Arncliffe and Banksia Precincts
Transport Plan

01 November 2016

60344887

Client: Transport for New South Wales
ABN: 18 804 239 602

Prepared by
AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

01-Nov-2016

AECOM in Australia and New Zealand is certified to the latest version of ISO9001, ISO14001, AS/NZS4801 and OHSAS18001.

Quality information

Document name	Ref	Prepared for	Prepared by	Date	Reviewed by
Arncliffe and Banksia Precincts: Strategic Transport Plan	60344887	Transport for New South Wales	Zak Roslie, Brett Linnane	01-Nov-2016	Brett Linnane

Revision history

Revision	Revision date	Details	Authorised	Name	Position
A	31-July-2015	Draft	Original signed	Nick Bernard	Principal Consultant
B	26-Oct-2015	Update Draft	Original signed	Nick Bernard	Principal Consultant
C	12-Nov-2015	Draft for Discussion	Original signed	Nick Bernard	Principal Consultant
D	23-Feb-2016	Draft for Discussion	Original signed	Nick Bernard	Principal Consultant
E	01-Nov-2016	Final		Nick Bernard	Principal Consultant

Executive Summary

In response to actions identified in *A Plan for Growing Sydney,* the NSW Government is currently undertaking investigations into the suitability of various areas within Greater Sydney to support the city's forecast growth. The Department of Planning & Environment (the Department) Priority Precincts program has been established with the overarching objective of delivering additional dwellings in places with good access to infrastructure, transport, services and jobs.

In response to *A Plan for Growing Sydney*, the Department has prepared a Land Use and Infrastructure Strategy (the Strategy) to guide future growth and to identify infrastructure needs in the Arncliffe, Banksia and Cooks Cove precincts. In order to develop the Strategy the Department has undertaken investigations into the potential for urban renewal in these Precincts. This Transport Plan has been prepared to inform the investigations for the Arncliffe and Banksia precincts. A separate strategic transport study has been prepared for the Cooks Cove Precinct. For the Arncliffe and Banksia Precincts the Strategy identifies:

- An increase in medium and high density residential dwellings, particularly to the east of Arncliffe Station.
- A more modest residential intensification to the west of the Arncliffe Station along Wollongong Road and within the Banksia Precinct.
- Mixed-use development within the Princes Highway corridor.

To determine the scale of development that may occur in the Arncliffe and Banksia Precincts under the proposal the Department has undertaken an analysis of likely take up of dwellings. The analysis indicates that approximately 5,100 dwellings are anticipated in Arncliffe and Banksia by 2036. This has been used as the basis for the transport analysis. The creation of an additional 1,840 jobs has also been assumed. Should higher development yields, within these areas be realised then further analysis would be required to understand the impacts on the transport network.

This Transport Plan will provide Government with an understanding of the additional transport infrastructure and service upgrades and potential timing required to cater for future growth.

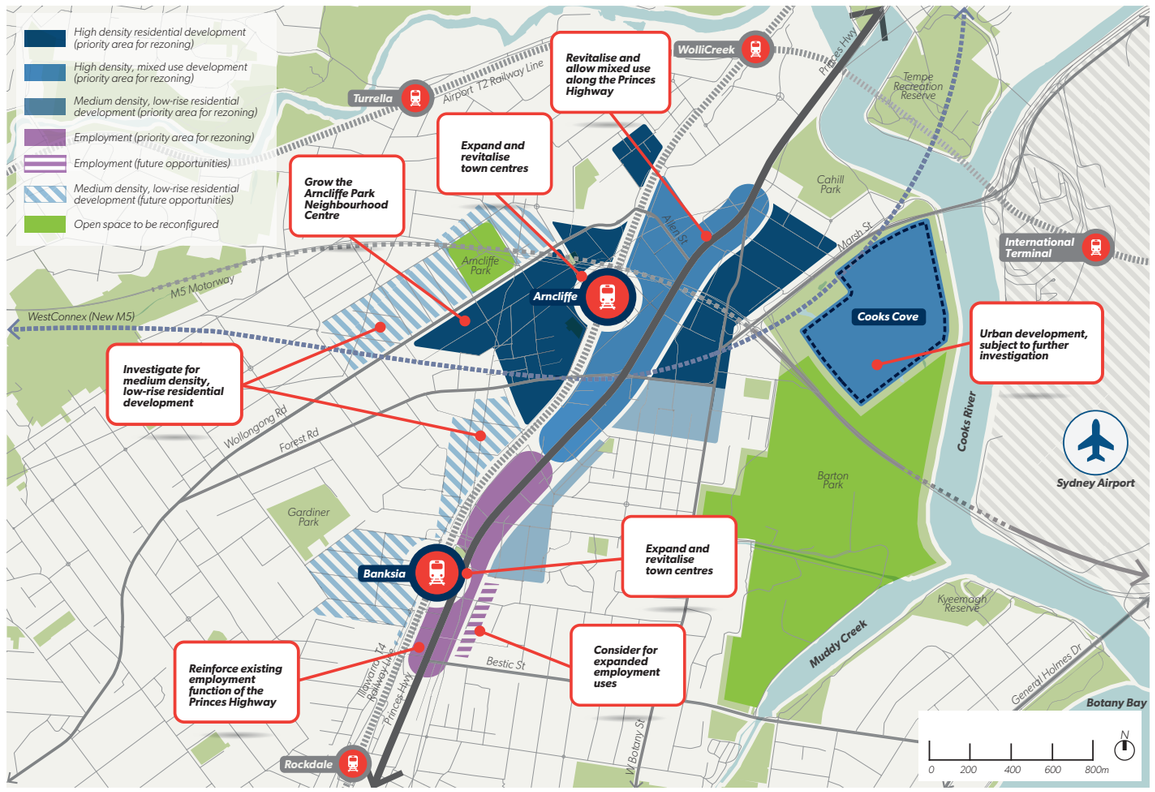
Existing conditions

The key generators of pedestrian activity include the train stations, the higher density residential areas and businesses along Princes Highway, education facilities and the various open spaces. Dedicated pedestrian facilities within the study area include a mix of grade-separated, signalised and zebra crossings of the road network, footpaths providing connectivity between train stations and surrounding residential precincts, dedicated footpaths to and through open spaces and to major education facilities. The Princes Highway and the rail corridor form barriers to east-west movement for all modes, with limited crossings.

Dedicated cyclist facilities within the area include a mix of on and off-road facilities, predominantly forming connections radially from the Cooks River bridges and south along the coast. While a level of north-south connectivity is provided at the train stations, there is limited east-west connectivity across the precincts.

Arncliffe and Banksia Train Stations are located on the T4 Illawarra and South Coast rail lines. A high level assessment of passenger demand and capacity indicates that in the AM peak, seating and standing capacities are already being reached. These crowding levels result in standing room only on most services from Hurstville inbound during the AM peak hour. Should current patronage growth rates continue, the acceptable passenger-carrying limit of the T4 Illawarra and South Coast lines would be reached before the focal year of 2036.

With passenger rail services providing public transport access to the CBD and other major centres, the key role for local bus services is considered to be providing public transport access to areas not serviced by rail, and acting as a trunk feeder to the rail line. Data indicates that the Sydney Airport is the largest attractor of local bus trips, followed by areas in the CBD and other key destination areas in the east, such as UNSW and the Prince of Wales Hospital. A key constraint in the bus network is the limited access to services in the west of the precinct, with indirect routes driven by topographical and road constraints.



Proposed Arncliffe and Banksia Precincts
Source: Department of Planning & Environment, 2015

Proposed transport network

A transport network has been developed that responds to the proposed growth, and provides a range of travel choices to support the range of trip purposes and distances to, from, and within the precinct.

Active transport

- A series of road crossings and through-site links anticipated to improve connectivity to key generators and attractors including the Arncliffe and Banksia Train Stations, neighbourhood centres and open spaces
- Implementation of new east-west active transport linkages addressing current constraints in the network.

Rail

- Further investigation is required into potential improvements to rail services to get more people to and from the Sydney CBD and other key centres on the rail network
- The activated precincts would bring forward the need for rail investments to support the intended uplift. Parallel bus services may provide additional capacity in the interim, though these are likely to be insufficient in the long term
- Transport for NSW are currently investigating opportunities to increase available rail capacity for southern Sydney, including for the Arncliffe and Banksia Stations. The increased capacity would help to accommodate increased travel demand resulting from the proposed growth.

Bus

- A new Suburban bus route between Bondi Junction and Miranda via Arncliffe, Banksia and Rockdale, that will improve access for residents to primary employment areas such as the Sydney Airport
- Potential improvements to bus services to enhance accessibility of the overall public transport network to residents. These would be implemented in response to demonstrated demand.
- Investigation into the need for any bus priority infrastructure.

Roads

- The proposed WestConnex project, anticipated to significantly improve traffic conditions on the Princes Highway
- A set of localised intersection upgrades aimed to improve accessibility of the trunk network to proposed uplift areas, and preserve accessibility for the local freight task
- Further investigation into upgrades that may be required along key State Road corridors to support the combination of both regional growth and the development uplift in the precinct.

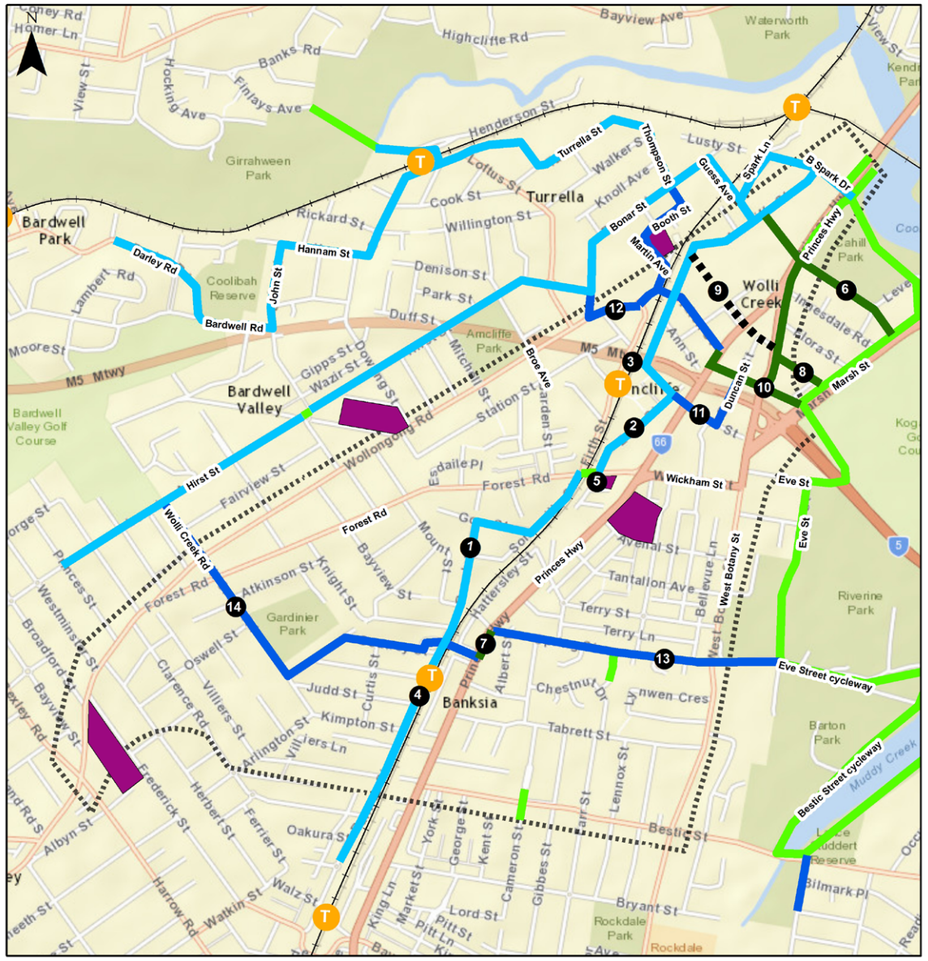
Next steps

The Department will exhibit the draft Strategy and any subsequent rezoning proposals for the priority areas in Arncliffe and Banksia Precincts. Following exhibition, the Department will assess the matters raised in the submissions and where required, amendments to the exhibited material will be made. Once finalised, the final Strategy will be published and any rezoning proposal will be forwarded to the Minister for Planning for determination.

The planning controls described in the draft Strategy allow for greater yields to be delivered. Any development beyond the assumed yield will require further assessment to augment the transport response. As proposed development proceeds, Transport for NSW and Roads and Maritime Services will continue to monitor the performance of the transport network and the timing of initiatives proposed in this report.

Transport and traffic modelling has been undertaken to assess the transport network and proposed upgrades. Should the planning proposal receive the necessary approvals, further investigations and stakeholder consultation will be undertaken to confirm the details and timing of required works.

AECOM



Proposed Cycle network to support the Arncliffe Precinct
Source: AECOM, 2015

Introduction

1.0

1.0 Introduction

AECOM was commissioned by Transport for NSW and the Department to provide integrated transport and land use planning services for the Arncliffe and Banksia Precincts.

1.1 Context

The Government's vision for Sydney, as outlined in *A Plan for Growing Sydney*, is: a strong global city, a great place to live.

To achieve this vision, the Government has set down goals that Sydney will be:

- A competitive economy with world-class services and transport
- A city of housing choice with homes that meet our needs and lifestyles
- A great place to live with communities that are strong, healthy and well connected
- A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

Sydney is a rapidly growing city with current forecasts suggesting that more than 1.6 million additional people will be living in Sydney by 2031, requiring around 664,000 more homes. The city will generate $565 billion in annual economic output, helping to support an additional 689,000 jobs.

In response to *A Plan for Growing Sydney*, the Department has prepared a Land Use and Infrastructure Strategy (the Strategy) to guide future growth and to identify infrastructure needs in the Arncliffe, Banksia and Cooks Cove precincts. In order to develop the Strategy the Department has undertaken investigations into the potential for urban renewal in these Precincts. The Arncliffe and Banksia Precincts are identified as key locations to enable additional dwellings due to their proximity to employment centres and access to road and rail transport networks.

This Transport Plan has been prepared for the Arncliffe and Banksia Precincts and will provide NSW Government with an understanding of the additional transport infrastructure and service upgrades required to cater for growth in these areas. A separate strategic transport study has been prepared for the Cooks Cove Precinct, which is at a preliminary stage in the planning process.

1.2 Purpose

The overall intent of the Transport Plan is to:

- Investigate the transport infrastructure and service requirements across all modes that are needed to support growth and urban renewal in the long term (notionally 2036) within an approximate 800 metre catchment of Arncliffe and Banksia Stations on the T4 Illawarra Line
- Develop a plan that meets specific transport objectives for the Arncliffe and Banksia Precincts as a whole.

1.3 Study area

The geographical area defined by Transport for NSW for this transport study is illustrated in Figure 1. The area is contained within the Bayside Council (formerly Rockdale City Council) LGA and is broadly bound by the Cooks River to the north, West Botany Street to the east, Bestic Street and Clarence Road to the south and Wollongong Road to the west.

Current land use zonings reflect the dominant land uses around Arncliffe and Banksia Train Stations. The area immediately surrounding Arncliffe Station is characterised by a mix of low, medium and high density dwellings, small business and open space. The dominant land use zonings are R3 and R4 (medium and high density residential respectively), B4 (mixed use) and RE1 (open space).

The area immediately surrounding Banksia Station is characterised by detached dwellings, small business and open space. Residential densities around Banksia Station are lower than around Arncliffe Station. Consequently, residential lands are zoned R2 (low density residential). Small business is supported through land use zonings; B1 (commercial premises) and B6 (enterprise corridor). A small pocket park to the north-east of the station is zoned as RE1 (open space).

The more dense residential and commercial uses lie generally close to the trunk road (Princes Highway) and rail (T4 Illawarra Line) corridors, with the lower density residential uses offset from these.

In the context of the broader subregion of Sydney, key precincts and regional / local centres close to the Arncliffe and Banksia Precincts include:

- Sydney Airport
- Port Botany
- Hurstville strategic centre
- Kogarah strategic centre
- Rockdale town centre
- Bexley town centre.

AECOM

AECOM P:\603X\60344867\4. Tech work area\4.2 GIS\02_Maps\G002_01_Strategic_Centres_250515.mxd Updated 27/10/2015

Arncliffe to Banksia | OCT 2015

Source: LPMA 2011, StreetPro 2010

Policy context

2.0

2.0 Policy Context

NSW Making it Happen is the NSW Government's overarching plan to make New South Wales a better place to live. Other key strategies that are central to transport and land use planning in NSW include:

- *A Plan for Growing Sydney*
- *NSW Long Term Transport Master Plan*
- *State Infrastructure Strategy.*

Each of the key documents and their relevance to the Arncliffe and Banksia Precincts are discussed in the sections following. The treatment of relevant planned land use and transport infrastructure changes identified in these documents is discussed in more detail in Section 4.0 of this document.

2.1 NSW Making it Happen

The recently released *NSW Making it Happe*n is the NSW Government's plan for making NSW a better place to live. Thirty priorities are identified to:

- Grow the economy
- Deliver infrastructure
- Improve health, education and other services.

Relevant transport and land use planning priorities for the NSW Government include:

- **Building infrastructure**: Key infrastructure projects to be delivered on time and on budget across the state
- **Faster housing approval**: 90 per cent of housing development applications determined within 40 days
- **Accelerating major project assessment**: Halve the time taken to assess planning applications for State Significant Developments
- **Improving road travel reliability**: 90% of peak travel on key road routes is on time
- **Increasing housing supply across NSW:** Deliver more than 50,000 approvals every year
- **Ensure on-time running for public transport**: Maintain or improve reliability of public transport services over the next four years.

The above priorities infer a NSW Government focus on delivering State-significant infrastructure (e.g. WestConnex, Sydney Metro) and maintaining or improving transport services that may service the Arncliffe and Bankisa Precincts.

2.2 A Plan for Growing Sydney

As the NSW Government's planning strategy for Sydney, *A Plan for Growing Sydney* (APGS) will guide land use planning decisions between 2011 and 2031. The vision is for Sydney to be a strong global city and a great place to live.

APGS identifies six subregions to deliver the infrastructure needed to support the city's growth. The Arncliffe and Banksia Precincts are located in the South Subregion, which comprises the Local Government Areas of Canterbury-Bankstown, Georges River, Bayside and Sutherland Shire. In 2011, the South Subregion had a residential population of 610,500. By 2031, this population is expected to grow by 154,750 to 765,300 (Population, Household & Dwelling Projections South Subregion, 2015). An additional 62,800 dwellings are required to support this growth.

The Arncliffe and Banksia Precincts are identified in one of the four goals set out in APGS:

i) Goal 2: Greater housing supply, choice and affordability to meet Sydney's changing needs and lifestyles.

Goal 2 is supported by Direction 2.1: Accelerate housing supply across Sydney, and the associated Action 2.1.2: Accelerate new housing in designated infill areas (established urban areas) through the Priority Precincts and UrbanGrowth NSW programs.

The Priority Precincts program responds to this challenge by providing for new housing and jobs in centres with good existing or planned transport services. The program coordinates the delivery of infrastructure to ensure that the growth will be supported by improved public open space and community facilities to make these areas attractive places to live and enhance people's lifestyles and living standards.

Action 2.1.2 is more specifically aimed at identifying sites that meet certain land use and transport criteria, including:

- The site aligns with State, regional or local strategies that relate to housing, employment or urban renewal
- There is potential to maximise existing and planned infrastructure, especially transport investments
- The precinct is environmentally, socially and economically sustainable and viable.

In the context of the Arncliffe and Banksia Precincts, the existing and planned transport investments refers to the existing T4 Illawarra and South Coast Lines and the planned WestConnex and Sydney Metro projects.

2.2.1 The plan for the surrounding area

The Arncliffe and Banksia Precincts lie within the northern section of the South Subregion. The planned centres close to the Arncliffe and Banksia Precincts are illustrated in Figure 2 and associated relevant extracts from the Plan are highlighted below.

Sydney Airport will continue to be the largest employment area in the immediate vicinity, followed by Hurstville, Port Botany and Kogarah. However, it is considered that the Sydney CBD will continue to form the key employment area for Arncliffe and Banksia Precincts residents.

2.2.2 Sydney Airport – Transport Gateway

Sydney Airport is located approximately 2.9 kilometres east of Arncliffe and Banksia Precincts. Sydney Airport is the busiest airport in Australia, handling 38.5 million passengers and providing connections to 88 domestic and international destinations in the 2013-14 financial year.

In 2011, an estimated 39,000 people worked at Sydney Airport and its environs, making it one of the five biggest employment hubs in Sydney. By 2031, 47,000 people are forecast to be employed in the area, an increase of 8,000 jobs.

APGS identifies Sydney Airport as a Transport Gateway and as the southern extent of the Global Economic Corridor (along with Port Botany). Sydney Airport provides a significant concentration of jobs and performs an essential and ongoing role connecting Sydney with locations in Australia and around the world.

APGS aims to implement an operational support strategy for Sydney Airport and Port Botany, taking into account land uses and proposed road-based transport investments.

2.2.3 Hurstville – Strategic Centre

Hurstville is located approximately 4.8 kilometres south-west of Arncliffe and Banksia Precincts. Hurstville is identified as a Strategic Centre in APGS. Hurstville is a retail hub within the South Subregion and also has a significant commercial market. In 2011, an estimated 12,000 people worked in Hurstville. This is expected to reach 17,000 by 2031.

2.2.4 Port Botany – Transport Gateway

Port Botany is located approximately ten kilometres south-east of Arncliffe and Banksia Precincts. Port Botany is Australia's second busiest container port. Along with Sydney Airport, Port Botany defines the southern extent of the Global Economic Corridor. In 2011, Port Botany and its surrounds had 12,000 employees. By 2031, it is expected 16,000 people will work in the area.

Like Sydney Airport, Port Botany is identified as a Transport Gateway in APGS. This is because it provides a significant concentration of jobs and performs an essential and ongoing role connecting Sydney with locations across Australia and around the world.

2.2.5 Kogarah – Strategic Centre

Kogarah is located approximately 2.5 kilometres south of Arncliffe and Banksia Precincts. Kogarah is identified as a Strategic Centre in APGS, as it has developed a reputation as a medical hub with associated commercial uses. In 2011, 12,000 people were estimated to be working in Kogarah. This number is expected to reach 14,000 by 2031, an increase of approximately 2,000 jobs that will be accessible to Arncliffe and Banksia Precincts residents.

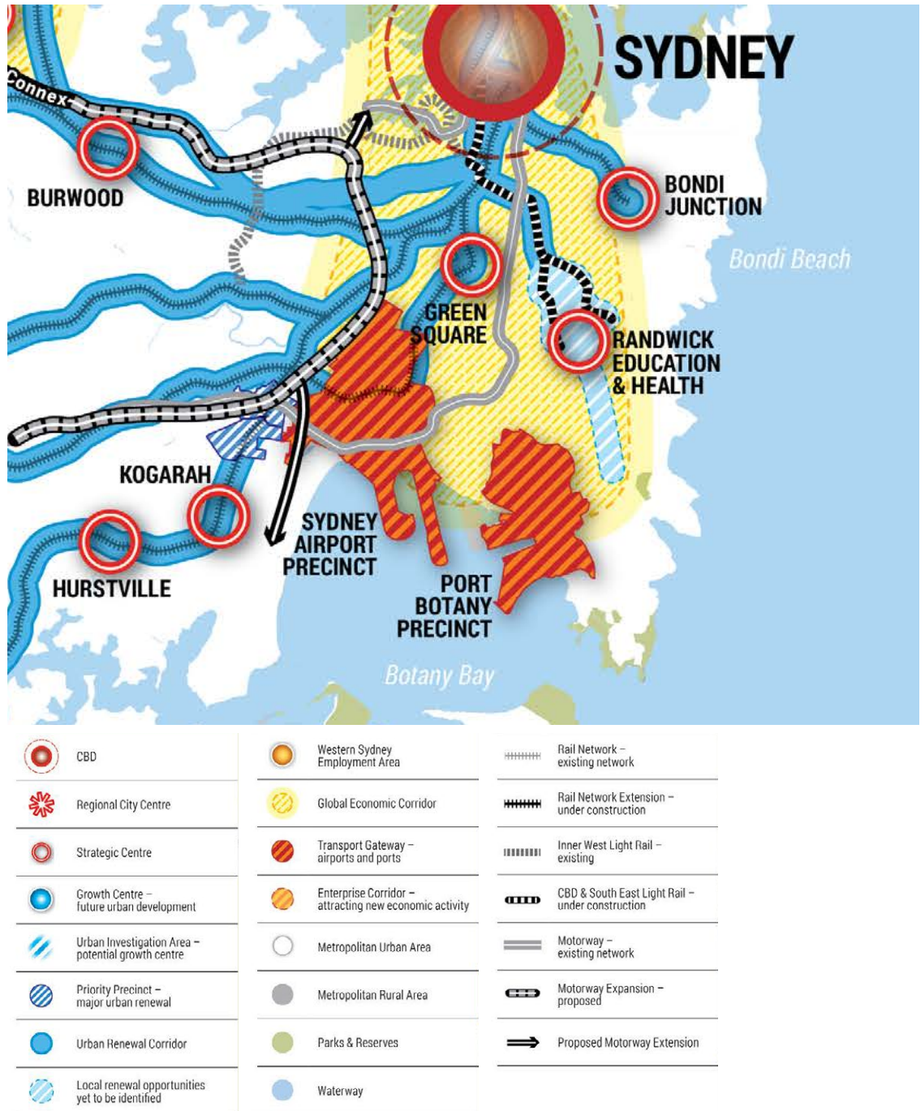


Figure 2 The plan for surrounding areas
Source: A Plan for Growing Sydney, 2014

2.3 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (LTTMP) sets the direction for transport planning for the next 20 years, providing a framework for transport policy and investment decisions that respond to key challenges. The LTTMP identifies solutions and actions that integrate, modernise, grow, and manage the transport system in the short term (0-5 years), medium term (5-10 years) and longer term (10-20 years). The LTTMP proposes a number of improvements to the transport network to deliver stronger connections to regional cities, towns and communities.

Through detailed analysis and customer engagement, six major challenges of the NSW transport system were identified:

- Integrating modes to meet customer needs
- Getting Sydney moving again
- Sustaining growth in Greater Sydney
- Providing essential access to regional NSW
- Supporting efficient and productive freight
- Statewide actions.

In response to these challenges, the LTTMP identifies a total of 220 short, medium and long term actions to transform the transport system to 2031.

The LTTMP identifies two strategic transport corridors that pass through the Arncliffe and Banksia Precincts:

- Liverpool to Sydney Airport; one of six strategic transport corridors with high constraints
- Cronulla to Sydney Airport (via Hurstville and Kogarah); one of 17 strategic transport corridors with medium constraints.

The M5 Motorway forms the dominant transport connection in the Liverpool to Sydney Airport corridor, connecting regional NSW, south-west Sydney, Sydney Airport and the Sydney CBD. In the location of Arncliffe Street, the M5 East Motorway had a volume to capacity (V/C) ratio of 1.22 in 2011. Under a 'Do Nothing' scenario, population growth in south-west Sydney would further reduce travel speeds with the V/C ratio expected to worsen to 1.39 by 2031. The WestConnex motorway project is expected to improve congestion on the M5 Motorway and is discussed in Section 4.1.5.

Several specific strategies for public transport, active transport and freight support the LTTMP and its delivery. These are highlighted in the following sections.

2.3.1 Sydney's Walking Future

Sydney's Walking Future aims to encourage and enable more people to walk, reducing congestion on roads and easing pressure on public transport. *Sydney's Walking Future* will provide for customers by:

- Promoting walking as a form of transport
- Connecting people with places by establishing safe walking networks around centres and public transport interchanges
- Engaging with partners to maximise effectiveness.

Research indicates 73 per cent of customers could be encouraged to walk more if the following issues are addressed:

- Connectivity and reduced delays: Establish more legible routes that provide stronger connections between public transport and centres, helping create more pleasant trips
- Pedestrian safety and personal security: Initiatives such as reducing traffic speeds in high volume pedestrian areas and improving street lighting will improve safety and security
- Health and wellbeing benefits: Using travel behaviour and planning initiatives in appropriate settings (such as schools, universities and workplaces) to promote the physical, emotional and social benefits of walking
- Supporting facilities: Weather protection, effective signage and more facilities at transport interchanges will help support walking.

In terms of connecting people, emphasis is placed on linking walking with urban centres. A strong focus is placed on investing in areas within two kilometres of centres and public transport interchanges, including Priority Precincts. This is directly relevant to the Arncliffe and Banksia Precincts, indicating increased potential for investment in initiatives that will increase pedestrian trips and improve mobility.

The plan proposes a series of both infrastructure and non-infrastructure (i.e. policy, awareness etc.) initiatives sequenced over the short, medium and long term (7+ years). A key infrastructure initiative of relevance to the Arncliffe and Banksia Precincts is the Transport Access Program (TAP), which proposes several upgrades to facilities at Arncliffe Station.

2.3.2 Sydney's Cycling Future

Sydney's Cycling Future aims to support a shift towards cycling. About 70 per cent of NSW residents have indicated that they would like to cycle more for everyday transport. As such, *Sydney's Cycling Future* plans, prioritises and provides for cycling by:

- Investing in separated cycleways and providing connected cycle networks to major centres and transport interchanges
- Promoting better use of the existing cycle network
- Engaging with partners to maximise effectiveness.

Sydney's Cycling Future proposes a hierarchy of cycleways that help identify and prioritise key projects:

- Regional bicycle corridors: separate cycleways on high volume routes that connect major destinations
- Local bicycle network: lower volume routes that connect to priority corridors and neighbourhood destinations within catchments
- Quiet local streets: low traffic environment which connects residential destinations and local services.

The Arncliffe and Banksia Precincts will benefit from the proposed improvement of bicycle links within a five kilometre catchment of strategic centres and transport gateways, which includes each of the nearby Hurstville Strategic Centre, Kogarah Strategic Centre, Sydney Airport Precinct and Port Botany Precinct. In the longer term, these bicycle networks will be expanded to service catchments of ten kilometres.

The Government will work with councils and developers to identify and co-fund these bicycle links.

2.3.3 Sydney's Rail Future

Sydney's Rail Future is a long term plan to transform and modernise the city's rail network. *Sydney's Rail Future* proposes a five stage approach to enhancing the capability and capacity of the city's rail network:

- Operational efficiencies: such as the introduction of a new timetable, improved dwell management and platform decluttering
- Network efficiencies: including completion of capital works, introduction of simpler timetables, Automatic Train Operations and dedicated fleet types, track infrastructure enhancement and platform redesigns
- Sydney Metro Northwest (formerly North West Rail Link): providing a new rapid transit system between Cudgegong Road and Chatswood
- Sydney Metro City (formerly Second Harbour Crossing): extending the Sydney Metro from Chatswood to Sydenham via the Sydney CBD
- Southern sector conversion: including further extension of the new rapid transit system from Sydenham to Bankstown (referred to as Sydney Metro Southwest) as well as from Sydenham to Hurstville.

The plan identifies the need for additional rail capacity along corridors south of the CBD, including the T4 Illawarra Line that passess through Arncliffe and Banksia Precincts.

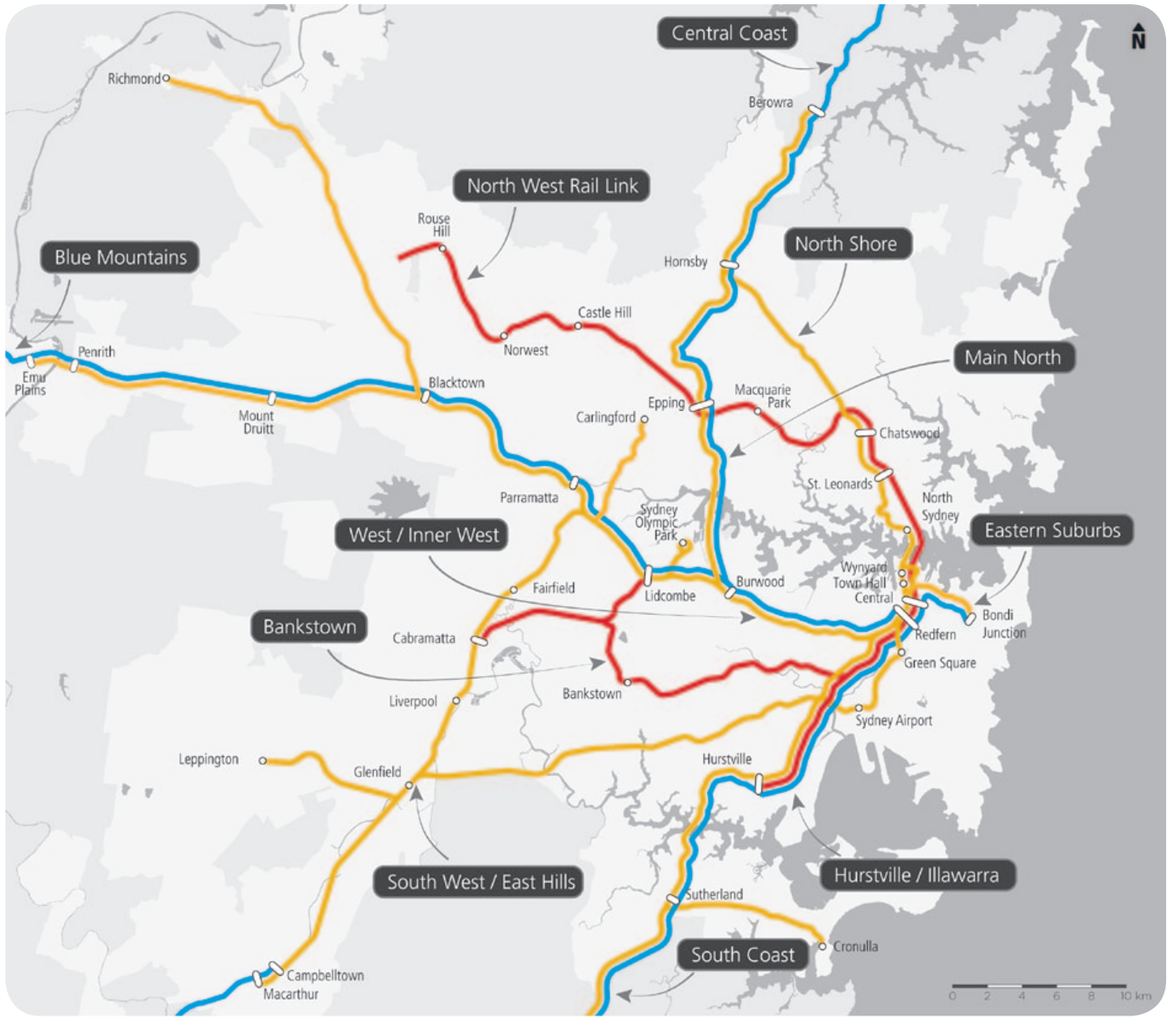


Figure 3 Three tier railway
Source: *Sydney's Rail Future*

2.3.4 Sydney's Bus Future

Sydney's Bus Future forms an important part of the Sydney strategic transit network. *Sydney's Bus Future* envisages the rationalisation of bus operations through a new route hierarchy:

- Rapid routes – fast, high capacity, 'turn up and go' services between major centres on key corridors
- Suburban routes – mix of timetabled and 'turn up and go' services on cross-metropolitan routes
- Local routes – timetabled services providing connections to key services.

Sydney's Bus Future highlights four different ways bus infrastructure can support bus priority on major corridors:

- Public Transport Information and Priority System (PTIPS) at traffic lights
- Bus priority lane through traffic lights
- Dedicated bus lanes
- Dedicated bus lanes and stops.

The proposed core bus network includes a total of 13 Rapid bus routes and 20 Suburban bus routes. Under the proposed core bus network, a new Suburban route would be operational from Bondi Junction to Miranda via Sydney Airport and Eastgardens. This service would help meet higher customer demand along the Princes Highway, providing high frequency services and improved accessibility from the Arncliffe and Banksia Precincts to the Airport, Eastgardens and Randwick areas.

2.3.5 NSW Freight and Ports Strategy

The *NSW Freight and Ports Strategy* is the 20 year plan to ensure freight is at the forefront of the NSW economy. The strategy is the Governments response to the forecast doubling of freight volumes through NSW in the 20 year period to 2031. The key objectives of the strategy are the delivery of a freight network that efficiently supports the projected growth of the NSW economy, and balancing freight needs with those of the broader community and the environment. The strategy infers a need for the road network to promote the efficient movement of freight, whilst minimising the impacts of freight movement on the community. An adaption of the plan is illustrated in Figure 5.

The strategy defines a three stage action program as identified below.

1. Network efficiency – aimed at identifying and utilising latent capacity in the existing network and assets
2. Network capacity – aimed at setting out to establish and maintain a whole-of-network approach to identify actions that increase network capacity, and achieve the desirable balance of capacity and performance
3. Network sustainability – aimed at achieving a sustainable freight network that balances efficient freight movements with community expectations of safety, good neighbourhood amenity and positive environmental outcomes through the integration of land use and freight logistics planning.

The Strategy highlights that:

- The Princes Highway and the Illawarra Rail Line are critical infrastructure in the movement of freight between Sydney and the Illawarra
- Some of the largest NSW inter-regional freight movements include those accessing the nearby Port Botany precinct as well as those to Port Kembla to the south
- The Sydney Airport and Port Botany precincts will continue to function as critical transport gateways
- WestConnex and its linkages will allow significantly improved freight access to these precincts.

Of the 71 projects identified in the *NSW Freight and Ports Strategy* infrastructure program, some projects have secured funding and work has commenced. The infrastructure program also incorporates additional projects identified as a result of the actions in the Strategy.

Project information relevant to the Arncliffe and Banksia Precincts has been extracted and provided in Table 1.

Table 1: NSW Freight and Ports Infrastructure Program

Project	Description	Status
Strategic Noise Action Plan	This will develop a plan to address rail noise issues on the rail network in support of Government modal objectives and an expected growth in rail freight movements. The outcomes of such plans may have noise reduction benefits to residential communities along freight corridors such as Arncliffe and Banksia.	Updated information provided below.
Maldon-Dombarton Rail Line	The Australian Government provided Transport for NSW with $25.5M to undertake planning and preconstruction development in 2011. This planning encompassed assessment of design, engineering, safety, operations, environmental, economic, cost and stakeholder issues. Completion of this line would allow a significant redistribution of rail freight movement from the Illawarra Line across to the Main South Line, particularly for movements to Port Kembla.	Planning complete. Private sector interest to build and operate being sought.
West-Connex	WestConnex is the largest transport project in Australia, linking Sydney's West and South-West with the City, Airport and Port Botany in a 33km continuous motorway. The project also includes a proposed southern connection through the Arncliffe and Banksia Precincts. Refer section 4.1.5 for further information.	Funded. Expected completion in 2023.

Source: Adapted from NSW Freight and Ports Strategy

Freight Noise Attenuation Program

The Freight Noise Attenuation Program (FNAP) is one of a number of initiatives being undertaken in response to the NSW Government's Strategic Noise Action Plan. Transport for NSW is rolling out the FNAP as part of a suite of initiatives designed to minimise the impact of freight rail noise on NSW residents. The FNAP will provide noise reduction treatments to homes affected by high levels of freight rail noise along NSW Government managed rail corridors between Nowra and Newcastle, and west to Lithgow. This initiative applies to the rail corridor through Arncliffe and Banksia. The program is designed to treat 200 homes per year over a ten year period.

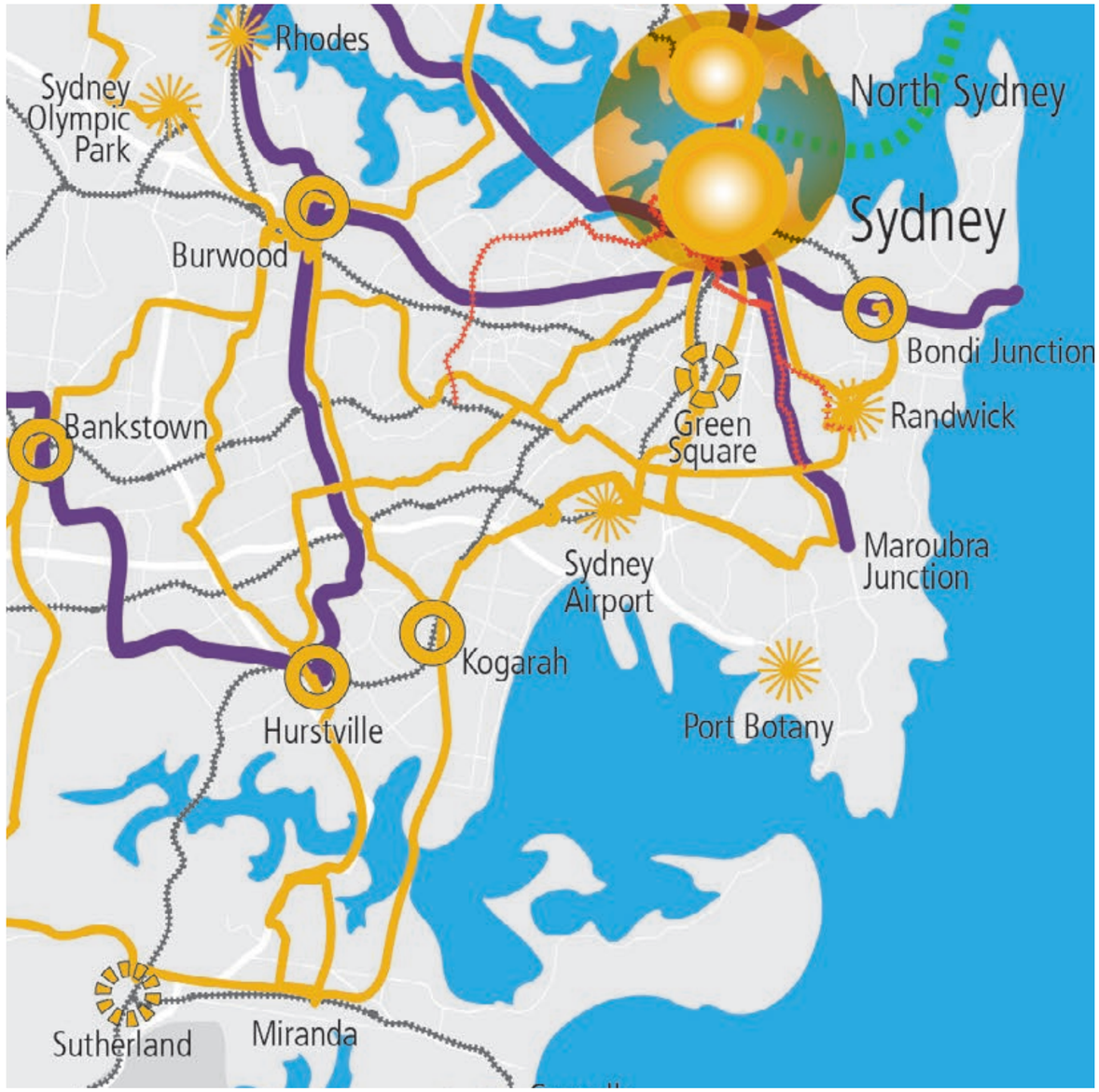


Figure 4 Sydney's core bus network
Source: Adaptation from *Sydney's Bus Future*

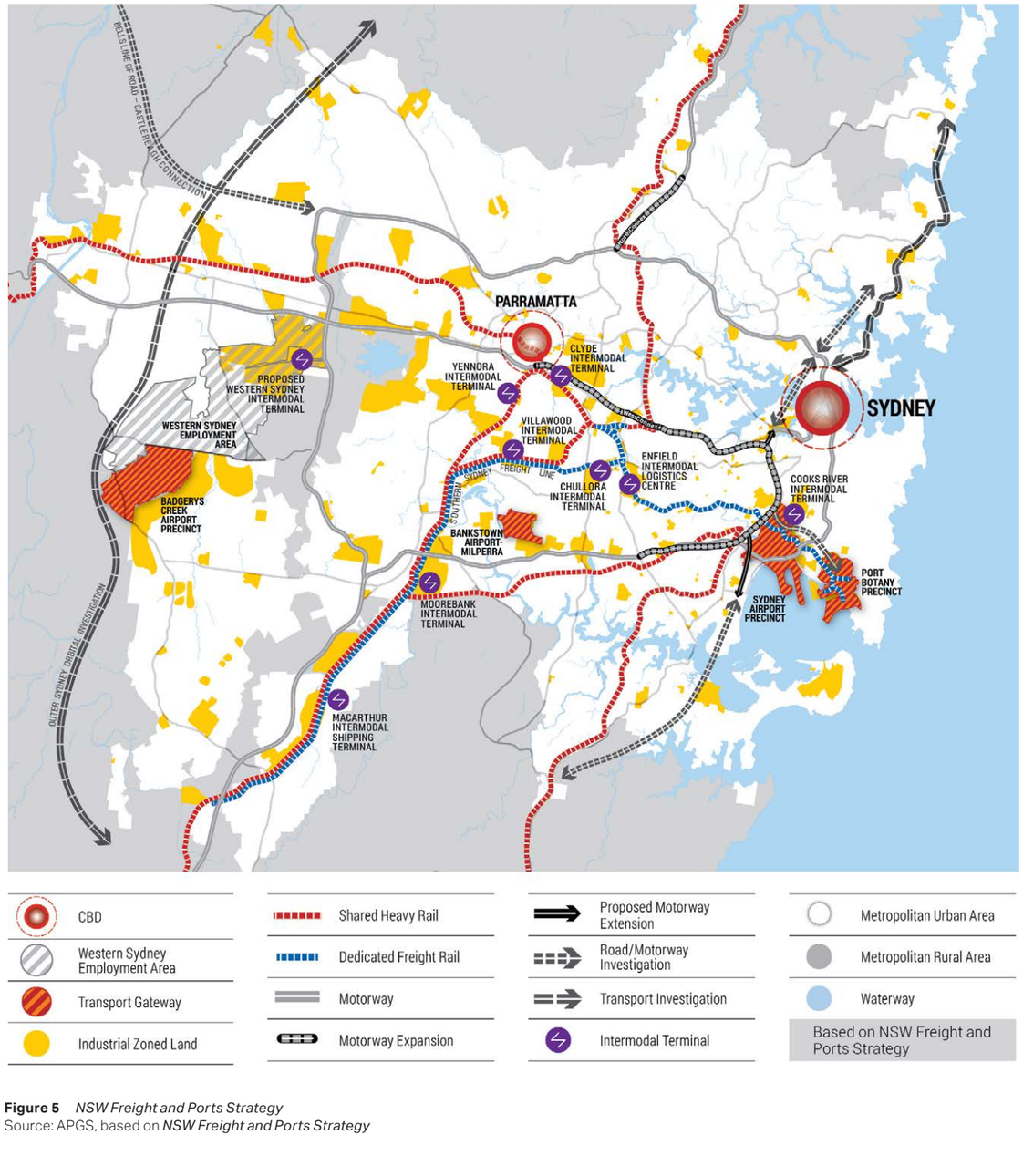


Figure 5 *NSW Freight and Ports Strategy*
Source: APGS, based on *NSW Freight and Ports Strategy*

2.4 State Infrastructure Strategy

The *State Infrastructure Strategy* is produced by Infrastructure NSW in its function of delivering independent advice to the NSW Government on the highest priority infrastructure projects for NSW. The strategy was initially developed in 2012 following the establishment of Infrastructure NSW in mid-2011. It was subsequently updated in 2014 following the transition of many important projects from concept to business case. As part of the *Rebuilding NSW Plan*, the NSW Government has reviewed and accepted the investment recommendations put forward by Infrastructure NSW, with larger scale transport commitments including:

- $7 billion reserved for Sydney Metro (formerly Sydney Rapid Transit)
- $1.1 billion reserved to invest in the WestConnex northern and southern extensions, and the Western Harbour Tunnel
- $300 million for the 'Gateway to the South' Sydney to Illawarra Pinch Point program, including $45 million in 2015-2016 to fix pinch points such as the Princes Highway intersections with Forest Road and Railway Road
- Complete investigations for larger-scale investment in the F6 and A6 corridors
- $300 million for the Urban Roads Pinch Points program
- $300 million for Bus Rapid Transit and Bus Priority Infrastructure
- $2 billion for a Regional Road Freight Corridor program.

The design and delivery of projects identified in the Strategy, for which funding is reserved, will be subject to thorough examination and scrutiny.

The Strategy identifies strong financial commitment for projects that will likely impact the transport network within the Arncliffe and Banksia Precincts including Sydney Metro, WestConnex and the Gateway to the South program. Updated information on these projects is presented in section 4.1.

2.5 Local Council planning

The Arncliffe and Banksia Precincts lie wholly within the Bayside Council LGA. The current population within the LGA is approximately 153,000 people. Bayside Council was formed in 2016 as part of the NSW Government's Fit for the Future program. The new council is a merger between Rockdale City Council (RCC) and City of Botany Bay Council. Previously, the Arncliffe and Banksia Precincts were within the Rockdale City Council LGA. As such, the current overarching planning document for the area is the Rockdale City Plan 2013-2025.

2.5.1 Rockdale Community Strategic Plan 2013-2025

The Rockdale Community Strategic Plan forms part of the suite of documents that make up the Rockdale City Plan 2013-2025. It identifies long term community aspirations before identifying outcomes and long term strategic responses. The Plan makes reference to its support for Priority Precincts and encourages redevelopment in areas identified by the NSW Government.

2.5.2 Rockdale Open Space Recreation Strategy (2010)

Council's Open Space Recreation Strategy (OSRS) seeks to improve the city's liveability and quality through enhanced open space and recreation. A purpose of this document is also to help address key issues moving forward and further enhance open space quality and provision in the area, particularly to cater for the forecast population growth.

This is proposed to be achieved through:

- The provision of public and private open space
- The quality and function of open space
- Sports development opportunities
- Recreation natural areas
- Indoor sports facilities.

2.5.3 Rockdale Princes Highway Corridor Strategy (2013)

The Princes Highway Corridor Strategy provides a vision for the Princes Highway corridor between Wolli Creek and Rockdale Town Centre. The Princes Highway Corridor Strategy included recommendations for new planning controls to promote the revitalisation of the corridor for employment uses and to grow the Arncliffe centre.

The former Rockdale City Council adopted the Princes Highway Corridor Strategy on 9 April 2013, however has not implemented the recommendations into the Local Rockdale LEP or Rockdale DCP.

The recommendations of the Strategy are being revisited as part of the Arncliffe and Banksia Precincts investigations..

2.5.4 Rockdale Local Environmental Plan (2011)

The Rockdale Local Environmental Plan 2011 (LEP 2011) is a statutory document prepared by Council and approved by the NSW Government to regulate land use and development.

The LEP provides zoning maps which indicate the permissible land uses within the Rockdale LGA. The area adjacent to Arncliffe Station is zoned for a mixture of land uses, including Low to High density Residential (R2 to R4), Mixed Use Developments (B4), Neighbourhood Centres (B1) and Public Recreation Areas (RE1). However, the area surrounding Banksia Station contains primarily low density residential (R2), Neighbourhood Centre (B1) and Enterprise Corridor (B6) zones, designating significantly lower densities than around Arncliffe Station. The remainder of the study area is comprised of primarily low to medium density Residential zones (R2 to R3).

The LEP controls are being revisited as part of the Arncliffe and Banksia Precincts investigations.

2.5.5 Rockdale Council Development Control Plan 2011

The purpose of the Rockdale Council Development Control Plan (DCP) is to:

- Communicate the planning, design and environmental objectives and controls against which Council assess Development Applications (DAs)
- Promote high quality urban design outcomes within the context of environmental, social and economic sustainability
- Encourage innovative design with particular emphasis on the integration of buildings and landscaped areas that contribute to the character of neighbourhoods.

The urban strategy presented within the DCP includes the following objectives:

- Enhance the primary centres of Rockdale and Brighton-Le-Sands to create vibrant centres with improved linkage along Bay Street
- Concentrate future development around the existing villages and local centres, improving their vibrancy and character through an increase in the local and residential population and reducing the need to travel
- Protect and utilise the natural resources in the three open space corridors which run through the area to improve recreational opportunities, foster biodiversity and add to the character of the area
- Ensure that all aspects of the development within the city are of high design quality, creating a more attractive urban environment.

Residential Flat Buildings, Mixed Use and Highway Commercial land uses are most relevant to the Arncliffe and Banksia Precincts and associated controls are provided within the DCP. These controls address a range of development features including building setbacks, site coverage, building design and public domain relationships.

The DCP also outlines additional design requirements for areas considered as Special Precincts, including Bonar Street and Wolli Creek. The DCP provides precinct specific controls including Public Domain Plans and Technical Manuals, incorporating streetscape design and concept designs for parks and plazas for the Bonar Street Precinct (located in Arncliffe) and Wolli Creek.

The DCP also outlines the Section 94 Contributions Plans applicable to the Rockdale LGA. The plans outline the collection of contributions to assist in the delivery of infrastructure to support increased demand generated by new development.

Existing conditions

3.0

3.0 Existing conditions

3.1 Travel pattern and behaviour

Transport for NSW provide a range of Journey to Work (JTW) data on travel patterns and behaviour. JTW data is derived from the five-yearly Census of Population and Housing conducted by the Australian Bureau of Statistics. JTW data identifies trip origins and destinations, as well as journey characteristics such as mode of travel.

3.1.1 Trip origin and destination

Eight travel zones defined by Transport for NSW contain the majority of the Arncliffe and Banksia Precincts (see Figure 6[1]). The JTW data for these zones has been used to gain an understanding of where people in the Arncliffe to Banksia Precincts are travelling to and from. The predominantly residential nature of the area is evident in the data, with more resident-based trips made from the area compared to worker-based trips to the area.

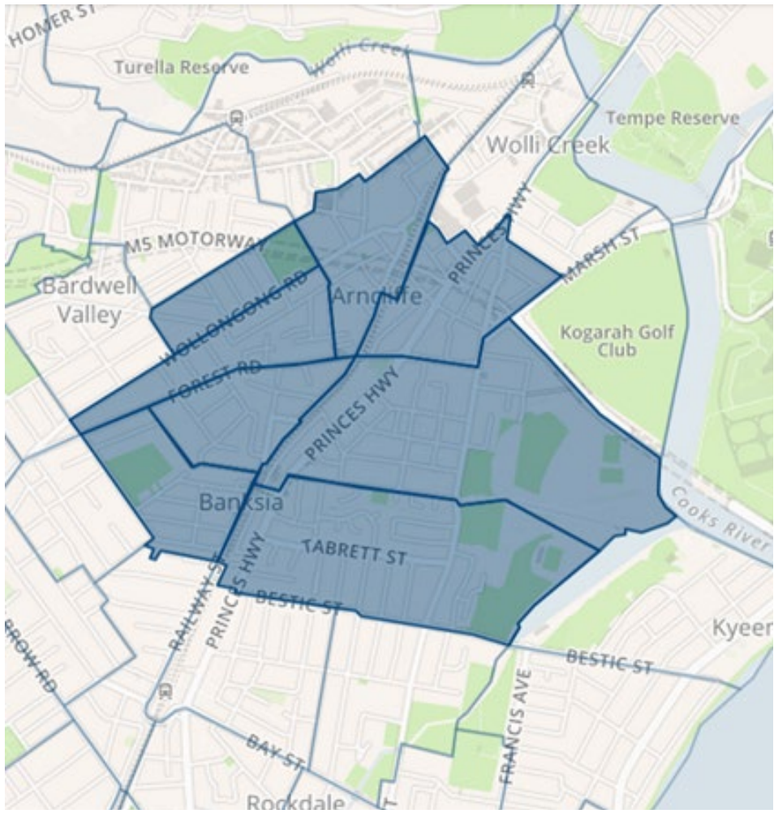


Figure 6: Travel zones in the Arncliffe and Banksia Precincts
Source: Transport for NSW, 2015

Table 2: Most common JTW destinations for employed residents

Destination	Trips	Percentage
Sydney Inner City	1,240	27%
Kogarah-Rockdale	870	19%
Botany	590	13%
Eastern Suburbs-South	210	5%
Marrickville-Sydenham-Petersham	150	3%
Other	1,490	33%

Source: Transport for NSW, 2015

From this data it is evident that a significant number of employed residents in the Arncliffe and Banksia Precincts commute to the north and east to access jobs in the Sydney CBD, Sydney Airport and Randwick.

Of 2,280 people that work in the area, 860 (38 per cent) live in Kogarah-Rockdale. After Kogarah-Rockdale, the most common JTW origins are Hurstville (230), Cronulla-Miranda-Caringbah (150) and Sutherland-Menai-Heathcote (120). These areas are all located to the south of the Arncliffe and Banksia Precincts and represent the majority of JTW origins for local workers. Collectively, these four areas account for 59 percent of all local workers, as Table 3 shows.

Table 3: Most common JTW origins for local workers

Origin	Trips	Percentage
Kogarah-Rockdale	860	38%
Hurstville	230	10%
Cronulla-Miranda-Caringbah	150	6%
Sutherland-Menai-Heathcote	120	5%
Canterbury	110	5%
Other	830	36%

Source: Transport for NSW, 2015

[1] Study area travel zones include: 2705, 2706, 2707, 2711, 2712, 2713, 2761 and 2763 (http://visual.bts.nsw.gov.au/jtwbasic/#2705,2707,2713,2712,2711,2706,2761,2763) Study area travel zones include: 2705, 2706, 2707, 2711, 2712, 2713, 2761 and 2763 (http://visual.bts.nsw.gov.au/jtwbasic/#2705,2707,2713,2712,2711,2706,2761,2763)

3.1.2 Mode share

The car is the dominant mode of transport for JTW trips for residents of the Arncliffe and Banksia Precincts – 2,340 (57 per cent) of all JTW trips from the area are by car. Public transport accounts for 31 per cent, whilst walking and other modes of transport (such as cycling) comprise six per cent of all JTW trips. Table 4 shows the breakdown by mode.

For JTW trips for workers in the Arncliffe and Banksia Precincts, the car is an even more dominant mode of transport – 1,600 (79 per cent) of all JTW trips to the Arncliffe and Banksia Precincts are by car. Public transport only accounts for 13 per cent of all JTW trips. Walking and other modes of transport (such as cycling) comprise eight per cent of all JTW trips. Table 5 shows the breakdown by mode.

Table 4: JTW mode share for local residents

Destination (Place of Work)	Trips	Mode Share
Car driver	2,340	58%
Car passenger	260	6%
Car total	2,600	64%
Train	1,100	27%
Bus	110	3%
Public transport total	1,210	30%
Walked Only	110	3%
Mode not stated / other mode	100	2%
Other	60	2%

Source: Transport for NSW, 2015

Table 5: JTW mode share for local workers

Destination (Place of Work)	Trips	Mode Share
Car driver	1,480	73%
Car passenger	130	6%
Car total	1,610	79%
Train	240	12%
Bus	30	1%
Public transport total	260	13%
Walked Only	80	4%
Mode not stated / other mode	40	2%
Other	40	2%

Source: Transport for NSW, 2015

3.2 Existing active transport network

Considering the geographic size of the study area and the proximity of rail services, the network for active transport is generally limited. The rail line and highway act as significant barriers to east-west travel, while the undulating nature of some areas can make active travel less attractive.

3.2.1 Pedestrian activity

The key generators and attractors of trip and pedestrian activity in the vicinity of the Arncliffe and Banksia Precincts include:

- The transport nodes of Arncliffe and Banksia Stations and surrounding small shops
- The increasingly higher density of mixed use and residential areas in the Wolli Creek precinct
- The recently developed high density residential areas provided in the Bonar Street precinct
- The employment provided within the Princes Highway corridor precinct – predominantly large scale retail / commercial generating vehicle trips rather than pedestrian trips
- The low and medium density residential areas offset from the trunk rail and road corridors
- Education facilities in the area, including the Al Zahra College, Athelstane Public School, St Francis Xavier's Catholic Primary School and the Arncliffe Public School
- Various open spaces provided within, to the east and west of the Arncliffe and Banksia Precincts.

Station entries and exits recorded in 2014 indicate approximately 1,430 entries during the AM peak period (6am to 9:30am) at Arncliffe Station, and 210 exits[2]. This pattern is similar at Banksia Station with approximately 980 entries and 110 exits recorded in the 2014 AM peak period. These figures are reflective of a predominantly residential local catchment in the Arncliffe and Banksia Precincts, in which the predominant flux of pedestrian movement in the area is from residential areas to transport nodes in the AM peak and vice versa in the PM peak period.

3.2.2 Pedestrian facilities

Dedicated pedestrian facilities within the study area include:

At Arncliffe Station:

- Grade-separated pedestrian crossings over the rail line
- Zebra crossings across adjacent streets
- A dedicated footpath between Station Street and Wollongong Road providing connectivity to residential areas to the west
- Dedicated footpaths to Eden Street providing connectivity to the employment areas along the highway and residential areas further east.

At Banksia Station:

- A grade-separated underpass allowing crossing of the rail line and access to the train platforms
- Pedestrian crossings across adjacent streets.

Arncliffe Public School:

- A pedestrian overpass of the Princes Highway

Athelstane Public School:

- Gore Street to Forest Road and Esdaile Place to Station Street links, as well as links to Hirst Street and Fripp Street
- Dedicated footpaths to and through open spaces and to other major education facilities
- Various dedicated links between Spring Street and Tabrett Street
- A pedestrian overpass of Forest Road, immediately north of its intersection with Bexley Road, and a signalised mid-block crossing further north
- Mid-block pedestrian crossings at Wollongong Road near its intersections with Wolli Creek Road, Dowling Street, Mitchell Street, Broe Avenue.

[2] BTS Electronic Publication No. E2015-11-Train-Barrier Counts-Summary, May 2015

Existing pedestrian infrastructure and key links are shown in Figure 7. The current infrastructure provision is generally adequate within each suburban / local area inside the precinct. However the connections between different areas within the precinct and to locations outside the precinct are limited. There are opportunities throughout the precinct to improve pedestrian connectivity including:

- Between Arncliffe Station and Wolli Creek
- Between Wollongong Road and Wolli Creek
- Across the Princes Highway and West Botany Street north of Wickham Road
- Across West Botany Street between the precinct and Barton Park
- Across Forest Road
- Between Banksia Station Gardiner Park.

The rail corridor forms a barrier to east-west pedestrian movement, with limited crossing opportunities provided. The Princes Highway corridor also forms a barrier to east-west pedestrian movement, with traffic signals set at large cycle times during peak periods and a priority on providing for north-south traffic movements resulting in delays for pedestrians and poor amenity.

There are two walking 'connecting trails' identified by Council within the study area. The first connects the Cook Park Trail to Bardwell Park via Arncliffe. The second route is between Riverine Park and Bardwell Park via Banksia. Note that these routes are informal and for the purposes of leisure walking, as such, they are somewhat circuitous.

The existing pedestrian network includes no formal walking trails inside the study area. Wayfinding is provided at rail stations for the immediate area surrounding each station. Information on wider connections is not provided.

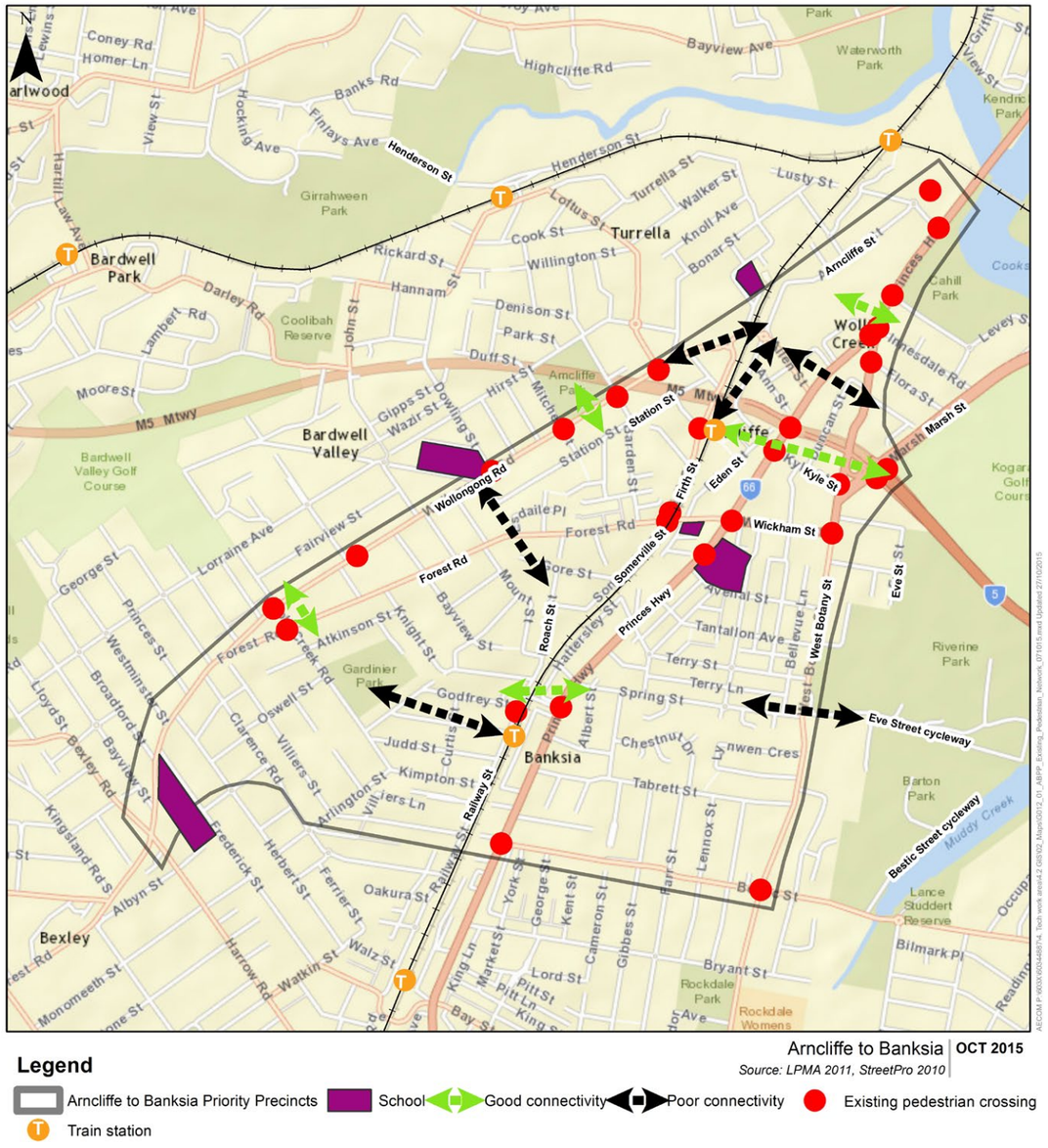


Figure 7 Existing pedestrian network
Source: AECOM, 2015

3.2.3 Cycling activity

To gauge current ridership in the Arncliffe and Banksia Precincts, information has been extracted from an application-based data source. Strava is a mobile and online application that allows users to track their ride using a GPS device, and upload their data. The data is used to update a website-accessible global heat map every hour. Figure 8 shows the heat map for the local area.

It should be noted that this method of data capture is limited. In particular, it only captures the movements of the cyclists utilising the geocoding software. It can generally be assumed therefore, that this data relates more to experienced and serious cyclists who are likely to be more confident and undertake trips of greater length / significance than the average cyclist. As such, it is possible that groups such as children, leisure cyclists and those with less access to technology may be excluded from this data. However, while this data is limited in its ability to inform future demand, it does provide a useful indicator of the routes cyclists are using.

The heat map indicates:

- High use of the dedicated cycle facilities across the Cook River and connecting facilities to the east through Cahill Park, Eve Street Cycleway, Bestic Street Cycleway and the Grand Parade
- A high volume of riders using West Botany Street and Bestic Street as an alternate on-road route between the Princes Highway Cooks River crossing and The Grand Parade
- A comparatively low use of the dedicated routes through the Arncliffe and Banksia Precincts along Wollongong Road and the rail corridor
- Some utilisation of Forest Road and Princes Highway informally on-road.

The combination of the above observations indicates that cyclists want to use the more direct routes, despite the risk of interaction with heavier traffic flows. Existing cycle routes serve a proportion of the demand shown, however gaps in cycle infrastructure provision in an east-west direction leaves cyclists with no viable alternative to the road network.

Figure 8 Bicycle user heat map
Source: Strava Inc, 2015

3.2.4 Cycling facilities

Dedicated cyclist facilities within the area include a mix of on- and off-road facilities, predominantly forming connections radially from Cooks River bridges and south along the coast. The cycle network in the area includes (see Figure 9):

- In the north east of the study area, off-road shared paths connecting the two crossings of the Cooks River (at Marsh Street and the Princes Highway) to and through adjacent open spaces including Cahill Park, Barton Park, and further south along the coastline towards Brighton-Le-Sands
- On road facilities connecting Turrella Station and areas west of Wolli Creek to the Wolli Creek precinct and Cahill Park
- On road facilities along the western side of the rail corridor. The route includes parts of Arncliffe, Firth, Somerville, Gore, Roach and Railway Streets. This is the only formal cycle route within the study area
- On road facilities along Lorraine Avenue (parallel to Wollongong Road)
- Bicycle racks at both Arncliffe and Banksia Stations.

A level of north-south connectivity is provided at the train stations; however there is limited east-west connectivity in the network. It is difficult for cyclists to move in an east-west direction across the rail stations as both station designs necessitate the carrying of bikes up / down stairs.

Uncovered cycle racks are provided adjacent to both Arncliffe and Banksia Stations. These facilities are small and underutilised, with no other end of trip facilities, including lockers, provided.

- On road facilities along the western side of the rail corridor. The route includes parts of Arncliffe, Firth, Somerville, Gore, Roach and Railway Streets. This is the only formal cycle route within the study area
- On road facilities along Lorraine Avenue (parallel to Wollongong Road)
- Bicycle racks at both Arncliffe and Banksia Stations.

A level of north-south connectivity is provided at the train stations; however there is limited east-west connectivity in the network. It is difficult for cyclists to move in an east-west direction across the rail stations as both station designs necessitate the carrying of bikes up / down stairs.

Uncovered cycle racks are provided adjacent to both Arncliffe and Banksia Stations. These facilities are small and underutilised, with no other end of trip facilities, including lockers, provided.

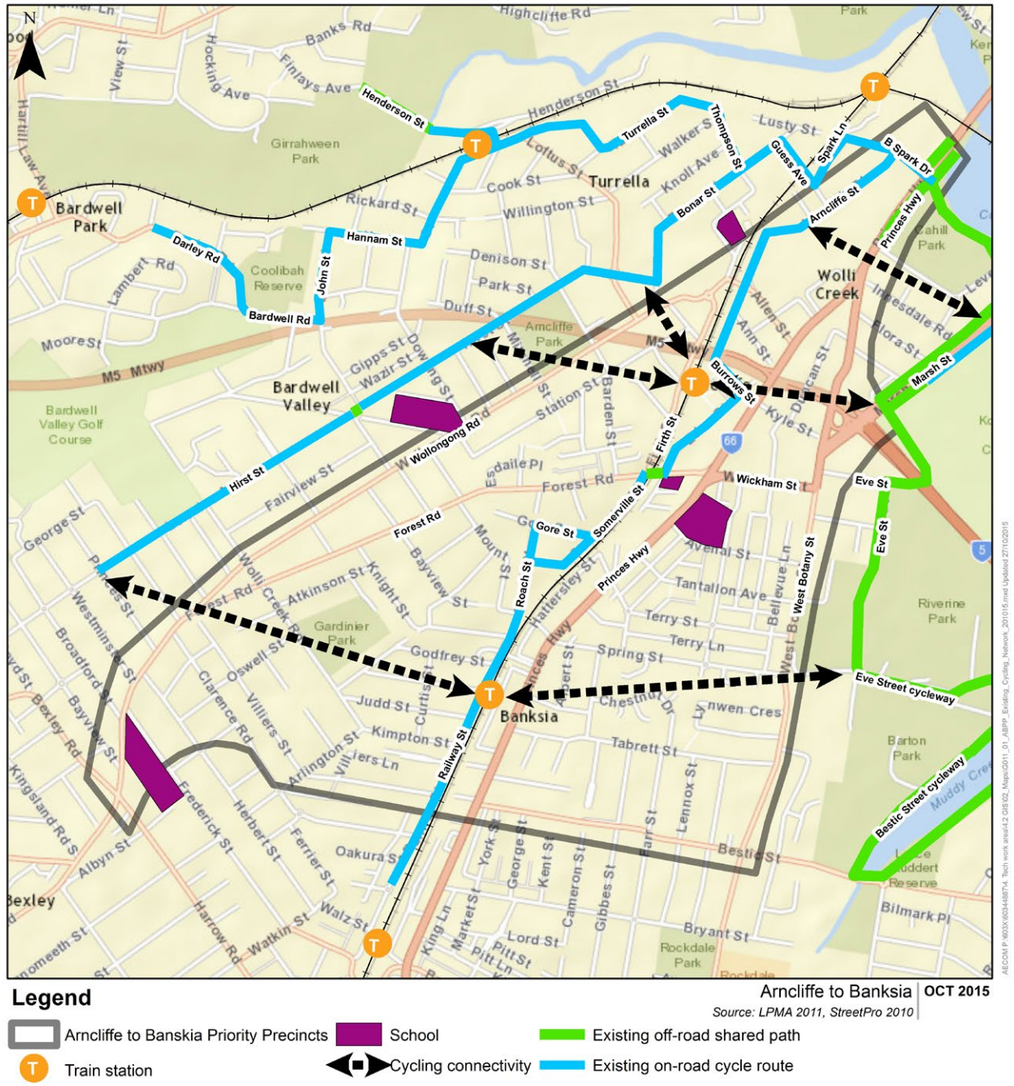


Figure 9 Existing cycle network
Source: Roads and Maritime Servies (Cycleway Finder) and Council (On the Go, July 2013), adapted by AECOM, 2015

3.3 Existing public transport network

3.3.1 Passenger rail

Arncliffe and Banksia Stations are located on the T4 Illawarra Line (see Figure 10). The T4 Illawarra Line also forms part of the South Coast Line which extends all the way to Bomaderry and Port Kembla in the Illawarra. Arncliffe is located approximately eight kilometres (or approximately 16 minutes travel time) south-west of Central Station, whilst Banksia is ten kilometres. The services operating through the Arncliffe and Banksia Stations provide public transport access to the CBD (via Central, Town Hall and Martin Place Stations), Bondi Junction and other major centres to the south such as Kogarah and Hurstville. The opportunity to interchange to other trunk rail services to the north and west are provided at Central Station while opportunity to switch to the T2 Line and access the Airport, Green Square, Mascot or areas to the south west is available at the nearby Wolli Creek Station.

General characteristics of services along the T4 Illawarra and South Coast Lines are as follows:

- Trains operate for 20 hours on a typical weekday in both directions
- The current capacity of the line is 18 trains per hour, with the line operating at full capacity during the AM peak hour, accommodating:
  - 15 Suburban services (operating between Bondi Junction and either Hurstville, Cronulla or Waterfall)
  - 3 Intercity services (originating to the south in the Illawarra)
- 6 of the 18 peak hour services stop at Arncliffe and Banksia Stations (i.e. 10 minute average headways). These are the all-stop services between Hurstville and Bondi Junction. The remainder are express services that do not stop between Wolli Creek and Hurstville.

Local passenger rail demand

Analysis of JTW and station barrier count data made available by Transport for NSW indicates:

- Train travel comprises 28 per cent of JTW trips by the existing local resident workforce
- About 90 per cent of those trips have destinations to the north along the line, 10 per cent to the south
- Although the utilisation of rail as a JTW transport mode is significant, the daily turnover of patrons at the Arncliffe and Banksia Stations is relatively low. In 2013, the two stations ranked 125th and 140th respectively in the NSW InterCity network in terms of daily patronage. It is considered this is due to the relatively low density of the residential population within the station catchments
- While the historic barrier count data showed a drop in patronage at Arncliffe Station between 2004 and 2006, growth in patronage has generally been steady at both stations since.

T4 Illawarra / South Coast lines demand and capacity

A high level assessment of passenger demand and capacity has been undertaken based on data made available by Transport for NSW.

The passenger carrying capacity of a rail line is determined by the combination of the train carrying capacity of the line, and the passenger carrying capacity of the trains. Train line capacity is determined by the minimum safe headway between services and stopping patterns, and is currently 18 trains per hour for the T4 Illawarra and South Coast lines.

Train passenger capacity is the maximum number of passengers able to be carried per train, taking into account seating capacity, standing capacity and operational requirements (i.e. loading / unloading times). The predominant type of train currently utilised on the T4 Illawarra Line is an eight carriage Tangara type train. Passenger carrying capacity of the line has been estimated based on information provided by Transport for NSW as follows (see Table 6):

- **Train seating capacity**: is approximately 850 passengers per train, based on the existing 18 AM peak hour services providing seating for 15,220 passengers
- **Nominal train standing capacity:** is approximately 300 passengers per train
- **Nominal train capacity**: is 1,150 (seated plus standing) passengers per train, based on the sum of the above
- **Nominal line capacity**: is 20,610 passengers per hour (pph), based on the current provision of 18 AM peak hour services
- **Train load limit**: is approximately 1,380 passengers per train, as when trains are loaded to 120 per cent nominal capacity, service reliability and line capacity are impacted
- **Line load limit:** is approximately 24,750pph, beyond which delays and unreliability are considered likely.

In terms of current passenger rail demand, analysis of data made available by Transport for NSW indicates:

- The critical section of the Illawarra Line in terms of passenger loads is from Arncliffe to Sydenham in the AM peak hour, with train loads then reducing on approach to, and within, the CBD
- The 6 all-stops services, which stop at Arncliffe and Banksia, have an average load of 98 per cent nominal train capacity at Sydenham in the 2014 AM peak hour
- The average train load across all 15 suburban services on the line was 99 per cent nominal train capacity at Sydenham in the 2014 AM peak hour
- The line load at the most congested location ('critical line load') on the T4 Illawarra and South Coast lines is 19,800 in the 2014 AM peak hour (see Figure 11), approximately 96 per cent of the nominal line capacity or 80 percent of the line load limit
- Average annual growth on the T4 Illawarra Line was one per cent from 2008 to 2013.

The demand analysis indicates that during the AM peak, nominal train capacities are already being reached. Furthermore, should even current growth rates continue, the load limit of the T4 Illawarra and South Coast lines would be reached within the 2036 planning horizon, increasing delays and impacting service reliability. This highlights the need for additional passenger rail capacity to support growth along the rail corridor in the long term.

Table 6: 2014 AM peak hour loads on the T4 Illawarra and South Coast Lines

Service	No. Trains	Seats	Pax	Average Load	
				% Seating capacity	% Nominal capacity
Illawarra Express	3	2,520	2,800	11%	82%
South Coast-ESR Special	1	840	1,180	141%	104%
Illawarra limited stops	5	4,200	6,210	148%	109%
Illawarra all stops	6	5,060	6,710	133%	98%
T4 Illawarra Total^	**15**	**12,620**	**16,900**	**134%**	**99%**
South Coast-ESR Express	3	2,590	1,940	75%	56%
South Coast Total*	**3**	**2,590**	**1,940**	**75%**	**56%**

*^Taken at Sydenham / Hurstville *Taken at Helensburgh*
Source: Transport for NSW, 2015

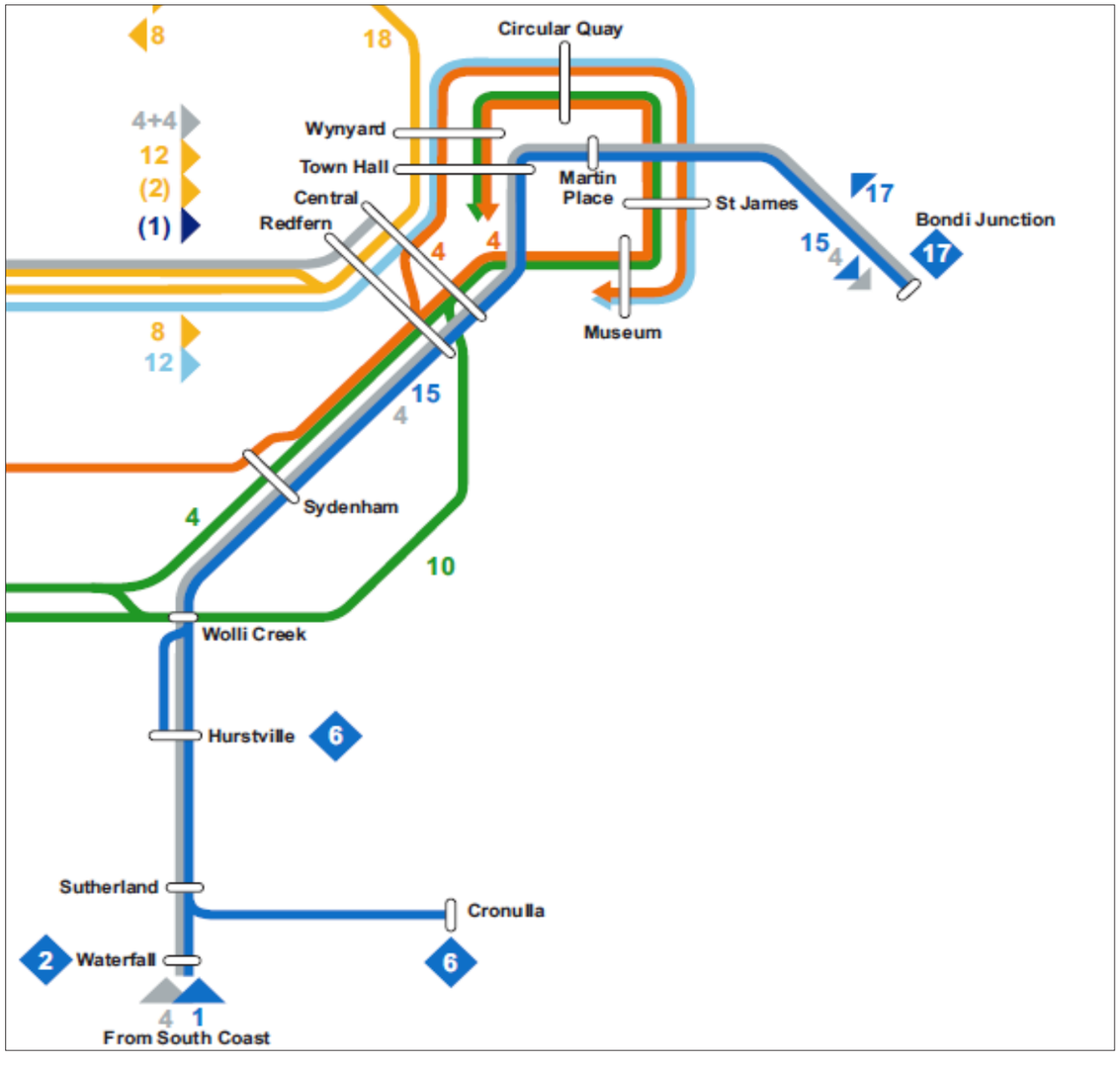


Figure 10 2013 peak hour services arriving at Central (7:45am to 8:44am)
Source: Transport for NSW, 2015

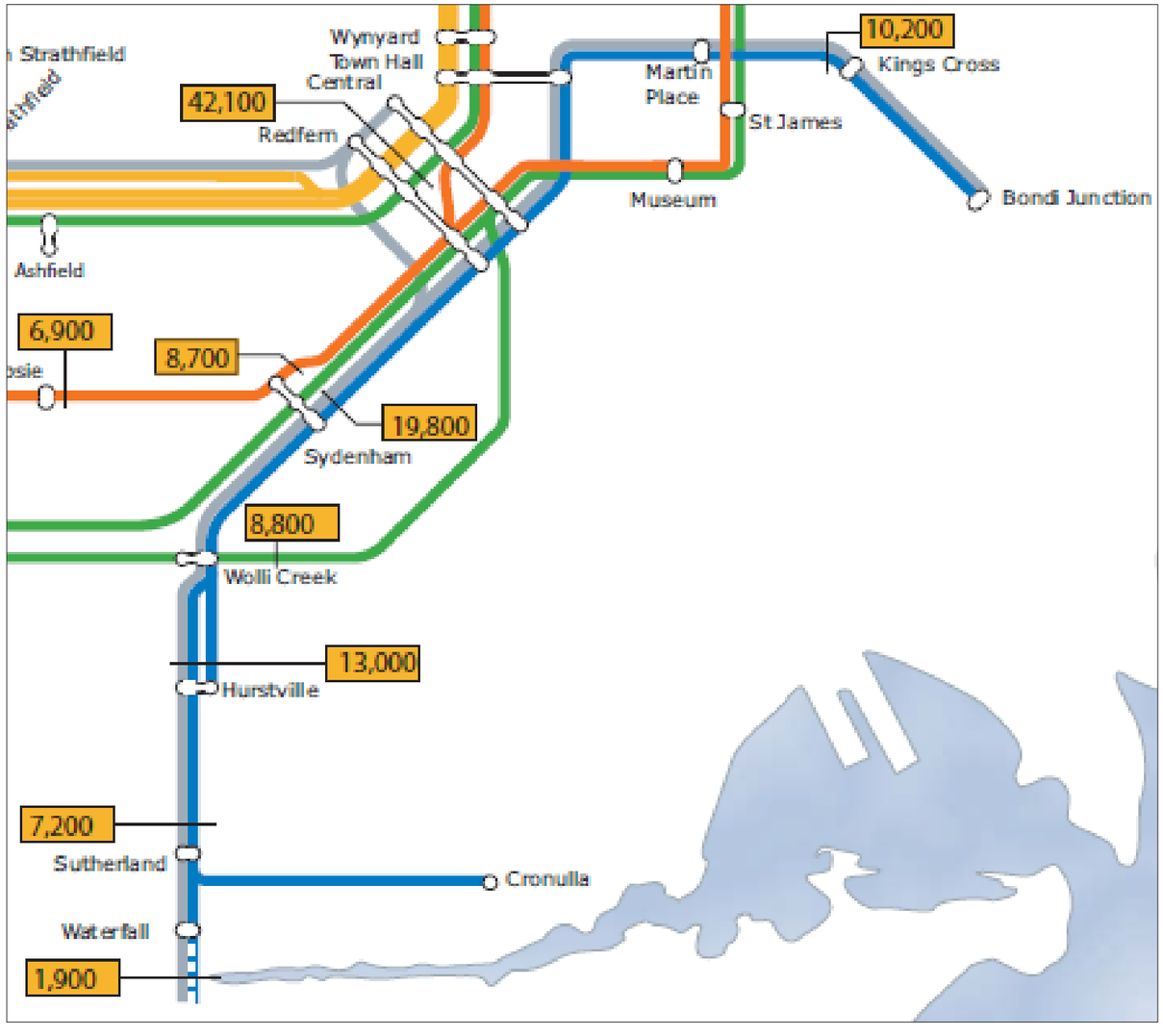


Figure 11 March 2014 AM peak hour passenger flows (8:00am to 8:59am Central time)
Source: Transport for NSW, 2015

Station facilities

A summary of the facilities provided at both Arncliffe and Banksia Stations are as below. Active transport accessibility and park availability are discussed further in the sections following.

- Arncliffe Station:
  - Primary access to station platforms and grade separated pedestrian crossings across the rail line are via stairs
  - Although portable boarding ramps are available at the platforms, wheelchair accessibility is low in lieu of lack of lifts, ramps or other facilities such as wheelchair accessible toilets, payphones or parking
  - Interchange to all nearby modes of transport is available with nearby bus stops, taxi ranks, kiss and ride spaces and bike racks.
- Banksia Station
  - Primary access to station platforms and grade separated pedestrian crossings across the rail line are via stairs
  - Banksia is not wheelchair accessible
  - Interchange to all nearby modes of transport is available with nearby bus stops, taxi ranks, kiss and ride spaces and bike racks.

3.3.2 Bus services

With passenger rail services providing public transport access from Arncliffe and Banksia Precincts to the nearby major centres, the key role for local bus services is considered to be providing public transport access to areas not serviced by rail:

- To the east towards the Airport and Randwick
- West towards Bexley and Campsie
- South towards the coast line and Miranda
- Acting as a trunk feeder to the T4 Illawarra Line.

Trunk bus services are currently available along the Princes Highway and West Botany Street corridors and provide links to Sydney Airport, the Eastern Suburbs and the Sydney CBD. These routes service the eastern side of the precinct. The western side of the precinct has scarce bus service provision with only a local route (473) between Rockdale and Campsie. This is reflected in the low existing mode share seen for buses in the study area (3 per cent). The five different bus routes providing public transport connections through and within Arncliffe and Banksia Precincts are listed below. Bus routes and stop locations are shown in Figure 12.

- 348: Wolli Creek to Bondi Junction via St Peters, UNSW
- 400: Burwood to Bondi Junction via Rockdale, Sydney Airport, UNSW
- 410: Rockdale to Bondi Junction via UNSW, Randwick (peak only)
- 422: Kogarah to City via St Peters, Newtown, University of Sydney
- 473: Rockdale to Campsie.

Approximate bus frequencies for each service during a typical weekday are shown in Table 7. Table 8 shows the first and last bus services for each route on a typical weekday.

The 400 and 410 services are the trunk services operating through the precinct. However, the 400 is a limited stops service through Arncliffe and Banksia whilst the 410 is a peak period limited stops service stopping in Arncliffe only. The actual operating frequency of the 400 service is approximately 7 minutes during peak periods, however the limited stops nature of the service results in a service frequency to Arncliffe and Banksia patrons of only around 20 minutes.

The 422 also operates more frequently between Tempe and the City, with approximately half the services provided to Arncliffe and Banksia.

JTW data indicates that the predominant destinations for current working residents by bus are:

- Botany (44 per cent), including the Sydney Airport and Eastgardens areas
- Sydney CBD (18 per cent)
- Eastern Suburbs (14 per cent), including the UNSW and Randwick areas
- Kogarah / Rockdale (local trips) (10 per cent)
- Sydenham / Petersham (6 per cent).

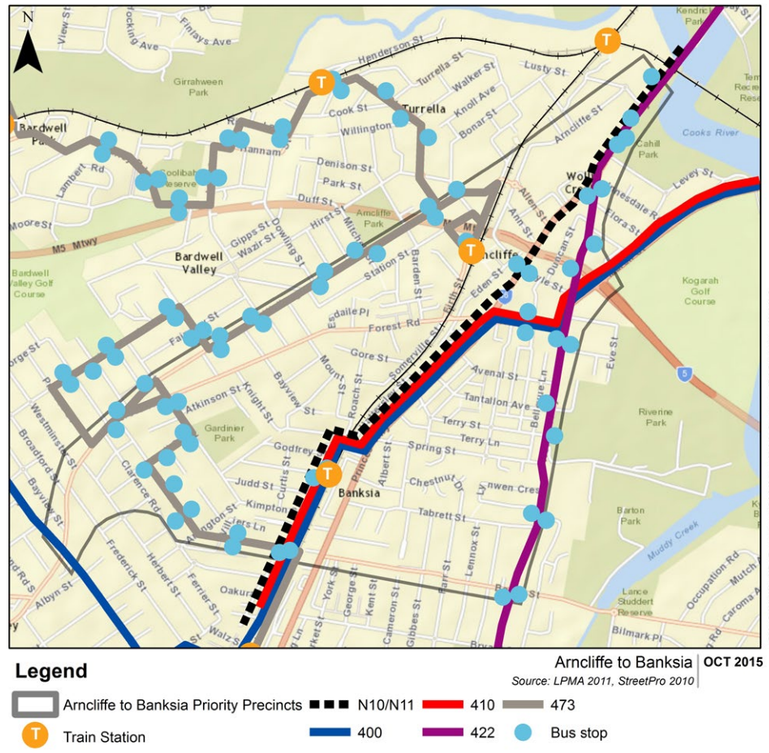


Figure 12 Stop locations and bus routes
Source: Sydney Buses, 2015 adapted by AECOM, 2015

The data indicates that the 400 / 410 services operating through the Botany area are the most heavily utilised bus routes. The data also indicates little take up of services bound for the west with relatively low proportional uptake.

Opal data provided by Transport for NSW for the period January to April 2015 shows the following key bus destinations in the study area[2]:

- Sydney Airport, International Terminal: 2,344 trips (24 per cent)
- Rockdale Station, Railway St: 1,186 trips (19 per cent)
- Sydney Airport, Domestic Terminal (T3). Shiers Av: 851 trips (9 per cent)
- Firth Street near Arncliffe Station: 360 trips (4 per cent)
- Wollongong road catchment : 347 trips (4 per cent)
- Anzac Pde Stand B opp UNSW: 332 trips (3 per cent)
- High Street near Clara Street (near Prince of Wales Hospital): 120 trips (1 per cent).

The above destination data demonstrates some consistency with the JTW data, showing that the Sydney Airport is the largest attractor of local bus trips, with most originating from the Banksia Station and Wickham Street bus stops. This is followed by other key destination areas in the east such as UNSW and the Prince of Wales Hospital, as well as local trips to Rockdale and Arncliffe Station precincts (including feeder trips). Note that the common factor among a majority of the above destinations is that they are on the existing 400 / 410 routes.

Table 7: Typical weekday bus service frequencies

Route	Direction	AM peak	Mid day off peak	PM peak
348	Northbound	30 minutes	30 minutes	20 minutes
400	Northbound	20 minutes	20 minutes	20 minutes
	Southbound	20 minutes	20 minutes	30 minutes
410	Northbound	30 minutes	Not in service	30 minutes
	Southbound	80 minutes	Not in service	30 minutes
422	Northbound	30 minutes	30 minutes	30 minutes
	Southbound	30 minutes	30 minutes	30 minutes
473	Northbound	30 minutes	60 minutes	30 minutes
	Southbound	30 minutes	60 minutes	30 minutes

Includes Wollongong Road stops near Bonar, Earle, Kelsey, Kembla, Mitchell and Station Streets as well as, Wilsons Road, Wolli Creek Road and opposite Wilsons Road.

Source: TripView Lite, 2015

Table 8: Bus service span on a typical weekday

Route	Direction	First service departs	Last service departs
348	Northbound	Wolli Creek at 6:01am	Wolli Creek at 7:21pm
400	Northbound	Banksia at 5:11am	Arncliffe at 11:23pm
	Southbound	Arncliffe at 5:56am	Banksia at 12:04am
410	Northbound	Rockdale at 6:47am	Arncliffe at 5:53pm
	Southbound	Arncliffe at 8:15am	Rockdale at 6:52pm
422	Northbound	Banksia at 6:23am	Wolli Creek at 6:43pm
	Southbound	Wolli Creek at 6:29am	Banksia at 7:27pm
473	Northbound	Banksia at 6:14am	Arncliffe at 8:55pm
	Southbound	Arncliffe at 6:35am	Banksia at 9:06pm

Source: TripView Lite, 2015

[2] Note that all trips in January were removed from the below analysis, leaving a total number of 9,699 trips in the anlysis.

3.4 Existing road network

The road network in the local area supports a variety of different road users. This includes a significant volume of through-trips from commuters accessing the large employment centres of the Sydney CBD and Sydney Airport, as well as regional freight movements accessing critical freight hubs such as the Port Botany area. These through trips are mixed with localised traffic generators such as the large-floor retail land uses along the Princes Highway corridor and surrounding residential areas.

3.4.1 Road hierarchy

Roads and Maritime's *Schedule of Classified Roads and Unclassified Regional Roads* provide definitions under the administrative classification system. Administrative classifications help define jurisdictional responsibility and the basis for funding responsibility. Under the administrative classification system, a three tier road hierarchy has been developed comprising:

- **State Roads:** managed and financed by Roads and Maritime
- **Regional Roads:** perform an intermediate function between State Roads and council-controlled local roads. Financial assistance provided by Roads and Maritime to councils for management
- **Local Roads:** council-controlled collector and local roads.

Within Arncliffe and Banksia Precincts, the following roads belong to the state and regional classifications (see Figure 13):

- **State Roads:** Princes Highway, Forest Road, Marsh Street, West Botany Street, Wickham Street and Bexley Road
- **Regional Roads:** Bestic Street, Flora Street and West Botany Street
- **Local Roads:** all others.

The **Princes Highway** is part of the national highway network, running from Sydney to Port Augusta, South Australia. The highway is three lanes in each direction in the vicinity of the site and carried in the order of 75,000 vehicles per day in 2012 . The highway serves as the spine of the trunk road network in the local area for both private vehicles and freight. The highway also provides access to employment within the Princes Highway corridor, comprising predominantly of large-space retail / commercial land uses.

Forest Road is a state road carrying traffic from Peakhurst to and from Princes Highway and Wickham Street. The road is predominantly two-lane with clearways eastbound during the AM peak periods, and westbound in the PM peak period.

Marsh Street is a state road and the primary connection to the Sydney Airport precinct. The road is a key access point for the M5 East Motorway and Sydney's southern suburbs, linking West Botany Street to Airport Drive. Marsh Street is broadly a two-lane road but widens to five lanes at the intersection of Marsh Street / M5 East Motorway.

West Botany Street has a section of road classified as a state road, providing a link between Marsh and Wickham Streets.

Wickham Street is a short 300m two-lane state road, which combines with Forest Road, West Botany Street and Marsh Street to form the main east-west connection for traffic through the study area.

Bexley Road is a state road which forms part of an east-west connection, between Campsie and Brighton-Le-Sands via Bexley North and Rockdale. A short section of Bexley Road is located in the study area at the south-western boundary.

3.4.2 Traffic demand

Peak period traffic volumes within the study area are heavily driven by through traffic utilising the State road network (particularly the Princes Highway and the M5 Motorway) to access the Sydney CBD and other major employment centres. Nearby Sydney Airport is a large generator of traffic through various periods of the week, whilst Port Botany is also a large generator of private and freight vehicles on a typical weekday.

Traffic volumes at key links for the critical AM peak are summarised in Table 9. The flows at the Princes Highway and West Botany Street are currently at, or exceeding, the theoretical capacity of urban roads[5].

Table 9: AM peak hour traffic flows at key locations

Road	Location	Direction	Flow (vph)	
			Total	Per lane
West Botany Street	Marsh Street	Northbound	2,650	1,330
Princes Highway	Cooks River Bridge	Northbound	3,580	1,190
Wickham Street	West Botany Street	Eastbound	1,820	910
Forest Road	Princes Highway	Eastbound	1,310	660

Source: Transport for NSW, 2015

[5] Austroads' Guide to Traffic Management Part 3: Traffic Studies and Analysis indicates peak period traffic capacity for urban roads is in the order of 1000 pcu/hour/lane, or 1200 to 1400 pcu/hour/lane when adequate flaring at intersections, peak period parking controls and traffic signal priority are provided.

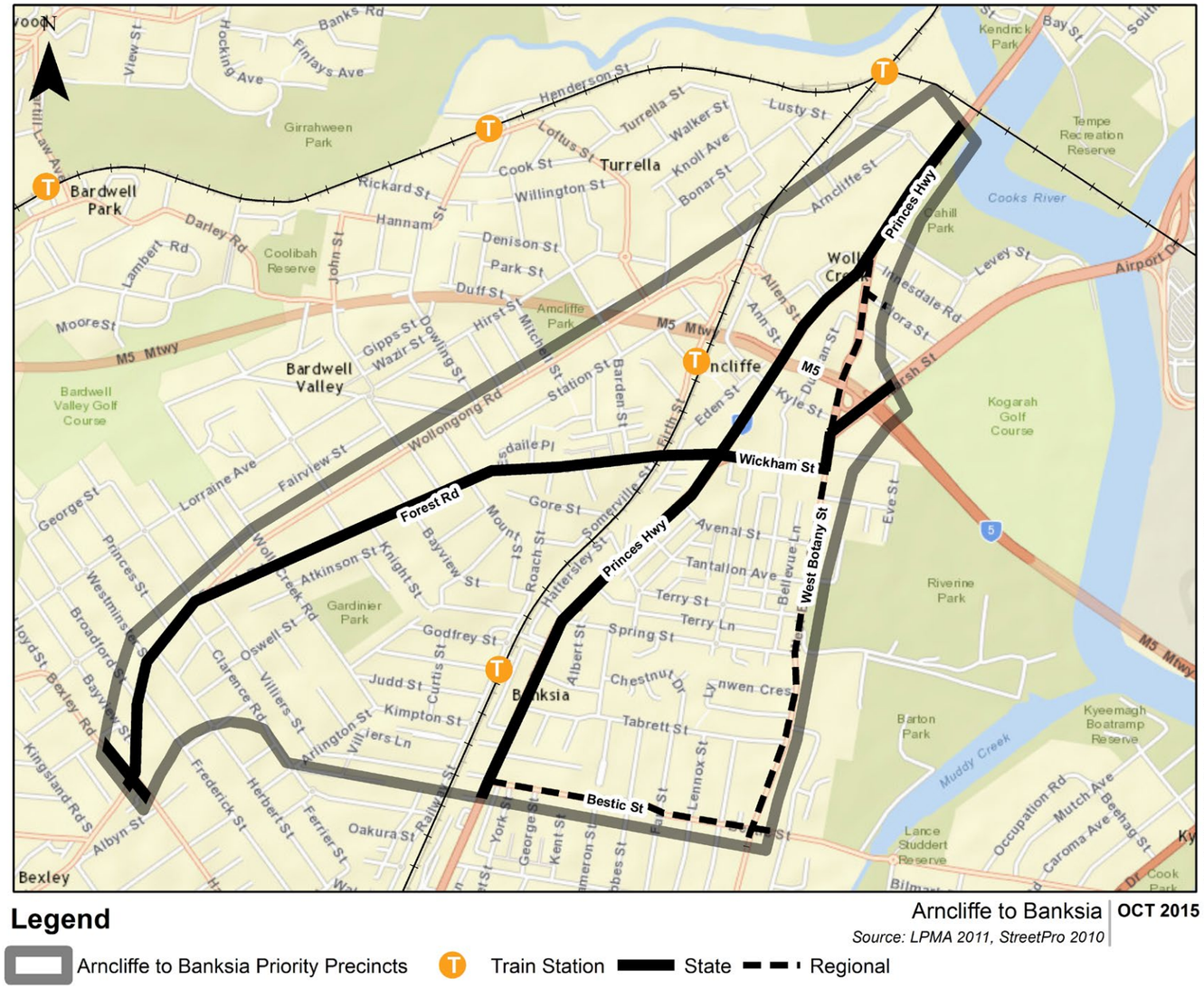


Figure 13 State and Regional roads
Source: AECOM, 2015

A weekday traffic profile for flows on the Princes Highway (at Cooks River Bridge) has also been generated based on traffic signal data collected at the Princes Highway / Brodie Spark Drive intersection for the duration of a week in March 2015. The data was split by direction and is illustrated in Figure 14.

The data confirms that the peak directional flow at the Cooks River Bridge is the AM peak northbound flow with in the order of 3,600 vehicles per hour. The peak southbound flow is between 5pm and 6pm and is in the order of 3,400 vehicles per hour. This coincides with the peak two-way flow across with bridge with approximately 5,400 vehicles per hour total in the PM peak hour.

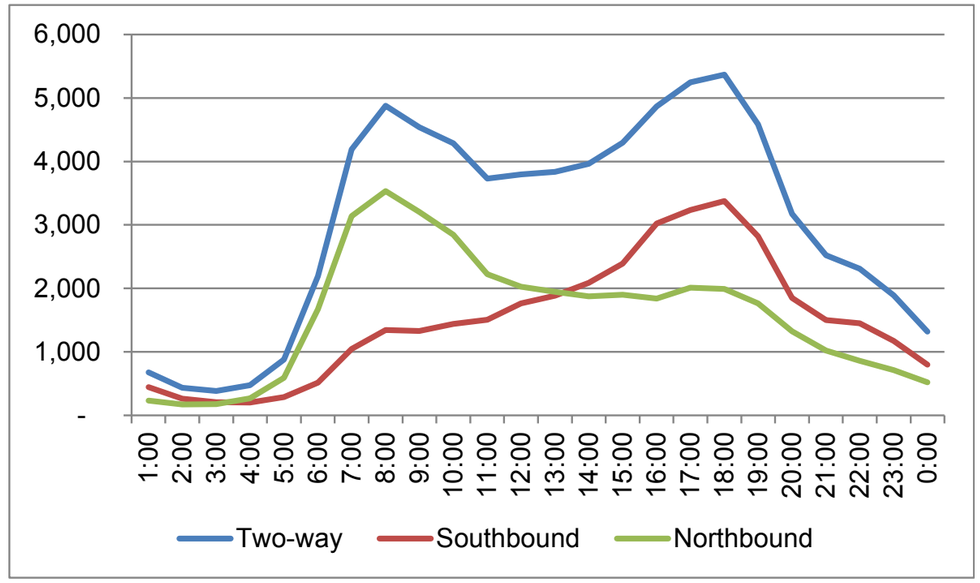


Figure 14 Typical weekday traffic flow profile at Princes Highway Cooks River Bridge (vehs/hour)
Source: SCATS data provided by Transport for NSW, 2015

3.4.3 Traffic distribution

As identified in section 3.1, the private vehicle is the dominant mode of choice for both employed residents and local workers in Arncliffe and Banksia. The JTW data indicated that of the 2,200 employed residents driving to work, the main destinations were:

- Local (Kogarah / Rockdale) (20 per cent)
- Botany (17 per cent)
- Sydney Inner City (16 per cent).

The JTW data also showed that of the 1,470 local workers accessing Arncliffe / Banksia by car came from:

- Local (Kogarah / Rockdale) (31 per cent)
- Hurstville (11 per cent)
- Cronulla / Miranda (8 per cent).

A common observation between the two data sets is that the largest proportional traffic generation is within the Kogarah / Rockdale area, whilst some of the other major origins / destinations are served relatively well by public transport.

JTW trip distribution to/from the study area by car is illustrated in Figure 15. The trip origins and destinations have been broadly summarised into the following areas in relation to the Arncliffe and Banksia Precincts:

- North, including Sydney CBD (and areas in between), North Shore and Northern Beaches
- East, including Botany and Eastern Suburbs
- South, including Kogarah, Rockdale, Hurstville and Cronulla
- West, including Canterbury, Bankstown and Strathfield.

The data shows patterns consistent with other modes, with the spatial distribution of trips being driven by local residents accessing employment to the north and east and workers accessing the precinct from residential areas to the south.

3.4.4 Traffic operating conditions

Intelematics travel time data has been used to determine current speeds on key links in the local road network and is illustrated in Figure 16. The data provided indicate that the critical locations in the network in the AM peak period are at intersections of the key State roads in the network and include:

- The Princes Highway corridor, from Brodie Spark Drive to Spring Street
- The east-west corridor of Forest Road, Wickham Street and Marsh Street from the M5 to Wollongong Road.

Onsite observations of the network in operation have validated the above data, and further indicated the following particular critical pinch points in the morning peak:

- The signalised intersections of Marsh Street with West Botany Street and the M5 interchange, with resultant queues to the west along Marsh Street, West Botany Street and Wickham Street.
- Princes Highway / Forest Road intersection, resulting in significant queues particularly along Forest Road.
- The Forest Road / Bexley Road / Harrow Road intersection, with queues extending to the south as well as moderate queueing to the east and west.

It was also observed that intersection operations upstream to the north along Princes Highway, at Gannon Street and Railway Parade, may also be having a negative impact on operations further south of the Cooks River.

Onsite observations of the network in the PM peak period indicated the following pinch points in the network:

- The Marsh Street interchange with the M5, with queues extending from the westbound on-ramp back east along the freeway and in both directions along Marsh Street – both to the east towards the airport as well as to the west along West Botany Street to the Princes Highway
- Princes Highway / Forest Road intersection, with queues to the north towards Allen Street and along Wickham Street towards West Botany Street
- Forest Road / Harrow Road / Bexley Road intersection, with queues extending to the north along Forest Road towards Herbert Street as well as minor queues to the east and west along Harrow Road and Bexley Road respectively.

The intersection of Bestic Street / West Botany Street has also been observed to be operating near capacity.

These observations and findings indicate that the current road network is already at capacity in several key locations, and has limited to no spare capacity to accommodate additional growth in traffic volumes. It is considered through traffic is the major contributor to current congestion in the local road network. Similarly for the rail network, it is considered that additional road capacity is required in the area to support future growth.

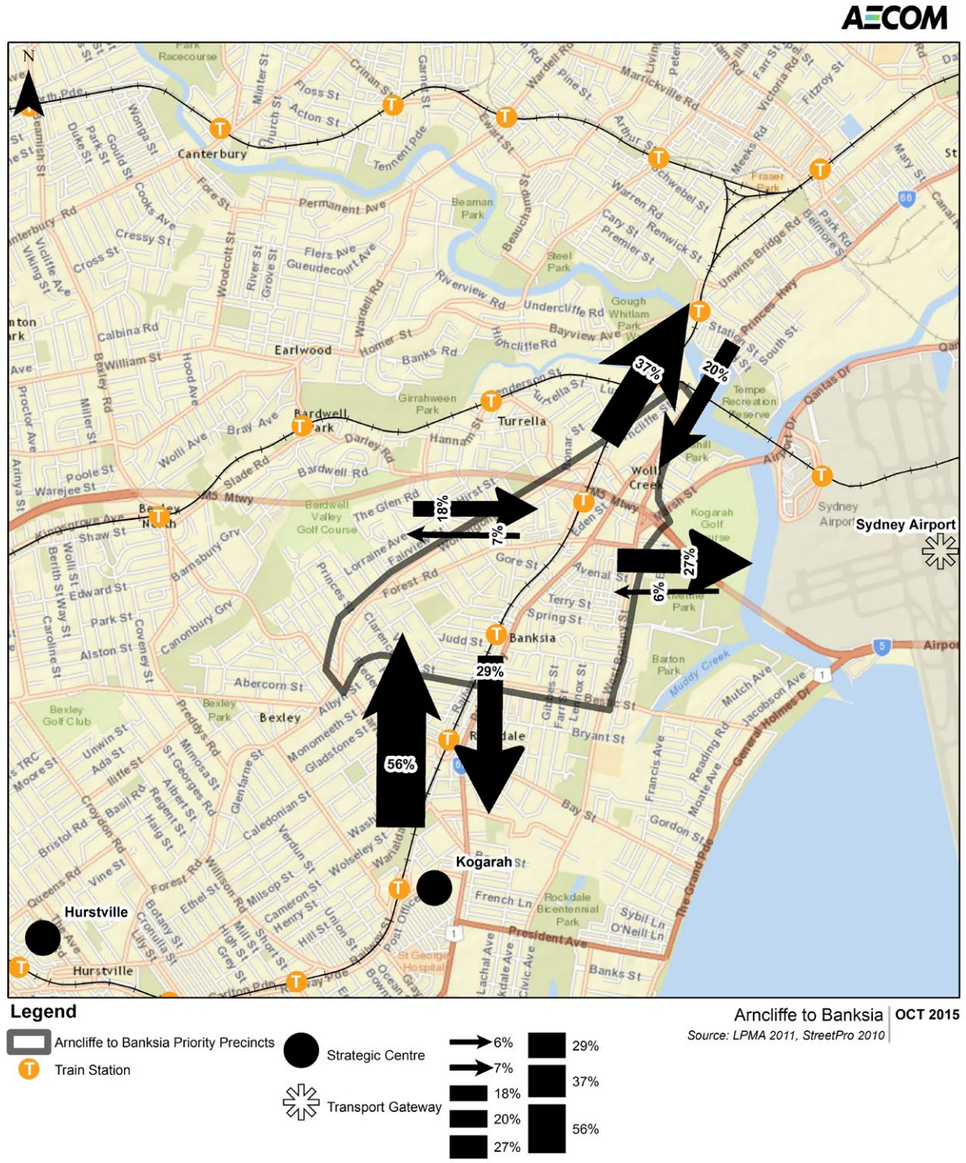


Figure 15 JTW car trips to/from Arncliffe and Banksia Precincts
Source: Transport for NSW, 2015 adapted by AECOM, 2015

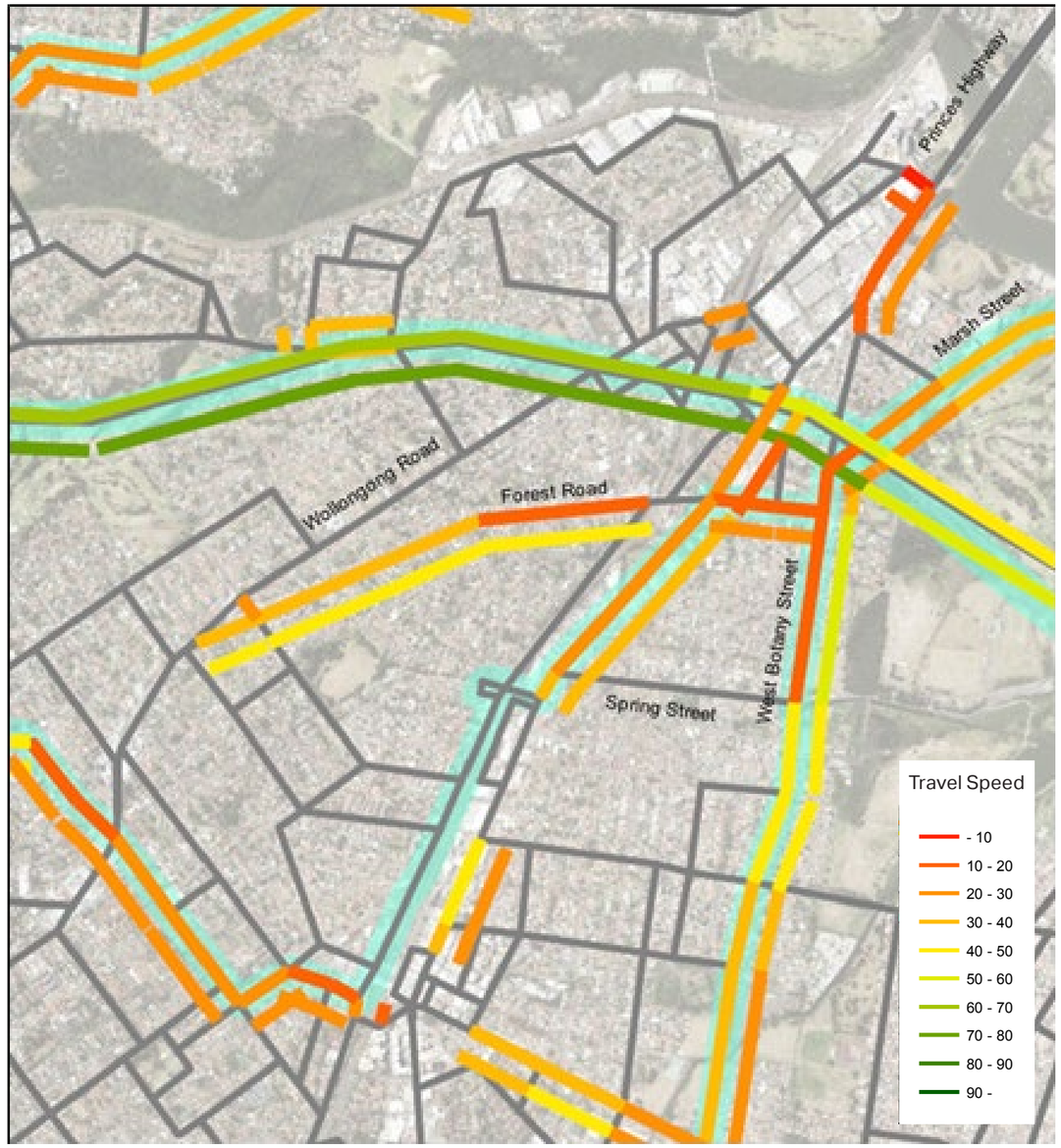


Figure 16 AM peak link speed data
Source: Transport for NSW Intelematics data

3.5 Station precinct parking facilities

A high level parking assessment was undertaken for the AM peak period (7:00am-9:00am) for both the Arncliffe and Banksia Station Precincts. The purpose of the parking assessment was to identify the dominant parking type on a block by block basis within a 400 metre catchment of both stations. In some cases multiple parking types were in effect for the AM peak period; for example unrestricted parking until 8:30am and then time restricted parking after 8:30am. The dominant parking type is defined as the longest in effect during the 7:00am-9:00am time period.

Three different parking types were identified during the AM peak period. These are colour coordinated in Figure 17 and Figure 18 as:

- Unrestricted parking (green)
- Time restricted parking (red) – 5 minute, 10 minute, 15 minute, 30 minute, 1 hour, 2 hour and 4 hour parking
- No general parking (black) – Clearways, no stopping, no parking, loading zones, truck zones, mail zones, bus zones and taxi zones.

Site observations indicated some parking availability during the morning peak period.

3.5.1 Arncliffe Station

In the Arncliffe Station Precinct, unrestricted parking spaces are the most common parking type, and serve a range of users, including all-day use by commuters. In the AM peak period exceptions to this include:

- No general parking on the Princes Highway (in both directions), Wickham Street (in both directions), Forest Road (in both direction: and some local roads which are too narrow for bidirectional parking.

A commuter carpark is located east of Arncliffe Station, off Burrows Street. The facility has approximately 30 unrestricted parking spaces

Formal kiss and ride and taxi facilities are located on the eastern side of Firth Street, just north of the station entrance.

Figure 17 Arncliffe Station Precinct AM peak period dominant parking restrictions
Source: AECOM, 2015

3.5.2 Banksia Station

Like the Arncliffe Station Precinct, unrestricted parking spaces are the most common parking type in the Banksia Station Precinct, and serve a range of users, including all-day use by commuters. In the AM peak period exceptions to this include:

- No general parking on the Princes Highway (northbound only), Subway Road (in both directions) and some local roads which are too narrow for bidirectional parking
- Time restricted parking southbound only on the Princes Highway (south of Bestic Street), and predominantly eastbound on Bestic Street.

No formal commuter carpark or kiss and ride facilities are located at Banksia Station. The station is however serviced by a taxi zone. This facility is located on Railway Street, to the west of the station.

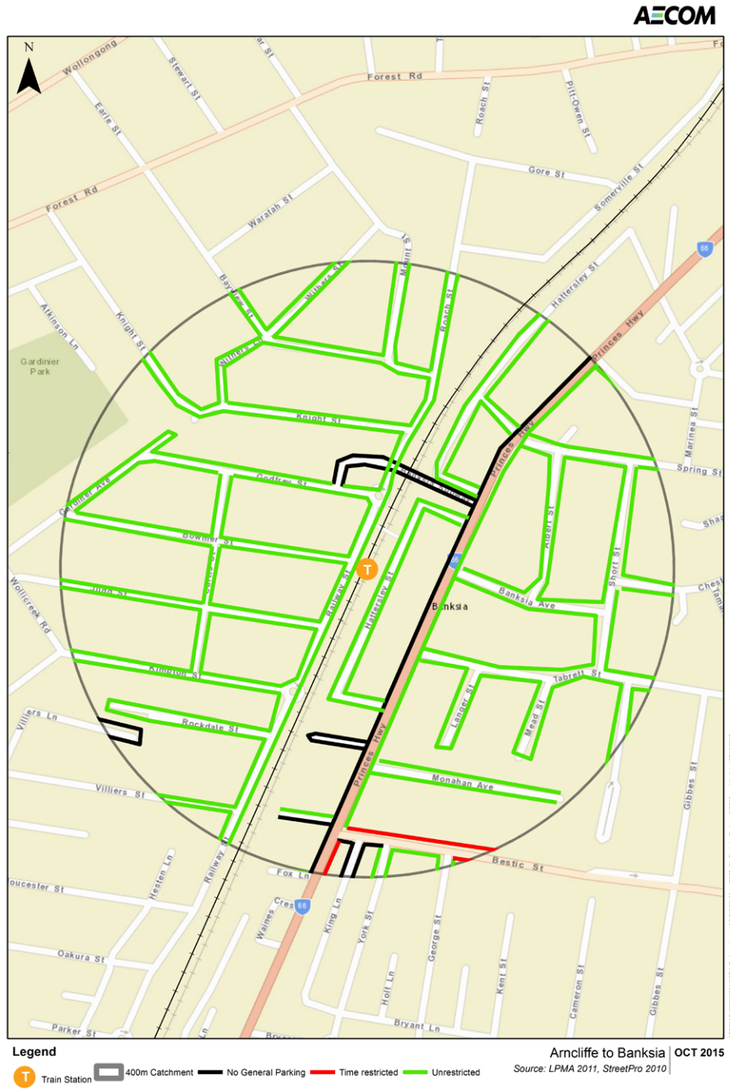


Figure 18 Banksia Station Precinct AM peak period dominant parking restrictions
Source: AECOM, 2015

3.6 Freight

The NSW freight network is made up of a combination of trunk roads and railways, which service key nodes such as ports, terminals, and industrial facilities where freight activity is generated. In general, NSW ports are the most significant origins and destinations for freight in NSW including:

- Port Botany, where the import/export container task was approximately 2 million containers in 2011
- Port Kembla, which receives approximately 15 million tonnes of coal per annum and approximately 2 to 4 million tonnes of grain per annum.

Figure 19 illustrates the top 10 NSW inter-regional freight flows. Several of these major flows pass through Sydney's southern region including:

- Port Botany to Sydney (9 million tonnes per annum)
- Central West NSW to Port Kembla (7 million tonnes per annum)
- Illawarra to Sydney (7 million tonnes per annum).

In NSW the freight movement task is predominantly undertaken on a shared transport network where the movement of freight and the movement of people compete for space. With the exception of some dedicated freight networks, such as railways to Port Botany and those in more regional NSW, the interaction of the movement of freight and people generally happens across the transport network. This includes roadways, railways, airports and waterways.

Road and rail corridors within Arncliffe and Banksia Precincts have an important role in facilitating the movement of freight within NSW. The local freight network is illustrated in Figure 20, which highlights that all local State roads form part of the B-Double road network. It also highlights the Illawarra Line as key freight infrastructure.

Road accommodates for 63 per cent of the freight movement task in NSW. In the vicinity of the Arncliffe and Banksia Precincts, the M5 East Motorway is a critical artery in the road freight network, servicing demand between Sydney's southwest via the M5 South Western Motorway, the north via the M1 Southern Cross Drive / Eastern Distributor Motorway, and the Port Botany precinct in the southeast (via Foreshore Road). The *NSW Freight and Ports Strategy* identifies the Princes Highway (near Sutherland in the south) as one of the largest road freight routes in NSW. However demand analysis presented in the NSW LTTMP indicates a significant portion of this road freight demand transfers to the A1 corridor at Presidents Avenue and bypasses the Arncliffe and Banksia Precincts to the south and east. This is supported by 2012 intersection count data collected at the Princes Highway / Brodie Spark Drive intersection at Wolli Creek in October 2012. The count data indicated the total bi-directional traffic flow along Princes Highway is approximately 2.8 per cent heavy trucks (237 vehicles) in the AM peak (7AM to 9AM) and 1.7 per cent (250 vehicles) in the PM peak (3PM to 6PM)[6]. Light truck volumes were in the order of 4.5 per cent and 2.6 per cent in the AM and PM peaks respectively.

In terms of rail demand, the South Coast Line carries approximately 7,000 kilotonnes per annum in serving its function as the primary freight rail line between Sydney and Port Kembla (the secondary being the Main South Line).

The shared-network issues associated with passenger and freight movement are observed in the Arncliffe and Banksia Precincts transport network. The congested conditions in peak periods along the Princes Highway noted in section 3.4.4 impact heavy vehicle movement as well as commuters. In terms of the rail network, capacity analysis presented in the *NSW Freight and Ports Strategy*, taking into account passenger rail services, also indicates that the South Coast Line has the least available capacity for freight movement out of all the key freight rail corridors. Rail freight currently has restricted operations during the day with passenger services consuming all available peak period capacity, resulting in some freight movements occurring at night. This further indicates that the existing shared line may have less than the required capacity to accommodate the APGS target of doubling the proportion of container freight movement by rail.

The capacity constraints in the road and rail network increase the likelihood of freight movements occurring at night. This infers increased potential for noise impacts during the evening, and associated impacts on the community.

[6] Source: Wolli Creek Traffic Surveys Report For Bitzios Consulting, Traffic Data & Control, 2012

Figure 19 Top 10 NSW inter-regional freight flows
Source: Transport for NSW, 2013

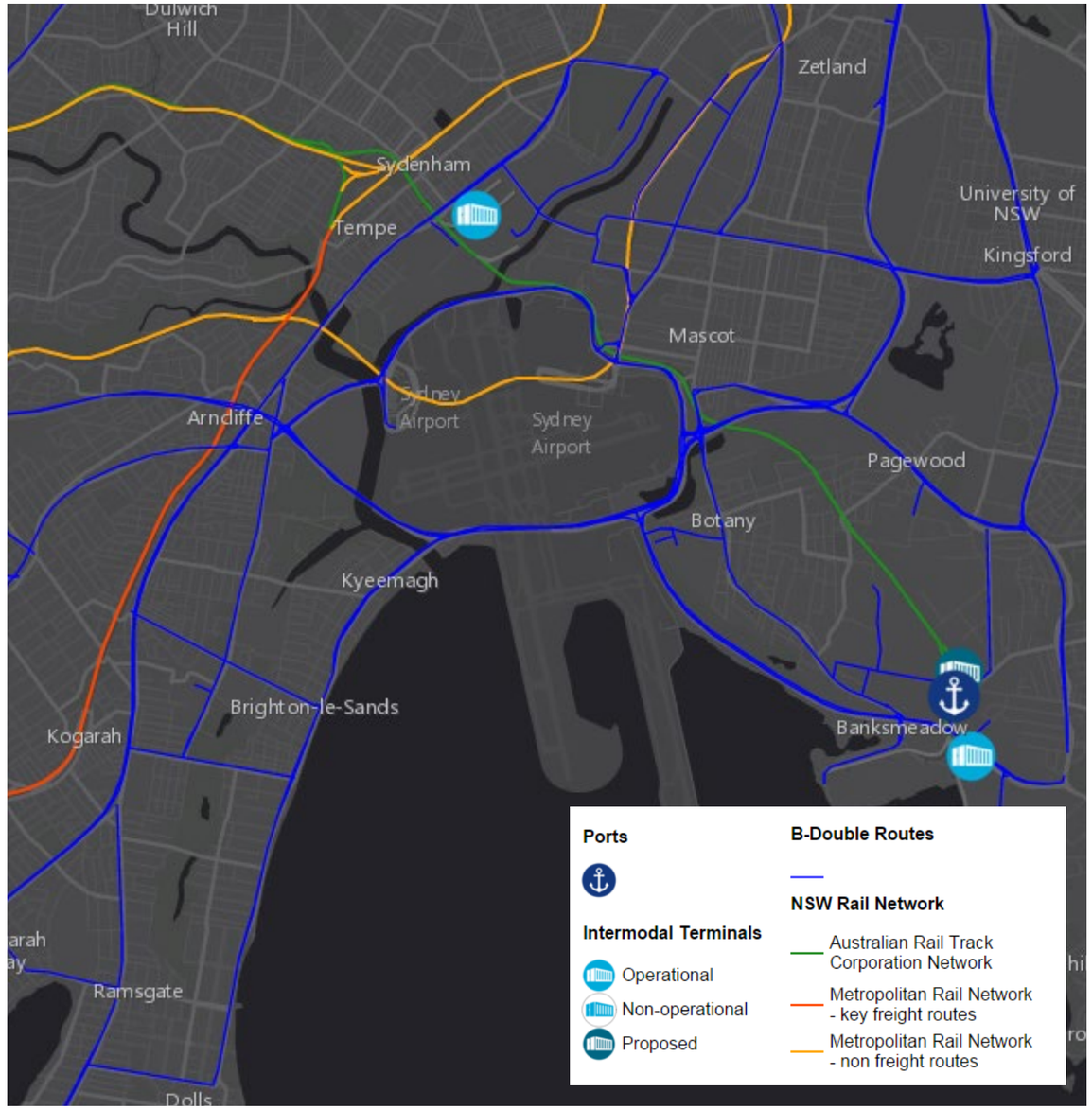


Figure 20 Local freight network
Source: Transport for NSW, 2015