<td>926,062 (70%)</td>
<td>194,171 (13%)</td>
<td>391,887 (26%)</td>
<td>7,004 (0.5%)</td>
</tr>
</tbody>
</table>

Source: Transport Performance and Analytics, Journey to Work, 2011

3.3 Motor vehicle ownership

Vehicle ownership is a key indicator of mode share. The portion of non-ownership indicates the need to rely on other transport modes. Compared to the Sydney Metropolitan Area, the precinct has lower proportions of private vehicle ownership. A high proportion of households in the precinct that do not own a private vehicle especially St Leonards at 30%, compared with the Greater Sydney Metropolitan Area where the proportion of households without a car is 12%. For the residents of the precinct that do own private vehicles, the majority only own one vehicle. In Crows Nest this is 58% and St Leonards is 54%, compared to the Greater Sydney Metropolitan Area which is 38%. Vehicle ownership in the precinct is detailed in Table 3-3.
Table 3-3 Residential motor vehicle ownership per household

<table>
<thead>
<tr>
<th>Sub precinct</th>
<th>Vehicles per household</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 Vehicles</td>
</tr>
<tr>
<td>Artarmon</td>
<td>0</td>
</tr>
<tr>
<td>Crows Nest</td>
<td>312 (17%)</td>
</tr>
<tr>
<td>St Leonards</td>
<td>615 (30%)</td>
</tr>
<tr>
<td>Sydney Metropolitan Area</td>
<td>184,242 (12.1%)</td>
</tr>
</tbody>
</table>

Source: Transport Performance and Analytics, Journey to Work, 2011

3.4 Transport mode share

3.4.1 Journey to work

Journey to Work data from 2011 is analysed in the following sections.

3.4.1.1 Residents of the precinct

A large proportion of residents who live in St Leonards travel to work via train 48%, 26% via private vehicle, 6% catch a bus and 15% walk.

For residents in Crows Nest, 36% commute to work using a private vehicle, 22% use the bus, 19% walk and 17% catch a train. This indicates there is a relatively higher proportion of people in Crows Nest live within walking distance to their job.

3.4.1.2 Workers of the precinct

In the St Leonards sub-precinct, the majority of workers commute there by private vehicle (53%). Of this, 50% drive and 3% travel as a passenger. Train is the second most popular mode at 32%, followed by bus at 7%.

60% of the Crows Nest workers travel to work by private vehicle (4% of which are vehicle passengers). 19% catch a train and 10% catch a bus, whereas only 9% of people walked to work.

Most of the workers (75%) in the Artarmon sub-precinct commute by either driving or as a passenger in a private vehicle. 20% of the workers use public transport, 16% by train and 4% by bus.

The mode share split for commuting from the precinct in shown in Figure 3-2 and commuting to the precinct in Figure 3-3.

There is a notable difference in the travel behaviour of residents from St Leonards and Crows Nest precinct. A much higher proportion of residents commute by train from St Leonards than from Crows Nest. The Crows Nest Metro Station is anticipated to significantly increase the proportion of trips by rail in Crows Nest.

There is currently no residential population in Artarmon therefore no population is shown commuting from the precinct.
Figure 3-2 Mode split commuting from the precinct

Figure 3-3 Mode split commuting to the precinct
3.4.2 Journey to Work

There are more people commuting from the north shore to the precinct than other areas across the Sydney Metro Area. The areas with a higher number of people commuting to the precinct include the lower north shore, areas in St Leonards, Greenwich, Lane Cove, Neutral Bay and Wollstonecraft. In general, there is a low number of people commuting from the southwest of Sydney. A summary map showing where people are commuting from to get to the precinct by travel zone is provided in Figure 3-4.

The precinct has high commuter trip containment for residents, demonstrating a strong relationship between housing and employment in the area. People commuting from the precinct mainly travel to jobs in Sydney CBD followed by jobs within the precinct, or to Chatswood, North Sydney, Macquarie Park and Pyrmont.

A summary map showing where people are travelling from the precinct is provided in Figure 3-5.
Figure 3-4 Commuting into the precinct
Figure 3-5 Commuting from the precinct travel zones
3.5 Crash analysis

There were 543 reported crashes in the precinct in the 5 year period 2011 to 2015 inclusive. This analysis excludes accidents in the Lane Cove Tunnel, Gore Hill Freeway and Warringah Freeway as this corridor bypasses the precinct. The crashes include:

- Fifty-two (52) crashes involving pedestrians;
- One (1) fatal pedestrian crash; and
- Two (2) fatal vehicle crashes.

A summary map of the crash locations is provided in Figure 3-6.

3.5.1 Crash clusters

There are several crash clusters within the precinct which involve at least ten crashes. These clusters are located along:

- Pacific Highway;
- Herbert Street;
- Falcon Street;
- Willoughby Road; and
- Miller Street.

The intersection between West Street and Falcon Street had the highest number of crashes (26 crashes in the 5 year period). This is closely followed by the intersection of Falcon Street, Willoughby Road and Pacific Highway with 25 crashes, followed by Herbert Street and Pacific Highway had 12 crashes. A density map summarising crashes in the precinct is shown in Figure 3-7.

High density cluster represent up to 50 crashes per 100 square meters and low density represents 1 crash per square 100 square meters.
Figure 3-6 Crash locations
Figure 3-7 Crash cluster locations
3.5.2 Crash types

One of the basic tools for understanding what happened in a crash is the road user movement (RUM) which describes the first cause for the crash.

3.5.2.1 Pedestrian crashes

The crash types which involve pedestrians are identified in the RMS accident database under RUM codes 00 to 09.

There was a total of 52 pedestrian crashes within the precinct between 2011 - 2015. The most common occurring crash types are RUM crash codes 00, where a pedestrian is hit in the near side lane and 02, where a pedestrian is hit in the far side lane. These crashes occurred 24 and 16 times respectively over the five year period. The number of pedestrian crashes by RUM code is shown in Figure 3-8.

![Figure 3-8 Pedestrian crash type](image)

The high prevalence of pedestrians hit on the near and far side is indicative of a lack of crossing facilities, driver behaviour and road conditions and environment in the precinct.

3.5.2.2 Vehicle crashes

There were 385 reported vehicle crashes in the five year period 2011 – 2015 inclusive. In relation to vehicle crashes, rear ending was the most common crash type across the precinct with 93 occurrences in the past five year period. This was followed by vehicles from the opposing direction crossing right through (RUM 21), and vehicles from the adjacent direction crossing traffic (RUM 10). A summary of the number of vehicle crashes by RUM code is shown in Figure 3-9.
3.5.2.3 Bicycle crashes

As a subset of reported vehicle and pedestrian crashes, over the five-year period there were 22 crashes that involved cyclists in the precinct. One of these involved a pedestrian and 21 involved another vehicle. The majority of these crashes were located on the eastern side of the rail line. Over 85 percent of these crashes occurred during daylight. The most common type of crash occurred when there was a right turn movement across opposing traffic (RUM Code 21) which occurred eight times. This type of crash can be due to several reasons including poor sight lines from either vehicles or cyclists and misjudgement of timing to cross opposing direction. Rear ending was the second most common type of crash involving cyclists, this occurred five times. The crashes involving cyclists are shown by type in Figure 3.10.
Most crashes involving cyclists occurred at intersections; over 40 percent of cyclist crashes occurred at four-way intersection and over 20 percent at T-intersections. Crash by road environment is shown in Figure 3-11.

**Figure 3-10 Cyclist crash types**

![Bar chart showing cyclist crash types]

**Figure 3-11 Road environment**

![Bar chart showing road environment]

<table>
<thead>
<tr>
<th>Road Environment</th>
<th>Number of Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-way undivided</td>
<td>3</td>
</tr>
<tr>
<td>Divided road</td>
<td>3</td>
</tr>
<tr>
<td>Roundabout</td>
<td>2</td>
</tr>
<tr>
<td>T-junction</td>
<td>5</td>
</tr>
<tr>
<td>X-intersection</td>
<td>9</td>
</tr>
</tbody>
</table>
3.5.3 Crash time of day

The majority of crashes occurred in daylight hours (370) in the precinct. This was followed by crashes occurring in hours of darkness (127). There were fewer crashes occurring during dawn and dusk (33) periods. A summary of pedestrian and vehicle crashes, broken down by the occurrence time is provided in Figure 3-12.

Figure 3-12 Crashes – time of day
4 Transport network

The assessment of the precinct’s existing transport networks and performance relied on:

- Desktop and site investigations
- Intersection counts at signalised intersections along the Pacific Highway
- Review of passenger data and vehicle counts.

4.1 Major transport corridors

The precinct sits within a series of major transport corridors which provide connections to regional and strategic centres throughout the Greater Metropolitan Area. These include:

- T1 North Shore & Northern Line operates between Berowra and the Hornsby to the City. In peak periods some T1 services extend to the Central Coast;
- Pacific Highway: A major arterial road corridor connecting the northern suburbs, and the Sydney Harbour Bridge or Tunnel; and
- The Warringah / Gore Hill Freeway: a key state road corridor forming part of the Sydney Motorway network, it connects to the Lane Cove Tunnel and M2 to the north-west, and the Sydney Harbour Bridge and Tunnel, and Eastern Distributor to the south.

4.2 Road network

The NSW road network can be described in terms of administrative and functional classification. The general relation between the two classifications and road function priority is shown in Table 4-1.

<table>
<thead>
<tr>
<th>Administrative classification (RMS)</th>
<th>Functional classification (AustRoads)</th>
<th>Road function priority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Roads</td>
<td>Motorways/, freeways</td>
<td>Movement</td>
<td>High mobility, movement function, limited if any land access function. Generally higher speed limits apply, 60km/h+</td>
</tr>
<tr>
<td></td>
<td>Primary arterials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Roads</td>
<td>Secondary/ sub-arterials</td>
<td></td>
<td>Intermediate roads, these can have a high mobility or access function and are generally a combination of the two.</td>
</tr>
<tr>
<td>Local Roads</td>
<td>Distributor/ collector</td>
<td></td>
<td>Higher access function to land uses. Generally lower speed limits of 60km/h or less.</td>
</tr>
<tr>
<td></td>
<td>Local road</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Access street</td>
<td>Access</td>
<td></td>
</tr>
</tbody>
</table>

The road network layout and spacing is an indication of the land uses it supports. The north-west side of the precinct generally has large blocks supporting light industrial, bulk goods, retail, education and health related land uses. Elsewhere, the road network is denser, supporting residential, retail and commercial office land uses. The road network is the densest (finer grain) in the Crows Nest sub-precinct, which contributes to a lower speed road environment.

4.2.1 Warringah/Gore Hill Freeway access

Access to the Warringah/ Gore Hill Freeway from the precinct is provided at:

- Pacific Highway at the intersection of Longueville Road;
- Reserve Road;
- Willoughby Road off-ramp from the Sydney CBD direction only;
- Brooke Street access to/ from Sydney CBD direction only; and
- Falcon Street.
Precinct links to the Warringah/ Gore Hill Freeway provide more opportunities for trips travelling towards the Sydney CBD than for north-west bound trips. Access away from the CBD is only available at Pacific Highway to the north east, Reserve Road and Falcon Street. The Falcon Street entry and exit points to the north are tolled which may act as a deterrent for some motorists. This means than any vehicle in the southern part of the precinct that needs to continue north or north-west may travel through the precinct along Pacific Highway, rather than deviate to the Falcon Street entry to the freeway and pay a toll.

4.2.2 Pacific Highway
The Pacific Highway is a state road and a key route through the precinct with a high movement function. It is generally configured with three through lanes in each direction, but occasionally with two lanes where turning lanes are provided at some intersections.

Where there are three lanes, parking is generally allowed in the kerbside lane during off-peak periods. Through the precinct there are 14 signalised intersections. It is obvious from the frequent change in the number of through lanes that the corridor is space constrained by surrounding development.

4.2.3 Falcon Street
Falcon Street is a state road and is a key primary arterial to the precinct. It links directly to Military Road, providing a key access point to the Northern Beaches region. It is generally configured with two lanes in each direction, with a combination of through and turning lanes. Kerbside parking is restricted during most of the day, but is available at some locations overnight.

4.2.4 Sub-arterial and distributor roads
Other key roads in the precinct are described in Table 4-2.

Table 4-2 Sub-arterial and distributor roads

<table>
<thead>
<tr>
<th>Road name</th>
<th>Managing authority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shirley Road/ River Road</td>
<td>RMS (Regional road 2070)</td>
<td>Shirley Road/ River Road provides a key link to suburbs to the west of the precinct, including Greenwich, Longueville and Lane Cove. This corridor also connects across the Pacific Highway to Falcon Street.</td>
</tr>
<tr>
<td>Reserve Road/ Frederick Street</td>
<td>Council</td>
<td>Reserve Road provides a key access point between the Artarmon sub-precinct and the Sydney motorway network. Frederick Street provides a direct link between Reserve Road and Herbert Street.</td>
</tr>
<tr>
<td>Herbert Street</td>
<td>Council</td>
<td>Herbert Street provides a parallel route to the Pacific Highway, connecting Artarmon and St Leonards.</td>
</tr>
<tr>
<td>Campbell Street</td>
<td>Council</td>
<td>Campbell forms the key east-west link between the Pacific Highway and Reserve Road.</td>
</tr>
<tr>
<td>Dalleys Road</td>
<td>Council</td>
<td>Dalleys Road forms a key east-west link between Herbert Street and Willoughby Road. It traverses through a residential area and has several local traffic management features of one-lane speed humps in an effort to reduce speeds and discourage through traffic.</td>
</tr>
<tr>
<td>Willoughby Road</td>
<td>RMS (Regional road 2029)</td>
<td>Willoughby Road provides a key north-south link which can be used as an alternative access point from the northern suburbs, including the Northern Beaches. Through Crows Nest it provides access to the activity centre along Willoughby Road and has Local Area Traffic Management measures to encourage lower vehicle speeds and enhance pedestrian amenity and safety.</td>
</tr>
<tr>
<td>Chandos Street/ Brooke Street/ Christie Street between Chandos Street and Pacific Highway</td>
<td>RMS (Regional road 2091)</td>
<td>Chandos Street/ Brooke Street/ Christie Street provides a key link between St Leonards and the Warringah Freeway. This provides an alternative access point to the freeway, bypassing the Pacific Highway.</td>
</tr>
<tr>
<td>Northcote Street/ Christie Street</td>
<td>Council</td>
<td>Northcote Street provides access to the Naremburn residential area.</td>
</tr>
</tbody>
</table>
### Local roads

There is a lack of capacity on some side streets off the Pacific Highways. A number of local roads in the precinct are cul-de-sacs which pushes general traffic onto the roads through the precinct that connect to the wider network. Some of the roads closed to reduce vehicle permeability and improve pedestrian amenity include Mitchell Street at Pacific Highway in St Leonards, and Ernest Street between Willoughby Road and Willoughby Lane in Crows Nest. Lane Cove Council has tried to prevent ‘rat-running’ in the planning and design of the street network in the area south-west of the Pacific Highway. The road widths and available linkages or no-through roads were planned to discourage through traffic but still allow servicing such as garbage trucks.

The lack of right-turn movements from the Pacific Highway into the surrounding street network increases vehicle circulation around Albany Street and Oxley Street in the North Sydney LGA. Traffic travelling inbound and headed for destinations south of the Pacific Highway (e.g. to Nicholson Street), can not turn right into the area and so must turn left into Albany Street and right into Hume Street or Oxley Street to cross the Pacific Highway. This particularly occurs in the PM peak period.

Most local roads in the precinct have one lane in each direction.

The general function (as set out by Austroads) of key roads in the precinct are shown in Figure 4-1.

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6. Lane Cove Council meeting, November 2016
7. North Sydney Council meeting, November 2016
Figure 4-1 Functional road hierarchy
4.2.6 Road network functions

Roads support a wide range of functions. They are places for people and they also support movement, access to buildings and spaces, parking and provide space for utilities, drainage, signage and street lighting. Of these functions, ‘place’ and ‘movement’ are considered the most important for assessing a road’s character and role within a network. Professor Peter Jones from the University College of London notes in Link and Place: A New Approach to Street Planning and Design (2009) that the purpose of the movement function is to save time while the purpose of the place function is to spend time. An ideal road supports both to some degree.

A road’s movement function supports through movement as part of a trip. The road is part of a route connecting someone or something from their origin to their destination in a seamless journey. A road’s place function acknowledges that roads can be end destinations themselves. Activities such as shopping, sitting, eating and meeting people can occur on or adjacent to the road. Movement and place are often looked at on a two-dimension chart, with different types of streets sitting along the spectrums of each.

In busy centres with a range of land uses and travel demands, a single road can support both movement and place functions. A road’s functions can change along its length, as the land uses and travel demands along it change. It can also change across a day or week as people use the road for different purposes at different times. Furthermore, and importantly as the precinct transforms, road functions can transition over time. As sites are redeveloped, they can be designed to enhance the movement and place functions of their surrounding road network.

The draft NSW Road Planning Framework defines the movement and place functions of the road network for five categories of road: motorways, movement corridors, vibrant streets, places for people and local streets. For each category, the typical characteristics and features are described including land uses, trip types, speed limits, intersection treatments, parking, and pedestrian and bicycle facilities. The road categories are shown visually and described in Figure 4-2.

Figure 4-2 Draft NSW Road Planning Framework - movement and place functions and road categories

The roads in the heart of the Crows Nest precinct are places for people or vibrant streets. This is due to the high pedestrian activity along a number of these streets, including active shop fronts, dining seats along the verges and the slow speeds of traffic established by the pedestrian priority of the roads. Roads south of Pacific Highway and west of the precinct are local streets as they provide access to residential areas. The Pacific Highway, is a movement corridor as it provides reliable and efficient movement between regions and strategic centres, however Brook Street and Chandos Street (west of Willoughby Road) are also movement corridors as these roads are predominately utilised by vehicles entering and exiting the Warringah Freeway.

The roads in the St Leonards precinct vary based on their location in relation to the Pacific Highway. The roads south of the Pacific Highway are local streets. In comparison, the roads north of the Pacific Highway...
serve a large number of commercial properties and support higher pedestrian volumes from the activity centre and public transport interchange. These have been assigned as vibrant streets or local streets that facilitate access to business premises.

The roads in the Artarmon precinct, which is comprised predominately of commercial property, are local streets that facilitate access to business premises; however, Herbert Street (between Pacific Highway and Cleg Street) is a vibrant street given the high vehicle movement demand and the pedestrian activity along the road.

The current road categories for the precinct are shown on Figure 4-3.
Figure 4-3 Road categories across the precinct
4.3 Walking

4.3.1 The pedestrian experience

The pedestrian experience in the precinct can vary dependent on the sub-precinct.

In Artarmon, pedestrians encounter large blocks without active street frontages, a lack of mid-block crossings and poor facilities at intersections, narrow footpaths, no weather protection and some steep hills, particularly north of the Royal North Shore Hospital along Reserve Road. Outside of business daytime hours the sub-precinct could present personal security concerns from the lack of passive and active surveillance.

The St Leonards sub-precinct presents different pedestrian experiences, dependent on location. To the south of the Pacific Highway steep grades affect all north-south routes. Currently a low-medium density residential area, there is a lack of street lighting, active surveillance and pedestrian activity. Around the RNS Hospital, pedestrians are affected by large block sizes, similar to those in the Artarmon sub-precinct. While Herbert Street has several pedestrian crossings, vehicle speeds are high, blocks are large, buildings are private with entrances set back from the street, and there is little weather protection. There are many driveways with alternative pavement treatment further emphasising the lack of pedestrian priority.

The road network adjacent to the eastern side of St Leonards Station generally has better pedestrian amenity. Northbound from St Leonards Station and to the east of the railway line has opportunities for improvement. Paths are shared with laneways with minimal lighting at night, however this actually improves further north away from the station.

Pedestrians heading east from St Leonards Station have a range of direct routes to choose from. The permeable grid network, awnings and active street frontages during the day encourage short walking trips between diverse land uses but queued traffic, pedestrian refuges that are too narrow at the intersection of Christie Street and Chandos Street, and the illegibility of the Christie Street Reserve, contribute to constrained pedestrian movements to and from the station.

The Crows Nest Village centre around Willoughby Road, Alexander Street and Clarke Street provides a pleasant pedestrian experience with priority road crossings, small block sizes and a network of laneways for permeability, active street frontages at all times of the day and week, civic spaces, weather protection from awnings and landscaping. Away from Willoughby Road there is less pedestrian amenity; Albany Street and Oxley Street are unpleasant roads to cross; vehicles speed towards intersections which either have no crossing facilities or small, non-compliant pedestrian refuges offer little protection for people attempting to cross. In particular, roundabouts in the area have poor pedestrian amenity; including the ones at the intersections Chandos Street/Christie Street, Oxley Street/Albany Street and Burlington Street/Alexander Street.

The pedestrian experience along the Pacific Highway changes little between the sub-precincts. Throughout the day, pedestrians experience a low of priority at intersections, limited crossing opportunities, high traffic volumes in the AM and PM peak and high traffic speeds at other times. This can give pedestrians the sense that the Pacific Highway is a dangerous road and could cause pedestrian frustration resulting in crossings against the red light or away from signalised intersections. While the section of the Pacific Highway through Crows Nest has an active retail strip, west of Hume Street there are less engaging street frontages and west of Reserve Road long blocks with building entrances set back from the road create an isolated walking experience.

4.3.2 Network

The precinct has a well-established pedestrian network, with walking connections throughout.

Primary walking routes are defined as key corridors that generally support higher volumes of pedestrians and provide the most direct and convenient connections between key trip-generating destinations. In the precinct, the current primary walking routes converge on St Leonards Station at The Forum and connect key commercial and mixed land uses in the neighbouring Artarmon and Crows Nest sub-precincts.
In St Leonards, a primary route runs along Christie Street, connecting to businesses and high-density residential areas.

Towards Artarmon, the primary walking routes proceed along the Pacific Highway and Reserve Road, connecting to the RNSH and businesses along the south side of Pacific Highway. Another route proceeds north along Herbert Street and Frederick Street, connecting to the SBS studio and Home HQ Homemaker Centre.

Towards Crows Nest, the primary walking routes along the Pacific Highway, Atchison Street and Willoughby Road provide direct connections to local restaurants, cafes and retailers in the Crows Nest Village.

Secondary routes provide a support function to the primary routes. These generally connect to fewer trip-generating land uses and facilitate lower volumes of pedestrian movement than primary routes.

In the St Leonards sub-precinct, two secondary routes proceed south along Canberra Avenue and Lithgow Street, supporting trips between St Leonards Station and low-density residential areas in St Leonards and Wollstonecraft.

In the Artarmon sub-precinct, secondary routes provide connections to local businesses along Reserve Road and Herbert Street, and extend towards the Artarmon local centre and train station. Another secondary route located further north-west along the Pacific Highway, connects to the Gore Hill technology park.

In the Crows Nest sub-precinct, secondary routes along Albany Street, Alexander Street, Oxley Street and Chandos Street provide connections to local retailers surrounding the major activity areas along Willoughby Road, and in the creative precinct between Willoughby Road and St Leonards Station. An additional route connects the Pacific Highway and Falcon Street intersection with Wollstonecraft Station via Shirley Road.

The primary and secondary walking routes and key pedestrian desire lines in the precinct are shown in Figure 4.4.

4.3.2.1 Pedestrian desire lines

Key pedestrian desire lines radiate out from St Leonards Station and Crows Nest activity centre. There is a strong desire lines between the Royal North Shore Hospital and St Leonards Station and between St Leonards Station and Crows Nest activity centre.

In commuter periods, notable numbers of pedestrians travel to and from the Artarmon employment precinct, however the northern half of the precinct is closer to Artarmon Station and pedestrians are generally attracted to the closer station.

Strong orbital links are not evident as these are longer distances and relatively few trips would be generated between low density residential land uses to other residential land uses or the employment and bulky retail areas of Artarmon.

Pedestrian desire lines from Crows Nest activity centre to residential land uses to the north, east and south are well served. The desire line west of the railway line is less well served by existing infrastructure towards St Leonards south and Greenwich.

The key pedestrian desire lines for the precinct are shown on Figure 4-4.

4.3.2.2 Walking catchments

Once the Sydney Metro Crows Nest Station is operational in 2024, the majority of the precinct will be within a 10 minute walk of a train station. Figure 4-5 presents the combined 400 metre, 800 metre and 1,200 metre walking catchment from St Leonards Station and the proposed Crows Nest Metro Station site.
Figure 4-4 Primary and Secondary walking routes
Figure 4-5 Walking catchments
4.3.3 Infrastructure

4.3.3.1 Footpaths

Footpaths around the St Leonards sub-precinct are provided on both sides of roads. Footpaths are generally wide, (over 1.8 metres) adjacent to business and retail land uses and in many cases extend from the property boundary to the kerb. On the southern side of the Pacific Highway, footpath connections are limited along key north-south streets proceeding towards St Leonards Station including Lithgow Street, Canberra Avenue and Christie Street. Footpaths along these streets are smaller in width and are aligned directly adjacent to property boundaries.

In the Artarmon sub-precinct, footpath quality and width is dependent on the road. Along the Pacific Highway footpaths are wide and in good condition. Reserve road also has generally average footpaths of approximately 1.5 metres wide. On minor roads such as Dickson Avenue, Campbell Street, Clarendon Street and Hotham Parade, footpath widths are generally between 1 to 2 metres, with grassy nature strips separating them from the roadside. Around the RNS Hospital the footpath network is too narrow for the volume of pedestrians and the requirements of mobility impaired people. The footpath network in the more industrial parts of the sub-precinct is missing in some sections and subject to interactions with driveway access for heavy vehicles.

Around the Crows Nest sub-precinct, footpath facilities are wide and in generally good condition. Links are provided to the proposed Sydney Metro Station site and key bus stops along the Pacific Highway and Willoughby Road. Where footpaths are provided, they are generally restricted in width, and intersect frequently with driveways.

Recent improvements in the Crows Nest sub-precinct include a widening of the footpath on the southern side of Albany Street, between Oxley Street and Hume Lane, and building frontage improvements, including new footpaths associated with the redeveloped Woolworths supermarket at the corner of Falcon Street and Alexander Street. To the south-west of the Pacific Highway, footpaths are provided on both sides of the local roads in residential areas. Footpaths along streets south-west of the Pacific Highway including Oxley Street, Hume Street, Nicholson Street and River Road are generally restricted in width (average width is 1.5 metres), but in serviceable condition and are well connected to the Pacific Highway corridor.

4.3.3.2 Wayfinding

The precinct contains several forms of wayfinding implemented either by private land holders, notably around The Forum at St Leonards Station and by Council, more noticeable around Crows Nest. In some locations road/ street name poles and signs are supported by additional green and white text wayfinding signs. TfNSW orange “T” symbols are located at three entrances to The Forum.

Overall there is a high reliance on general road signage which serves all road users, pedestrians and drivers inclusive.

There is an opportunity to improve wayfinding with a more consistent approach. The Crows Nest Metro Station will require wayfinding which should integrate into the precinct and with wayfinding for St Leonards Station and other key land uses.

4.3.3.3 Crossings

In the St Leonards sub-precinct, signalised pedestrian crossings are provided at intersections of the Pacific Highway and Christie Street, Herbert Street and Berry Road, however marked pedestrian crossings are not provided across all legs at these locations which results in reduced pedestrian connectivity and informal crossings made across the Pacific Highway. An underpass between The Forum and Lithgow Street provides an alternative north-south crossing across the Pacific Highway however the amenity here is poor with potential security concerns and it doesn’t provide a direct route between either side of the road. To the east, signalised pedestrian crossings and pedestrian refuges provide access to the Crows Nest sub-precinct, while a pedestrian bridge over Herbert Street links the Gore Hill and Artarmon Loop bus stop to the St Leonards Station’s western entrance.

Formal pedestrian crossings are very limited in the Artarmon sub-precinct. They are restricted to signalised crossings at four intersections and two pedestrian refuges at the intersection of Carlotta Street and
Clarendon Street. Recent improvements include reconstruction of a crossing on Herbert Street opposite the RNSH Community Health Centre to a raised pedestrian crossing (zebra).

Crossing facilities are provided at most intersections in the Crows Nest sub-precinct including raised crossings (zebra) and signalised crossings. Pedestrian refuges are also provided along Chandos Street and Albany Street, however these are not compliant to RMS current standards and provide only small waiting spaces, introducing a potential conflict risk with vehicles approaching the crossing at the posted 50km/h speed.

A summary of the existing pedestrian crossing facilities in the precinct is presented in Figure 4-6.

Both the rail corridor and the Pacific Highway act as major barriers for pedestrians, with limited places to cross. The distance required for pedestrians to travel before approaching a crossing of the Pacific Highway varies across the precinct; generally, pedestrians are required to travel further to arrive at a formalised crossing in the Artarmon sub-precinct compared to the St Leonards and Crows Nest sub-precinct.

In the Artarmon sub-precinct, the longest distance between two crossings is located along the Pacific Highway, between the intersection of Longueville Road and Hotham Parade at 530 metres. This is followed by the distance along the rail corridor between the Gore Hill Freeway and Ella Street at 520 metres, and along the Pacific Highway between Hotham Parade and Campbell Street at 495 metres.

In the St Leonards sub-precinct, the longest distance between pedestrian crossings is located along the rail corridor between the Pacific Highway and River Road at 480 metres. Along the Pacific Highway between Greenwich Road and Reserve Road the distance is 450 metres, and north of St Leonards Station, the distance between the station plaza and the Herbert Street bridge is 365 metres.

In the Crows Nest precinct, the distance required to travel between crossings is significantly shorter when compared to the St Leonards and Artarmon sub-precincts, with crossing facilities provided more frequently along the Pacific Highway. The longest distance between crossings in this area is located between the intersections of Alexander Street and Rocklands Road at 220 metres.

A map summarising the distances between formal pedestrian crossing facilities along the T1 rail corridor and the Pacific Highway is provided on Figure 4-7.
Figure 4-7 Distances between formal crossings in the precinct - Pacific Highway and T1 rail corridor
4.3.4 Demand

Pedestrian counts were completed on the 17th November 2016 at 18 locations throughout the precinct. The highest pedestrian volumes were found to be along the Pacific Highway, in close proximity to the St Leonards Station, and towards Crows Nest. Two-way daily pedestrian volumes at count locations surrounding St Leonards Station were a minimum of 2,800 pedestrians per day.

The pedestrian underpass at Pacific Highway adjacent to the east of the railway line at St Leonards has two-way pedestrian volumes of 4,700 pedestrians. This is well below that of the pedestrian crossings of Pacific Highway at Herbert Street and Christie Street which cater for 13,000 and 8,000 pedestrians two-way respectively. 2016 pedestrian intersection volumes are shown in Figure 4-8.

Pedestrian counts were also completed at select locations in the Lane Cove LGA as part of the 2013 Lane Cove Council Pedestrian Access and Mobility Plan, prepared by GTA Consultants. Surveys were completed across three time periods at ten locations. Two of these locations are situated within the precinct, near St Leonards Station. These included Location 6 (Intersection of Pacific Highway and Berry Road) and Location 7 (Intersection of Pacific Highway and Reserve Road).

A summary of the pedestrian volumes captured at these locations is provided in Table 4-3.

Table 4-3 Summary of two-way pedestrian volumes (2011)

<table>
<thead>
<tr>
<th>Survey location</th>
<th>7am – 9am</th>
<th>AM Peak</th>
<th>12pm – 2pm</th>
<th>MID Peak</th>
<th>4pm - 6pm</th>
<th>PM Peak</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Highway /</td>
<td>493</td>
<td>414 (8am -</td>
<td>805</td>
<td>515</td>
<td>506</td>
<td>251 (5pm-</td>
<td>1,804</td>
</tr>
<tr>
<td>Berry Road</td>
<td></td>
<td>9am)</td>
<td></td>
<td>(12:30pm -</td>
<td></td>
<td>6pm)</td>
<td></td>
</tr>
<tr>
<td>Pacific Highway /</td>
<td>708</td>
<td>527 (8am -</td>
<td>1,131</td>
<td>713</td>
<td>675</td>
<td>279 (5pm-</td>
<td>2,514</td>
</tr>
<tr>
<td>Reserve Road</td>
<td></td>
<td>9am)</td>
<td></td>
<td>(12:30pm -</td>
<td></td>
<td>6pm)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Lane Cove Council PAMP (GTA Consultants, 2013)
Figure 4-8 Daily Pedestrian Volumes 2016
4.4 Cycling

4.4.1 The cycling experience

The precinct features challenging topography and high volume roads reducing the attractiveness of cycling as a mode option for many users. The prevalence of kerbside parking further reduces the safety and attractiveness of cycling through the precinct. The limited provision of shared paths and separated cycleways means that cyclists can either share the road or illegally use footpaths.

Where shared paths are provided, these are generally of good quality with linemarking and lighting.

Road lanes are generally standard widths, although some streets have wider lanes which assist the shared use of the road. On-street infrastructure is provided in some locations in the form of painted bicycle lanes and contra-flow lanes for one way streets. Cyclists need to be prepared to use a range of cycling infrastructure typologies to complete a trip. Dedicated bicycle routes are supported by wayfinding signage and painted bicycle stencils and turning arrows.

Just as the Pacific Highway provides a direct route through the precinct for motorists, the same applies for cyclists. The cyclist willing to do so would likely be categorised as “Strong and Fearless” by the Portland Bureau of Transportation. This corridor is noted to attract a high proportion of cyclists who use the tracking application Strava.

Bicycle parking areas are provided at St Leonards Station and racks and hoops are provided in the Crows Nest activity centre, however these generally have no weather protection. Bicycle lockers are located on the east side of St Leonards Station and despite being next to the station, the walking distance to the station is circuitous.

Bicycle parking loops are integrated into parking sign poles along Willoughby Road in Crows Nest providing better opportunities for cyclists to park near to where they want to go.

4.4.2 Network

The precinct’s cycling network varies from a dense spaced network in some parts to limited and disjointed coverage depending on the sub-precinct. There is a general lack of directness and continuity along the existing network routes, as many avoid arterial road corridors such as the Pacific Highway and Falcon Street; they instead run along local and distributor roads. These roads are characterised by their lower traffic volumes and speeds, making them more suitable for mixed traffic cycling facilities.

North-south cycling routes in the existing network run predominately through the Crows Nest sub-precinct; the most direct route runs along West Street, connecting to routes along the Warringah and Gore Hill Freeways and proceeding towards Chatswood. The route along West Street also proceeds south to connect to North Sydney. An alternative north-south route runs through the Crows Nest village centre along Hayberry Street, Alexander Street, Clarke Street and Oxley Street, and proceeds through Naremburn before also connecting to the regional routes to Chatswood. In the Artarmon sub-precinct, a north-south route proceeds along Herbert Street and Hampden Road, connecting St Leonards Station and Artarmon Station.

Two key east-west routes are provided through the precinct. To the north of the precinct, a shared path facility is provided along the southern perimeter of the Warringah and Gore Hill Freeways. This facility forms part of a key regional route from Naremburn to Macquarie Park via Lane Cove and North Ryde. This provides several access points to the Artarmon employment land precinct. A second route runs along River Road and through suburban streets in Greenwich, connecting Lane Cove with Wollstonecraft and routes proceeding south towards North Sydney.

Cycling access to St Leonards Station is limited to two routes approaching from the north and east of the precinct. The first of the key access routes approaches from Herbert Street, with the second arriving from the east along Henry Lane and Christie Street. Access to St Leonards Station from the south is limited due to the lack of routes connecting to and across the Pacific Highway. The two routes in this area closest to St Leonards Station include a route along Greenwich Road (ending at the intersection with the Pacific Highway) and Nicholson Street (ending at the intersection with Oxley Street). Both routes are incomplete, with no additional facilities connecting to the St Leonards Station. Cycling access to the future Crows Nest Metro
Station is currently available via a route along Clarke Street. A summary map of the existing and proposed cycling routes is provided in Figure 4-9. Proposed routes are described in Section 2.4.2.

The majority of the precinct is within a 15 minute cycle of the St Leonards and Crows Nest stations. Figure 4-10 presents the combined 2.5 kilometre cycling catchment from St Leonards Station and the proposed Crows Nest Metro Station site.
Figure 4-9 Existing and proposed cycling routes
Figure 4-10 2.5 kilometre cycling catchment
4.4.3 **Infrastructure**

Along existing routes there is limited dedicated cycling infrastructure, many are unmarked with no accompanying signage and wayfinding. Off-road facilities are limited, however along some routes, facilities such as shared paths provide links between disconnected or incomplete on-road routes.

To the north of the precinct, a shared path is provided along the southern perimeter of the Gore Hill Freeway.

In the St Leonards sub-precinct, an on-road separated lane is provided in both directions along most of Herbert Street, reverting to mixed traffic on approach to the Pacific Highway. On the eastern side of the railway line, a combination of mixed traffic and shared paths run parallel to the rail corridor. To the east, a mixed traffic facility is provided on Henry Lane and Atchison Street (eastbound). For westbound movements along Atchison Street, a 1.4 metre wide contraflow on-road lane was recently implemented. The only facilities provided on the south side of the Pacific Highway include a combination of mixed traffic and separated on-road lanes run along the precinct boundary on Greenwich Road and River Road.

In the Artarmon sub precinct, formal cycling facilities are provided along major routes. A mixed traffic route with painted markings is provided running east-west on Carlotta Street, connecting a short section of shared path on Pacific Highway to a separated on-road facility on Herbert Street leading to St Leonards Station. This separated on-road facility on Herbert Street extends north to Artarmon Station via Hampden Road.

In the Crows Nest sub-precinct, most routes operate with mixed traffic arrangements. These include Atchison Street east of Willoughby Road, and the route along Oxley Street (northbound), Clarke Street (northbound), Alexander Street and Hayberry Street. Southbound along Oxley Street and Clarke Street, a separated on-road lane is provided. Two segments of this route are also rated as high difficulty by the Roads and Maritime Services Cycleway Finder; these include:

> The roundabout intersection of Chandos Street and Christie Street; and

> Oxley Street, between Chandos Street and Albany Street.

In the Crows Nest sub-precinct, no dedicated facilities are available to facilitate crossing of the Pacific Highway by bike.

Some cycling does occur in bus lanes, and along bus routes as the Pacific Highway is the most direct through route to traverse the precinct. This interaction between buses and bicycles in the same space may cause conflict.

4.4.4 **Bike parking for developments**

Each DCP nominates bicycle parking requirements for new developments, all referencing AS 2890.3 for the of bicycle facilities to be provided.

The rates of bicycle parking required generally vary between each DCP, particularly for residential requirements and business premises. For these land uses, North Sydney requires the highest level of parking provision, followed by Lane Cove and Willoughby requires the least amount.

Two sets of rates of measure for bicycle parking are required by each DCP, outlined in Table 4-4. The first rate of measure is generally for residents and employees and the second rate of measure is generally for visitors to the land use. More land uses are specified in the respective documents.

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1 Transport for NSW – RMS and Freight Strategy meeting, December 2016
### Table 4-4 Bicycle parking rates for each Council

<table>
<thead>
<tr>
<th>Land use</th>
<th>Rate 1 measure</th>
<th>Rate 2 measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lane Cove</td>
<td>North Sydney</td>
</tr>
<tr>
<td>Residents/ Employees</td>
<td>Residents/ Employees</td>
<td>Occupants</td>
</tr>
<tr>
<td>Customers/ Visitors</td>
<td>Customers/ Visitors</td>
<td>Visitor/ Customer</td>
</tr>
<tr>
<td>Rate 1 measure</td>
<td>1 per 4 dwellings[1]</td>
<td>1 per dwelling</td>
</tr>
<tr>
<td>Rate 2 measure</td>
<td>1 rack + 1 rack per 10 dwellings[1]</td>
<td>1 per 10 dwellings</td>
</tr>
<tr>
<td>Office or business premises</td>
<td>1 per 300sq.m GFA</td>
<td>1 per 150sq.m GFA</td>
</tr>
<tr>
<td>Rate 2 measure</td>
<td>1 rack + 1 rack per 800sq.m GFA</td>
<td>1 per 400sq.m GFA</td>
</tr>
</tbody>
</table>

[1] Residential flat buildings

#### 4.4.5 Network demand

Intersection counts were completed on 17th November 2016 at 18 locations throughout the precinct. These counts showed the Pacific Highway being used by between 80 to 160 cyclists per day, with the higher end of the range being recorded in Crows Nest.

The main ridership within the precinct was along Alexander Street with 288 cyclists northbound and Falcon Street with 500 cyclists eastbound counted. 2016 daily cyclist volumes are shown in Table 4-5.

In addition to the survey counts, RMS collects bicycle volume data using counters across Greater Sydney. The counters provide daily counts of passing bicycles, with average daily counts reported by month and year. There are currently no survey facilities installed in the precinct, however three counters are provided at the following nearby locations which indicate volume:

- Merrenburn Avenue (ramp onto the Warringah Freeway), Naremburn;
- Falcon Street pedestrian bridge, Neutral Bay; and
- Ridge Street bridge, North Sydney.

The most recent average daily counts by year are provided in Figure 4-11.

#### Table 4-5 RMS average daily cycling volumes

<table>
<thead>
<tr>
<th></th>
<th>Merrenburn Avenue</th>
<th>Falcon Street pedestrian bridge</th>
<th>Ridge Street bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>342</td>
<td>16</td>
<td>90</td>
</tr>
<tr>
<td>2015</td>
<td>310</td>
<td>16</td>
<td>85</td>
</tr>
</tbody>
</table>

Source: RMS Cycling Statistics (Viewed November 2016)

Willoughby City Councils reports a lack of cycling in their part of the precinct, but notes that the Gore Hill Freeway bike links are popular.

#### 4.4.5.1 Parking demand

Bicycle parking demand appear to be low through the precinct. The St Leonards Station bicycle racks are generally well used on both sides of the station. The ones on Herbert Street appear to have abandoned bicycles, indicative by flat tyres and repeated observations. Use of the station lockers is not known. These have graffiti vandalism and appear difficult to access.

The Royal North Shore has undercover bicycle parking on the north side of the building with moderately used parking.

Spot checks of racks around Crows Nest activity precinct indicate low usage.

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Willoughby City Council meeting, November 2016
Figure 4-11 Daily Cyclist Volumes 2016
4.5 Train

4.5.1 Train Network

St Leonards Station is located at the centre of the precinct, at The Forum, a commercial and residential development. The station, served by Sydney Trains, operates services along the T1 North Shore and Northern Lines. Customers can travel to Berowra via Gordon, Hornsby via Macquarie Park or Penrith, Epping and Richmond via the City. Customers can also interchange at Hornsby Station for NSW TrainLink intercity services to Hamilton, or at Town Hall for the T2, T3 and T4 lines on the Sydney Trains network.

With 2016 timetable arrangements, from St Leonards Station, the 30-minute rail catchment extends to stations on the following lines:

- T1 North Shore Line: Waitara Station (via Gordon);
- T1 Northern Line: Pennant Hills Station (via Macquarie Park);
- T1 Western Line: Redfern Station;
- T2 Inner West Line: Newtown Station;
- T3 Bankstown Line: Erskineville Station; and
- T4 Eastern Suburbs and Illawarra Line: Edgecliff and Sydenham Stations.

A map showing the extent of the 30 minute rail catchment is provided in Figure 4-12.
Figure 4-12 30 minute rail catchment
4.5.2 **Infrastructure and services**

St Leonards Station is configured as two island platforms, however space is available for an additional two platforms on either side of the current Platforms 2 and 3.

The station is wheelchair accessible, with lifts connecting both platforms with the concourse and accessible toilet facilities are provided. Access to the station is available from the Pacific Highway and Christie Street, and an accessible path is available via Herbert Street. Interchange opportunities are available with bus services departing from the Pacific Highway and non TfNSW bus services on Herbert Street. No dedicated taxi rank is provided at the interchange. No dedicated commuter parking is available, however Council and privately operated parking facilities are provided on the eastern side of the station. Bicycle parking is available, in addition to Kiss & Ride facilities on Sergeants Lane.

Trains operate between 4:47am and 12:02am to the City and between 4:44am and 12:55am towards Hornsby. During AM and PM peak hour, 15 trains serve St Leonards Station via the T1 North Shore Line in both directions, and four services operate in both directions on the T1 Northern Line via Macquarie Park. Outside of peak periods, eight trains per hour operate through the station in both directions, four each along the T1 North Shore and Northern Lines respectively. During weekend and public holiday periods, four trains per hour operate all day along the T1 North Shore Line via Gordon in both directions, and two trains per hour, in both directions along the T1 Northern Line via Macquarie University.

A summary of the St Leonards Station services is provided in Table 4-6.

| Table 4-6 St Leonards Station train services |
|---|---|---|---|---|---|
| **Line** | **Direction** | **Daily services (Weekday)** | **AM Peak 06:00-09:30** | **Daytime 09:30-16:00** | **PM Peak 16:00-18:30** | **Daily services (Saturday)** |
| T1 North Shore Line (via Gordon) | From City | 122 | 33 | 32 | 26 | 73 |
| | To City | 118 | 32 | 30 | 24 | 74 |
| T1 Northern Line (via Macquarie Park) | From City | 76 | 19 | 26 | 10 | 38 |
| | To City | 80 | 14 | 26 | 18 | 39 |

Source: Sydney Trains (viewed November 2016)

4.5.3 **Demand**

An average of 35,180 customers used St Leonards Station over a 24 hour period in 2014. Station Out and In volumes are particularly concentrated during the AM and PM peaks respectively, with commuters travelling to the precinct to work making up the dominant movement. A summary of the peak and daily customer volumes through the station is provided in Table 4-7.

| Table 4-7 In and Out volumes at St Leonards Station (2014) |
|---|---|---|
| **24 Hour** | **AM Peak (6:00am–9:30am)** | **PM Peak (3:00pm–6:30pm)** |
| Station Ins | 17,590 | 3,420 | 8,780 |
| Station Outs | 17,590 | 8,900 | 3,230 |

Source: Bureau of Transport Statistics (BTS, viewed November 2016)

During the AM peak hour approximately 18,000 people pass through on trains in the Sydney CBD bound direction. Given the assumed suburban rail line capacity of 24,000 trips per hour one-way (20 services x 1,200 capacity per train), the line is nearing capacity.

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March 2014 peak train load survey, TPA, TfNSW
4.6 Bus

4.6.1 TfNSW services

TfNSW bus services travelling through the precinct provide connections to key centres including Chatswood, North Sydney, Manly, the Sydney CBD and Bondi. They also connect with northern residential areas such as Lane Cove, Epping, the Hills District and Dural. The only direct connection to the Northern Beaches is from Manly bound services.

TfNSW buses operated are generally confined to primary and sub-arterial road network such as the Pacific Highway; some services also operate along River Road and Willoughby Road. The Pacific Highway is the most direct route to travel north-west to the CBD through the precinct.

Interchange is provided at Pacific Highway bus stops near St Leonards Station. The southbound stop provides a relatively simple interchange experience. Northbound stops near the station are across the Pacific Highway in several locations. The interchange between the northbound stops and St Leonards Station is longer and more circuitous.

Service coverage is limited in the Artarmon and St Leonards sub-precincts. Customers generally need to access major corridors to board services. Exceptions include:

> The 144 is the route between Manly Wharf and Chatswood, it provides direct connection to the Royal North Shore Hospital entrance; saving visitors a 200 metre uphill walk from the Pacific Highway.

> The M20 start/ end point is on Campbell Street near Reserve Road.

> The N90 operates via Herbert Street but does not stop in the precinct along Herbert Street.

Service coverage is higher in the Crows Nest sub-precinct, with a combination of local and suburban routes connecting to commercial and local land uses.

4.6.2 Other publicly accessible bus services

4.6.2.1 Gore Hill Shuttle Bus

The Gore Hill Loop is a free shuttle bus service that connects St Leonards Station with the Gore Hill business and technology precinct, providing a dedicated public transport connection for employees transferring from train services. The service runs between a shared stop (with the Artarmon Loop) on the western side of Herbert Street and two stops adjacent to the Fox Sports and Australian Stock Exchange buildings at Gore Hill.

4.6.2.2 Artarmon Loop

The Artarmon Loop is a free Willoughby City Council bus service that operates along three routes, connecting St Leonards Station with the Artarmon sub-precinct, Artarmon train station, or Royal North Shore Hospital depending on the time of day. During peak periods, the shuttle connects the shared bus stop (with the Gore Hill Loop) on Herbert Street with 16 designated stops through the industrial area. Outside of peak periods, the shuttle proceeds further north to service the Artarmon local centre and train station and diverts along Westbourne Street to link to the Royal North Shore Hospital.

A map summarising the precinct bus routes is provided in Figure 4-13.
Figure 4-13 Bus Network
4.6.3 Infrastructure and services

4.6.3.1 Infrastructure

Bus stop infrastructure varies in the precinct by LGA. All bus stops are identifiable by J-Pole or newer TfNSW “B” Mode ID signage at their respective boarding points, and most bus stops provide additional facilities including shelters and seating. Where stops are located beneath building awnings, these are used as shelters in favour over prefabricated shelter structures.

No weather protection is provided at stops along River Road, and on the western side of Greenwich Road.

Willoughby City Council engaged JCDecaux in 2013 for the supply and maintenance contract for bus shelters. As part of the engagement, new shelters with seating and boarding point TGSI were installed at most stops within the LGA. Some stops were not included in the upgrade program; one of the key stops where a shelter is not provided is the M20 Artarmon terminus stop on Campbell Street.

The Pacific Highway and its associated traffic congestion detrimentally impacts bus service delivery, particularly with limited bus priority infrastructure along the Pacific Highway. This impacts bus travel times and the overall customer experience. It should also be noted that bus operations are significantly restricted in Artarmon due to limited available road widths and on-street parking arrangements.

Bus layover in lower North Shore is currently at capacity, growth in service frequency would require additional layover options.

4.6.3.2 Services

During weekdays, eight out of the 21 routes operate until the early evening; seven operate during the peak periods only, and four provide all day services until late in the evening. 11 out of the 21 routes operate on weekends, with services on five routes each extending to the late afternoon and late night respectively, and route 290 restricted to the early morning.

A summary of the bus services travelling through the precinct, their weekday and weekend frequencies and precincts served is provided in Table 4-8.

Transport for NSW – Bus strategy meeting December 2016
### Table 4-8 Summary of bus service frequency and coverage

<table>
<thead>
<tr>
<th>Route</th>
<th>Operator</th>
<th>Route direction</th>
<th>General frequency (services per hour)</th>
<th>AM Peak service frequency 7:45am 8:45am</th>
<th>First service</th>
<th>Last service</th>
<th>Sub-precinct coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Weekday</td>
<td>Weekend</td>
<td>Weekday</td>
<td>Weekend</td>
<td>Weekday</td>
</tr>
<tr>
<td>602X</td>
<td>Hillsbus</td>
<td>Rouse Hill to North Sydney</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>05:39</td>
<td>-</td>
</tr>
<tr>
<td>612X</td>
<td>Hillsbus</td>
<td>Kellyville to Milsons Point</td>
<td>4</td>
<td>0</td>
<td>13</td>
<td>05:30</td>
<td>-</td>
</tr>
<tr>
<td>140</td>
<td>STA</td>
<td>Epping to Manly Wharf (via Macquarie University)</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>16:07</td>
<td>-</td>
</tr>
<tr>
<td>143</td>
<td>STA</td>
<td>Chatswood to Manly Wharf</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>06:41</td>
<td>-</td>
</tr>
<tr>
<td>144</td>
<td>STA</td>
<td>Chatswood to Manly Wharf (via RNSH)</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>05:04</td>
<td>07:10</td>
</tr>
<tr>
<td>200</td>
<td>STA</td>
<td>Chatswood to Bondi Junction</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>06:25</td>
<td>-</td>
</tr>
<tr>
<td>252</td>
<td>STA</td>
<td>Lane Cove West to City – King Street Wharf</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>06:00</td>
<td>06:24</td>
</tr>
<tr>
<td>257</td>
<td>STA</td>
<td>Chatswood to Balmoral Beach</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>06:52</td>
<td>06:19</td>
</tr>
<tr>
<td>261</td>
<td>STA</td>
<td>Chatswood to City (via Longueville &amp; Northwood)</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>06:14</td>
<td>07:45</td>
</tr>
<tr>
<td>263</td>
<td>STA</td>
<td>Cammeray to City – Bridge Street</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>06:04</td>
<td>07:06</td>
</tr>
<tr>
<td>Route</td>
<td>Operator</td>
<td>Route direction</td>
<td>General frequency (services per hour)</td>
<td>AM Peak service frequency 7:45am 8:45am</td>
<td>First service</td>
<td>Last service</td>
<td>Sub-precinct coverage</td>
</tr>
<tr>
<td>-------</td>
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<td>----------------------------------------</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Weekday</td>
<td>Weekend</td>
<td>Weekday</td>
<td>Weekend</td>
<td>Weekday</td>
</tr>
<tr>
<td>286</td>
<td>STA</td>
<td>Denistone East to Milsons Point (via St Leonards)</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>06:24</td>
<td>-</td>
</tr>
<tr>
<td>287</td>
<td>STA</td>
<td>Ryde to Milsons Point</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>06:27</td>
<td>-</td>
</tr>
<tr>
<td>290</td>
<td>STA</td>
<td>Epping to City</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>04:05</td>
<td>04:35</td>
</tr>
<tr>
<td>291</td>
<td>STA</td>
<td>Epping to McMahon's Point</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>06:01</td>
<td>05:58</td>
</tr>
<tr>
<td>343</td>
<td>STA</td>
<td>Chatswood to Kingsford</td>
<td>6</td>
<td>4</td>
<td>8</td>
<td>04:45</td>
<td>05:00</td>
</tr>
<tr>
<td>622</td>
<td>Hillsbus</td>
<td>Dural to Milsons Point</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>06:10</td>
<td>-</td>
</tr>
<tr>
<td>653</td>
<td>Hillsbus</td>
<td>West Pennant Hills to Milsons Point</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>06:25</td>
<td>-</td>
</tr>
<tr>
<td>M20</td>
<td>STA</td>
<td>Metrobus Gore Hill to Botany via City</td>
<td>4</td>
<td>4</td>
<td>6 (Approximately every 10 minutes)</td>
<td>06:31</td>
<td>07:38</td>
</tr>
<tr>
<td>254</td>
<td>STA</td>
<td>Riverview to McMahon's Point</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>06:33</td>
<td>06:49</td>
</tr>
<tr>
<td>265</td>
<td>STA</td>
<td>Lane Cove to McMahon's Point</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>05:53</td>
<td>08:50</td>
</tr>
<tr>
<td>267</td>
<td>STA</td>
<td>Chatswood to Crows Nest</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>06:39</td>
<td>08:27</td>
</tr>
</tbody>
</table>
### Existing Transport Conditions Summary

**St Leonards and Crows Nest Station Precinct Transport Study**

<table>
<thead>
<tr>
<th>Route</th>
<th>Operator</th>
<th>Route direction</th>
<th>General frequency (services per hour)</th>
<th>AM Peak service frequency 7:45am 8:45am</th>
<th>First service</th>
<th>Last service</th>
<th>Sub-precinct coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Weekday</td>
<td>Weekend</td>
<td>Weekday</td>
<td>Weekend</td>
<td>Weekday</td>
</tr>
<tr>
<td>Gore Hill Loop</td>
<td>Private operator</td>
<td>Loop service from St Leonards to Gore Hill</td>
<td>Unknown</td>
<td>0</td>
<td>9</td>
<td>Unknown</td>
<td>-</td>
</tr>
<tr>
<td>Artarmon Loop</td>
<td>Willoughby Council</td>
<td>Loop Service from St Leonards to Artarmon Industrial and Station or RNS Hospital</td>
<td>5</td>
<td>0</td>
<td>8</td>
<td>06:00</td>
<td>-</td>
</tr>
</tbody>
</table>

**Total (routes per sub-precinct)**: 17, 19, 21

*Source: State Transit Authority of NSW, Hillsbus, Gore Hill Business Precinct and Willoughby Council*

1. One additional 290 service operates at 23:00
2. Four additional 290 services operate hourly from 23:00 to 01:53
4.6.4 Demand

The Pacific Highway, along with the North Sydney and Sydney CBD, experiences bus congestion in peak periods. The majority of routes that use the Pacific Highway are affected by congestion on the Pacific Highway which can impact services from Chatswood. In the long term, bus capacity in the North Sydney and Sydney CBD may need to be addressed by reshaping the bus network to facilitate greater interchange from bus to railway from the CBD.

Bus to rail interchange occurs at St Leonards Station. The Hills Bus routes that stop at St Leonards see people transferring to the rail service. However, even due to the transfer, bus demand along the Pacific Highway is still between 1,000 to 1,999 commuters during the AM Peak in the city-bound direction, likely due to schools and employment easily assessable by the bus services. In the Chatswood direction it is evident that bus commuters interchange at St Leonards Station, as bus volumes decrease from 500-999 commuters at St Leonards to less than 500 commuters after St Leonard Station. This is likely due to commuters wishing to continue north on the railway line, or arriving at employment in St Leonards.

Although the Artarmon Loop Shuttle Service is well-utilised and receives positive feedback from customers, Council is reviewing the service frequency.

Existing bus services on Opal enabled buses to the Royal North Shore Hospital cater for less than 500 commuters during peak periods. TfNSW has indicated demand is growing for bus services to and from the Royal North Shore Hospital.

Outside of the study area, along the Lane Cove Tunnel, Gore Hill Freeway and Warringah Freeway, there are high volumes of bus commuters which bypass the study area, accounting for over 5,000 commuters during the AM peak period. These commuters are predominantly from the Hills District, and North Shore Regions. This bypass of the study area is important to be kept as it provides a fast and efficient trip into the CBD, decreasing traffic within the precinct.

4.7 Freight

4.7.1 Network

Freight movements are essential to support the employment land uses in Artarmon and general deliveries to retail, business and residential land uses throughout the precinct. The precinct’s freight network comprises of designated on-road routes, providing access to the wider NSW network and air, port, rail and intermodal terminals.

The precinct is accessible to heavy vehicles up to 19 metres long such as short combination trucks, semi-trailers, B-doubles and truck and dog combinations. Access is available along the Pacific Highway through the precinct, this is generally not used as a through route given the convenience and efficiency of the Warringah/ Gore Hill Freeway.

Special exemptions identified on RMS restricted access vehicles map apply as follows. These all link to the Gore Hill Freeway/ Lane Cove Tunnel.

- General Mass Limit (GML) 19 metre B-double routes (Over 50 tonnes):
  - Pacific Highway between Gore Hill Freeway and Campbell Street,
  - Campbell Street (between Pacific Highway and Lanceley Place) and Lanceley Place, and
  - Hotham Parade (between Pacific Highway and Mclachlan Avenue), Mclachlan Avenue and Marden Street

- Higher Mass Limits (HML):
  - Reserve Road between Gore Hill Freeway and Cambell Street,
  - Campbell Street between Reserve Road and Lanceley Place, and

---

1 Transport for NSW – Bus strategy meeting, December 2016
2 Willoughby City Council meeting, November 2016
- Lanceley Place.

> 25/ 26 metre B-double routes (noting these designated routes do not connect to a broader network)
  - Campbell Street between Pacific Highway and Lanceley Place
  - Lanceley Place

A summary map of the RMS designated freight routes is provided in Figure 4-14.

4.7.2 Infrastructure

All freight corridors in this precinct are road-based, there is no freight access via the rail line. The Gore Hill Freeway/ Lane Cove Tunnel provides a bypass route for general road traffic including freight vehicles past the precinct.

To meet the needs of the Artarmon industrial area, designated freight routes are provided for access between the Lane Cove Tunnel/ Gore Hill Freeway and Artarmon.

The core of the Artarmon industrial estate is also supported by rear access laneways. These provide access for smaller vehicles to on-site car parks and loading bays.

..
Figure 4-14 Restricted access vehicle routes
4.8 Private vehicles

4.8.1 Demand and performance

The performance of Pacific Highway between Lane Cove and North Sydney indicates the overall demand to the arterial road network has in the precinct. The performance of the highway was measured by two variables, including:

> Average speed (km/h); and

> Percentage of Speed Limit (%) (The posted speed limit along the Pacific Highway is 60 km/h).

The average speed is a mean of all the vehicle speeds travelling along a road in a particular timeframe. The percentage of speed limit is a measure of how many vehicles are travelling at the designated speed for the road, the higher the percentage of speed limit the better flow along the road. The data used for this analysis only considers weekdays during the time period from November 2015 to November 2016.

This analysis shows that this section of the Pacific Highway is not flowing at the designated speeds. The AM peak inbound and PM peak outbound are the worst performing time periods with average vehicle speeds below 40 km/h and percentage of speed limit below 70%. The performance data is summarised in Table 4-9 and Table 4-10.

Table 4-9 Pacific Highway inbound - Lane Cove to North Sydney

<table>
<thead>
<tr>
<th></th>
<th>AM Peak (6am- 9am)</th>
<th>PM Peak (3pm- 7pm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average speed (km/h)</td>
<td>37.0</td>
<td>41.1</td>
</tr>
<tr>
<td>Percentage of vehicles achieving 60 km/h speed limit (%)</td>
<td>69</td>
<td>76</td>
</tr>
</tbody>
</table>


Table 4-10 Pacific Highway outbound – North Sydney to Lane Cove

<table>
<thead>
<tr>
<th></th>
<th>AM Peak (6am- 9am)</th>
<th>PM Peak (3pm- 7pm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average speed (km/h)</td>
<td>43.4</td>
<td>35.7</td>
</tr>
<tr>
<td>Percentage of vehicles achieving 60 km/h speed limit (%)</td>
<td>80</td>
<td>66</td>
</tr>
</tbody>
</table>


Daily vehicle volumes from the traffic surveys completed on 17th November 2016 at 18 locations throughout the precinct confirm that the Pacific Highway is the main thoroughfare for drivers with over 20,000 vehicles using certain stretches of this road in both directions. There is also a high level of vehicles on Falcon Street, with approximately 10,000 vehicles in both directions. This is primarily due to Falcon Street providing direct access to the Warringah Freeway in both directions.

Key distributor roads, providing access to the Pacific Highway currently have a demand of between 4000 – 8000 vehicles per day.

A summary of the daily vehicle volumes for 2016 is provided in Figure 4-15.
Figure 4-15 Daily Vehicle Volumes 2016
4.9 Parking

4.9.1 Infrastructure

A range of car parking options are available through the precinct. This includes private parking spaces, and publicly accessible (paid and free) on and off-road facilities.

4.9.1.1 On street parking

Each Council has a different approach to on-street parking management in the St Leonards sub-precinct. North Sydney Council and Lane Cove Council have paid parking on the streets that fall within their LGA but Willoughby City Council does not, leading to higher parking demand in the Willoughby LGA. In some parts of the Artarmon sub-precinct, in particular on Dickson Street, on-street parking intended for customers of surrounding businesses has been used by car smash repair companies. A previous plan to introduce paid parking to the Artarmon Industrial Estate to address this issue has not had business support. It has only been implemented in Dickson Street but the meters there are subject to a lot of vandalism.

4.9.1.2 Off-street publicly available car parking

Publicly accessible off-street car parking areas within the precinct generally have fees (that vary by location) and are mainly managed by private operators including Wilson Parking and Secure Parking.

Council owned parking provisions generally offer two hours of free parking. This maintains parking for people making relatively quick trips to the area and discourages all day parking.

Off-street car parking locations are summarised in Table 4-11.

<table>
<thead>
<tr>
<th>Car Park</th>
<th>Location</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home HQ multi-level parking</td>
<td>Frederick Street, Artarmon</td>
<td>3 hours free parking on weekdays, free parking all weekend</td>
</tr>
<tr>
<td>Bunnings</td>
<td>Reserve Road, Artarmon</td>
<td>Free for customers, maximum stay is 3 hours</td>
</tr>
<tr>
<td>Two multi-story car parks at the Royal North Shore Hospital</td>
<td>Reserve Road, Artarmon</td>
<td>All day - $33.60</td>
</tr>
<tr>
<td>Artarmon Reserve</td>
<td>Artarmon Reserve off of Burra Road</td>
<td>Free</td>
</tr>
<tr>
<td>Alexander Street above Woolworths</td>
<td>Alexander Street, Crows Nest</td>
<td>2 hours free Monday to Saturday. Free all day Sunday. Monday to Saturday maximum daily fee- $52.00</td>
</tr>
<tr>
<td>Clemenger Garage</td>
<td>Pacific Highway</td>
<td>All day - $50.00</td>
</tr>
<tr>
<td>Holtermann Street garage</td>
<td>Holtermann Street</td>
<td>All day - $52.00</td>
</tr>
<tr>
<td>486-494 Pacific Highway</td>
<td>Pacific Highway</td>
<td>All day - $42.00</td>
</tr>
<tr>
<td>Forum Parking, Willoughby City Council</td>
<td>Chandos Street, St Leonards</td>
<td>All day - $34.00</td>
</tr>
<tr>
<td>Norths Rugby Club Wilson Parking</td>
<td>Christie Street</td>
<td>All day - $35.00</td>
</tr>
<tr>
<td>Charter Grove garage</td>
<td>Christie Street</td>
<td>All day - $35.00</td>
</tr>
<tr>
<td>Chandos Street Car Park Willoughby City Council</td>
<td>Chandos Street, St Leonards</td>
<td>All day - $24.00</td>
</tr>
</tbody>
</table>

1 Willoughby City Council meeting, November 2016
2 Willoughby City Council meeting, November 2016
<table>
<thead>
<tr>
<th>Car Park</th>
<th>Location</th>
<th>Fee</th>
</tr>
</thead>
</table>
| Hume Street car park, North Sydney Council | Hume Street, Crows Nest      | 2 hours free Monday to Saturday. Free all day Sunday.  
                                                   Maximum daily fee - $52.00 |
| Nicholson Street car park, North Sydney Council | Nicholson Street, Crows Nest | 2 hours free Monday to Saturday. Free all day Sunday.  
                                                   Monthly - $375.00 |
| Gore Hill Oval, Willoughby City Council | St Leonards, Pacific Highway | Three sections with different restrictions:  
                                                   >  2 hours free  
                                                   >  4 hour limit @ $3.50 per hour  
                                                   >  All day $11.00 |
| Crows Nest Plaza, North Sydney Council | Holtermann Street, Crows Nest | 2 hours free (with shopping docket or stamp)  
                                                   Maximum - $52.00  
                                                   Monthly - $420.00 |

Many other publicly accessible car parks exist as part of developments. These vary between casual availability and on a month by month basis.

A summary map of the locations of off-street parking in the precinct is provided in **Figure 4-16**.
Figure 4-16 Off-street parking locations
4.9.2 Parking rates for developments

4.9.2.1 Car parking

Multiple Development Control Plans (DCP) apply to the precinct due to the convergence of three LGAs and have area specific parking rates. Each Council has developed their parking rate provisions independently.

Lane Cove Council has minimum parking rates for new developments but it does allow developers to nominate their own car parking provision for residential land uses within 400 metre radius of St Leonards station. This is based on market demand, i.e. the willingness of people willing to purchase a dwelling with or without a car parking space and allows developers to construct dwellings without dedicated car parking provisions. The Lane Cove DCP also provides developers the flexibility to reduce car parking spaces by allocated car share space(s) if site constraints do not allow adequate on-site parking.

The North Sydney DCP nominates maximum parking rates for developments as opposed to the more common approach of applying minimum parking rates. Parking rates for some residential flat buildings and shop top housing in St Leonards Precincts 2 & 3 and mixed use developments in St Leonards have lower maximum parking rates than other areas of North Sydney Council LGA. The DCP also offers the flexibility to provide car share spaces in developments as a portion of required spaces.

The Willoughby DCP states that the parking requirements are neither maximum nor minimum rates. They are rates to be satisfied in any application and that applicants may nominate lower or higher rates, but this must be justified to Council in a Statement of Environmental Effects or Traffic Study. The current approach to parking provision is to ensure on-street parking in neighbourhoods is not impacted by demand from new nearby developments.

A summary comparison of the required parking rates for each Council is provided in Table 4-12.

<table>
<thead>
<tr>
<th>Council</th>
<th>Car parking rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Residential (multi-dwelling)</td>
</tr>
<tr>
<td>North Sydney Council</td>
<td>3 or more bedroom: 1.5 spaces</td>
</tr>
<tr>
<td>(maximum)</td>
<td>Visitor: 0.25 spaces</td>
</tr>
<tr>
<td>Lane Cove Council</td>
<td>Studio &amp; 1-2 bedroom: 1 space</td>
</tr>
<tr>
<td>(minimum)</td>
<td>1 bed: 1 space</td>
</tr>
<tr>
<td></td>
<td>2 bed: 1.5 spaces</td>
</tr>
<tr>
<td></td>
<td>3 or more bedrooms: 2 spaces</td>
</tr>
<tr>
<td></td>
<td>Disabled visitor: 1 space / 50 visitor spaces</td>
</tr>
<tr>
<td></td>
<td>(minimum 1 space)</td>
</tr>
<tr>
<td>Willoughby City Council</td>
<td>Studio: 0.5 spaces</td>
</tr>
<tr>
<td>(set rates)</td>
<td>1-2 bed: 1 space</td>
</tr>
<tr>
<td></td>
<td>3 or more bedrooms: 1.25 spaces</td>
</tr>
<tr>
<td></td>
<td>Visitor: 1 space / 4 dwellings</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.9.3 Parking levels

4.9.3.1 Motorcycle

The provision of motorcycle parking assists to reduce the spatial impacts of motorised vehicle parking. In the context of parking provisions, motorcycles also include scooters and mopeds. Each DCP has requirements for motorcycle parking based on the number of car parking spaces provided. Similar to bike parking requirements, North Sydney require a greater number of spaces followed by Lane Cove and Willoughby with the lowest requirement.
4.9.4 Demand

Parking demand within close proximity to high traffic-generating land uses are generally managed through restrictions and fees.

Where no on-street restrictions exist, parking demands for spaces occurs a considerable distance from activity centres on weekdays. This demand is most likely from employees of the St Leonards sub-precincts. Residential streets in Naremburn (north of Chandos Street) close to St Leonards have high levels of commuter parking associated with the employment centre.

Local businesses in Crows Nest are concerned about a lack of parking for customers [19].

4.10 Car share

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

Within the precinct, two car share companies operate:

> GoGet; and

> Hertz 24/7.

Car share is becoming increasingly popular, this is evident by the number of cars located in the precinct. North Sydney Council has indicated that several body corporates in the North Sydney LGA are purchasing their own vehicles to house in the car share spaces provided on their properties.

GoGet is an established car share company and provides the most comprehensive coverage of the precinct. Hertz 24/7 has one vehicle which is located in The Forum basement car park adjacent to St Leonards station. A map of the GoGet parking locations is shown in Figure 4-17.

GoGet car share parking locations are located in the central and south-east of the precinct, generally close to higher density residential and business land uses. This maximises the potential for use throughout the week.

[19] North Sydney Council meeting, November 2016
Peer to peer car share services generally offer both cheaper and more expensive hire rates than GoGet and Hertz 24/7 depending on the value of vehicle being driven. Peer to peer car share services include:

> Car next door; and
> Drive my car.

4.11 **Ride share**

Ride share services operate similar to, and compete, with taxi services. In Australia these include Uber and Go Catch and are booked using mobile phone applications. They generally offer cheaper alternatives to taxi’s, however during peak periods Uber has “surge” pricing which is claimed to encourage more drivers to offer their services. This can result in higher fares than a taxi. Go Catch has standard peak and off-peak rates as well as providing the option to book a regular taxi service.

4.12 **Transport network summary**

The train network currently serves only the St Leonards precinct, however it provides good north-south regional connections to other strategic centres across the Sydney Metropolitan area. The T1 North Shore and Northern Line alignment is restrictive as it limits opportunities for providing pedestrian and/or road crossing opportunities in the precinct. The addition of the Metro Station at Crows Nest will be considered as part of the next stage of the transport study.

The bus network provides coverage predominately for the St Leonards and Crows Nest precincts. Stops in these areas are connected with the footpath network, and are served by a combination of local and cross-regional routes. Bus services are available along the Pacific Highway corridor throughout the precinct. Coverage in the Artarmon precinct is limited, however free shuttle bus services are in operation here, and provide connections to St Leonards Station.
5 Opportunities and constraints

This section provides an overview of the opportunities and constraints applicable to the precinct, determined through the background review and consultation with stakeholders including local councils. Where applicable, sections of this report are referred.

A summary of the opportunities within the precinct is provided in Table 5-1.

Table 5-1 Precinct opportunities

<table>
<thead>
<tr>
<th>Category</th>
<th>Summary of opportunity</th>
<th>Description</th>
<th>Report section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel demand</td>
<td>High public transport commuting mode share from precinct</td>
<td>A high proportion of St Leonards residents commute by public transport. The percentage of commuters using public transport in Crows Nest is expected to increase with the introduction of the Crows Nest Metro Station.</td>
<td>3.4</td>
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<td></td>
<td>Demonstrated cycling demand for direct routes</td>
<td>Cycling along the Pacific Highway is popular among Strava users; there is an opportunity to harness Council plans to provide dedicated facilities along this corridor for the demonstrated demand.</td>
<td>4.4.5</td>
</tr>
<tr>
<td></td>
<td>Popularity of, and support for, car share</td>
<td>More car share facilities will help to reduce private vehicle ownerships and is an initiative supported by the three Councils.</td>
<td>4.10</td>
</tr>
<tr>
<td></td>
<td>Reduced need for vehicle ownership and parking spaces due to the potential for developments close to major transport interchanges</td>
<td>The introduction of the Crows Nest Metro Station will further reduce the need for private vehicle ownership in the precinct. More of the precinct will be in close proximity to a high quality rail service. Innovative parking rates and charges can be considered for this well connected precinct.</td>
<td>2.3.1.2</td>
</tr>
<tr>
<td>Infrastructure and services</td>
<td>Increased and improved pedestrian crossings.</td>
<td>Both the Pacific Highway and the T1 rail corridor act as barriers to pedestrian movement. There is a lack of designated crossing points across both corridors. Pedestrians can also experience long wait times at intersections and a lack of pedestrian crossings at some signalised intersections. The most common crash type involving pedestrians in the precinct were those where a pedestrian was hit by a vehicle in the near side lane. Future development plans should consider pedestrian desire lines and the best location to provide new or improved crossing facilities. Access to the future Crows Nest Metro Station should consider high capacity low delay DDA compliant options such as grade separated crossing(s) across the Pacific Highway.</td>
<td>2.3.1.2 4.3.2.1 4.3.3.3</td>
</tr>
<tr>
<td></td>
<td>Comprehensive current and future public transport network</td>
<td>The existing public transport network provides good service coverage and frequency, with many major destinations within a 30-minute travel catchment. The proposed Sydney Metro will improve public transport access to destinations across Sydney even further.</td>
<td>4.5 4.6</td>
</tr>
<tr>
<td>Category</td>
<td>Summary of opportunity</td>
<td>Description</td>
<td>Report section</td>
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<td></td>
<td>The introduction of Sydney Metro could be accompanied by optimisation of train and bus services</td>
<td>The shift of many passengers from the T1 North Shore line to the Sydney Metro presents an opportunity to reduce and reallocate services to meet other demands. There is also support for bus lanes along Pacific Highway to provide buses with priority and increase bus throughput.</td>
<td>2.3.1</td>
</tr>
<tr>
<td></td>
<td>Roll out of TNSW Wayfinding Strategy will improve public transport legibility</td>
<td>Improved public awareness of public transport options and access in the precinct can be achieved with the rollout of Transport for NSW's Wayfinding Strategy.</td>
<td>4.3.3.2</td>
</tr>
<tr>
<td></td>
<td>The Herbert Street road bridge over the railway line could be extended to Chandos Street to improve permeability for vehicles, pedestrians and cyclists.</td>
<td>Connecting this road bridge over the railway line would reduce trip distance and travel time for vehicles, pedestrians and cyclists travelling between Herbert Street and Chandos Street. It would also remove these movements from the busy Pacific Highway intersections with Christie Street and Herbert Street.</td>
<td>For further investigation</td>
</tr>
<tr>
<td></td>
<td>Crows Nest Metro Station provides the opportunity for the provision of cycling infrastructure.</td>
<td>The station should be equipped with secure bicycle parking and amenities, and can act as a 'pitt stop' for cyclists. Bicycle network improvements and more routes to access the Crows Nest Metro Station can encourage greater cycling mode share.</td>
<td>2.3.1.2</td>
</tr>
<tr>
<td>Land use development / design / parking</td>
<td>Proximity to other strategic and district centres</td>
<td>The precinct is located close to the Sydney CBD and other strategic centres including North Sydney, Chatswood and Macquarie Park. It is also in Sydney's Global Economic Corridor.</td>
<td>1.3</td>
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<td></td>
<td>Freight accessibility to Artarmon from Gore Hill and Warringah Freeways</td>
<td>The Artarmon sub-precinct has good heavy vehicle access from nearby regional roads such as the Lane Cove Tunnel and Gore Hill Freeway. This limits the heavy vehicle movements on the Pacific Highway.</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>Urban renewal will allow for street reconfiguration to accommodate walking and cycling facilities, reduce vehicle space, provide new through site links, pedestrianise areas and activate laneways.</td>
<td>New developments in the precinct should be used as an opportunity to deliver improvements to the pedestrian and cycle network, new through site links and active laneways. The new Sydney Metro Crows Nest Station could be accompanied by closure of Oxley Street adjacent to the site (this is occurring during construction) to enhance pedestrian amenity.</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Steep grades south of the Pacific Highway support the case for an underpass to the Crows Nest Metro Station</td>
<td>An underpass below the Pacific Highway may be easier to achieve because of the steep grades to the south. Pedestrian journey time will also be less affected than grade-separated crossings in level locations which require additional travel time for vertical movements.</td>
<td>2.3.1.2</td>
</tr>
<tr>
<td></td>
<td>Diverse land uses support trip containment</td>
<td>The mix of land uses and the high proportion of precinct residents who also work in the area support local trips by active transport.</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Extension of the public transport catchment with the new Sydney Metro station at Crows Nest</td>
<td>The new Sydney Metro Station at Crows Nest will extend the public transport catchment, increase capacity, and present an opportunity to improve bus and train interchange.</td>
<td>2.3.1</td>
</tr>
<tr>
<td>Category</td>
<td>Summary of opportunity</td>
<td>Description</td>
<td>Report section</td>
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<td>Proposed plazas over the railway line will reduce barriers to movement</td>
<td>Proposed open space plazas over the railway line at St Leonards will enhance freedom of movement for pedestrians and cyclists across the railway line. The plaza proposed south of the Pacific Highway could also include an upgrade to the Lithgow Walk underpass to improve amenity and directness.</td>
<td>2.3.2.1</td>
</tr>
<tr>
<td></td>
<td>Coordinated transport planning approach</td>
<td>A coordinated transport planning approach across the three Councils will ensure the delivery of integrated transport infrastructure, policy and management solutions for the precinct as a whole.</td>
<td>1.1</td>
</tr>
</tbody>
</table>
A summary of the constraints within the precinct is provided in **Table 5.2**.

**Table 5.2 Precinct constraints**

<table>
<thead>
<tr>
<th>ID</th>
<th>Summary of constraint</th>
<th>Description</th>
<th>Report section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel demand</td>
<td>Railway network at capacity in peak periods</td>
<td>The existing T1 North Shore and Northern Line can only accommodate a maximum of 20 trains per hour in each direction. Some services are already at capacity in the AM and PM peaks and Sydney's Rail Future notes that total capacity will be exceeded on large sections of the line between Chatswood and Wynyard by 2031.</td>
<td>4.5.3</td>
</tr>
<tr>
<td></td>
<td>Traffic congestion and queues on local and distributor roads</td>
<td>There is significant congestion on local and distributor roads in the St Leonards and Crows Nest precinct in peak periods. This can cause lack of concentration, tiredness, impatience (irritation), drivers not obeying road rules and/or ignoring pedestrians on pedestrian crossings, compromising pedestrian safety.</td>
<td>4.8.1</td>
</tr>
<tr>
<td></td>
<td>Future traffic growth on the Pacific Highway</td>
<td>Future developments in the precinct are anticipated to result in additional vehicle trips along the Pacific Highway, which is already affected by congestion during peak periods.</td>
<td>Subject to further assessment</td>
</tr>
<tr>
<td></td>
<td>High private vehicle mode share for St Leonards workers</td>
<td>The majority of precinct workers drive there. The continued car use for the majority of work trips contributes to traffic congestion and high parking demand.</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>High demand for on-street parking</td>
<td>There is high demand for on-street parking in the precinct by commuters who have driven to work in the area. Commuters driving to St Leonards are parking in nearby non-time restricted residential streets up to a kilometre away from their workplaces. Circulating occurs after 8:00am when spaces are largely occupied. In Artarmon, on-street parking is heavily utilised by local car smash repair companies.</td>
<td>4.9.4</td>
</tr>
<tr>
<td>Infrastructure and services</td>
<td>Pedestrian security in some areas</td>
<td>Pedestrian security concerns in some areas, particularly the Artarmon sub-precinct, due to a lack of land use activation, poor street lighting and passive surveillance could prevent some walking trips. At St Leonards the pedestrian underpass beneath the Pacific Highway could present personal security concerns late at night.</td>
<td>4.3.1</td>
</tr>
<tr>
<td></td>
<td>Lack of pedestrian connectivity between land uses in the west of the precinct</td>
<td>The west of the precinct including Gore Hill Oval, TAFE NSW, Royal North Shore Hospital and the Gore Hill Cemetery is poorly connected by walking routes due to large non permeable blocks. Direct access to the west from the proposed Crows Nest Metro Station is limited to where Oxley Street intersects with Lithgow Street and the railway line. Development on the opposite side of the railway line limits the ability to provide crossing infrastructure.</td>
<td>4.3.3.3</td>
</tr>
<tr>
<td>ID</td>
<td>Summary of constraint</td>
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<td></td>
<td>Lack of pedestrian amenity and inconsistent facilities</td>
<td>Pedestrian amenity is lacking in some parts of the precinct, where facilities are not provided or are non-compliant, affecting pedestrian comfort and safety. Inconsistency in pedestrian facilities, including paving, lighting and street furniture across the three Council areas varies the pedestrian experience.</td>
<td>4.3.1</td>
</tr>
<tr>
<td></td>
<td>Steep grades on pedestrian routes south of the Pacific Highway</td>
<td>Pedestrian trips south of the Pacific Highway are affected by steep grades which can reduce the attractiveness of walking for some people include mobility impaired or those who are carrying shopping.</td>
<td>4.3.1</td>
</tr>
<tr>
<td></td>
<td>Poor amenity of grade-separated crossing</td>
<td>The grade-separated crossing linking Lithgow Street to St Leonards Station has poor pedestrian amenity, and does not serve as a direct route across the Pacific Highway</td>
<td>4.3.1</td>
</tr>
<tr>
<td></td>
<td>Inconsistent wayfinding</td>
<td>Wayfinding for pedestrians and cyclists is inconsistent across council boundaries and could contribute to a lack of route legibility.</td>
<td>4.3.3.2</td>
</tr>
<tr>
<td></td>
<td>Lack of cycling infrastructure on direct routes, and cycling network gaps</td>
<td>The current cycling network is incomplete and has many gaps. There is a lack of cycling facilities along major road corridors with the most direct routes like the Pacific Highway where some cycling demand is concentrated, as indicated by Strava maps.</td>
<td>4.4.2</td>
</tr>
<tr>
<td></td>
<td>Limited TfNSW bus coverage in Artarmon</td>
<td>The Artarmon sub-precinct is not well served by TfNSW bus services. Council and privately operated shuttles run in the area to compensate for the missing public transport link.</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Inconsistent and some poorly located bus stop facilities and bus interchange amenity</td>
<td>Bus stop infrastructure like shelters, seating, signage and TGSI is inconsistent across the precinct. At some locations, facilities are poorly located and restrict pedestrian movement. The St Leonards bus interchange (south side of Pacific Highway) has poor amenity for waiting passengers.</td>
<td>4.6.3.1</td>
</tr>
<tr>
<td></td>
<td>Reduced public transport services, including at night and on weekends</td>
<td>Bus and train service frequencies are lower during weekends and late at night which reduces the attractiveness of public transport at these times.</td>
<td>4.5.2, 4.6.3.2</td>
</tr>
<tr>
<td></td>
<td>Lack of efficient interchange between modes</td>
<td>Efficient interchange between different modes at St Leonards is affected by a long walking distance between north-bound buses and the train station and a lack of integration between train and bus timetables, particularly during non-peak periods.</td>
<td>4.6.1</td>
</tr>
<tr>
<td></td>
<td>Lack of taxi ranks and pick up / drop off zones</td>
<td>Informal taxi pick up along the Forum side Pacific Highway can interfere with buses accessing the bus stop. There are no safe locations to stop and pick up / drop off on the southern side of the Pacific Highway near St Leonards Station.</td>
<td>4.5.2</td>
</tr>
<tr>
<td>ID</td>
<td>Summary of constraint</td>
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<td>Restricted vehicle movements to enter and exit the Pacific Highway.</td>
<td>Through routes from River Road to the Pacific Highway are limited to Park Road and Parkview Road. The banned right-turn movement off the Pacific Highway in many locations causes traffic circulation in local streets, in particular in the Crows Nest village area.</td>
<td>Subject to later detailed assessment</td>
</tr>
<tr>
<td></td>
<td>Land use development / design / parking</td>
<td>Lack of integrated transport planning</td>
<td>There is a lack of a coordinated transport planning approach for the St Leonards sub-precinct due to the different planning controls, management policies and proposed infrastructure projects from the three Councils.</td>
</tr>
<tr>
<td></td>
<td>Lack of pedestrian activity at night-time</td>
<td>There is a lack of weekend and night-time activity in Artarmon and St Leonards sub-precincts which discourages walking as a mode choice at these times.</td>
<td>4.3.1</td>
</tr>
<tr>
<td></td>
<td>Road tolls contribute to through traffic</td>
<td>The toll imposed on the Falcon Street entry and exit ramps leading to the Warringah Freeway could act as a deterrent for motorists, who may prefer to use the Pacific Highway to access and leave the precinct.</td>
<td>4.2.1</td>
</tr>
</tbody>
</table>