

Frenchs Forest Planned Precinct

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Transport Strategy – Final

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Frenchs Forest Planned Precinct

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1. Introduction

1.1 Background and purpose

Jacobs has been engaged by the NSW Department of Planning, Industry and Environment (DPIE) to undertake a traffic and transport assessment of the Frenchs Forest Planned Precinct. The precinct forms the first stage of the *Northern Beaches Hospital Precinct Structure Plan* previously developed by Northern Beaches Council in partnership with DPIE.

Figure 1.1 outlines the full *Northern Beaches Hospital Precinct Structure Plan* and highlights Phase 1 which represents the Frenchs Forest Planned Precinct.

The purpose of this document is to:

- Assess the existing transport opportunities and constraints associated with the Frenchs Forest Planned Precinct.
- Provide a detailed assessment of transport impacts as a result of the proposed Frenchs Forest Planned Precinct development.
- Outline the infrastructure and servicing required to support the precinct.
- Provide a strategic assessment of the full *Northern Beaches Hospital Precinct Structure Plan* and highlight potential constraints and opportunities to allow the development of the full plan in the long term.

Figure 1.1: Northern Beaches Hospital Precinct Structure Plan (Northern Beaches Council)



Figure 1.2: Metropolitan context, Frenchs Forest

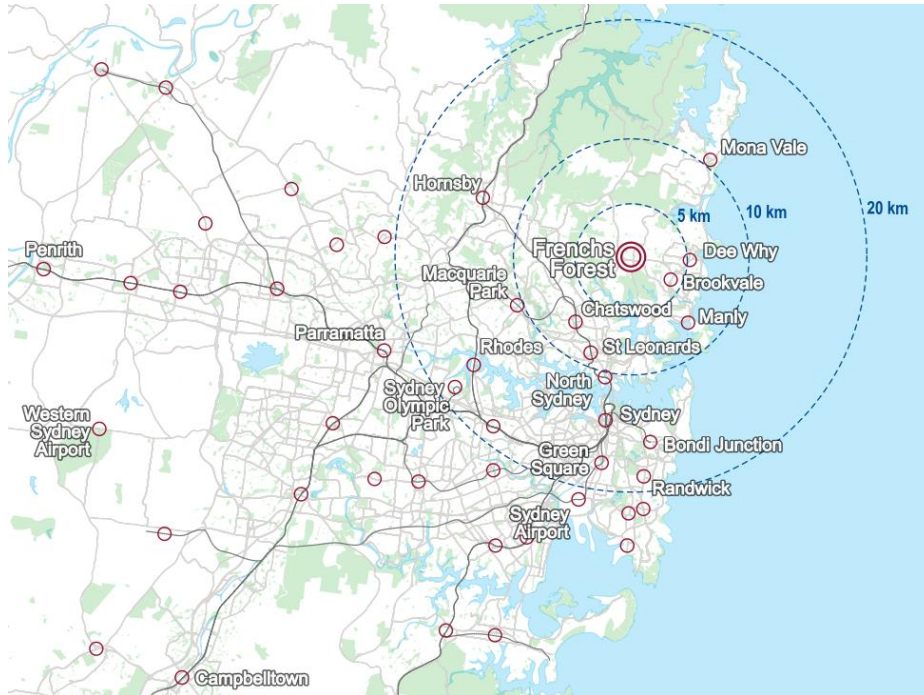


Figure 1.2 outlines the metropolitan context of the Frenchs Forest precinct. The Brookvale-Dee Why strategic centre lies approximately 5 kilometres to the east and increased connectivity with Frenchs Forest will play an integral role in the success of both precincts. Approximately 8 – 10 kilometres to the south-west lies the key strategic centres of Chatswood and North Sydney, whilst Sydney Central Business District (Sydney CBD) is approximately 14 kilometres to the south. This proximity provides Frenchs Forest with an excellent opportunity to leverage the infrastructure and land-use opportunities provided by Sydney's Global Economic Corridor, which arcs from Sydney Airport through the Sydney CBD and Chatswood to Macquarie Park.

1.2 Report structure

This document is structured as follows:

- **Section 1:** Introduction
- **Section 2:** Strategic context
- **Section 3:** Land use and transport context
- **Section 4:** Frenchs Forest Planned Precinct
- **Section 5:** Road network impacts
- **Section 6:** Public transport network
- **Section 7:** Active transport network
- **Section 8:** Travel demand management
- **Section 9:** Conclusion

2. Strategic context

2.1 North District Plan

The *North District Plan* outlines the goals and actions for Greater Sydney's North District to enhance its productivity, sustainability, and liveability. The *North District Plan* has a specific focus of growing the health and education precincts of Frenchs Forest, Macquarie Park, and St Leonards. Frenchs Forest's future is visioned as an emerging innovative strategic centre, providing knowledge and health employment opportunities in alignment with the Northern Beaches Hospital. The Frenchs Forest Planned Precinct is to be consistent with the *North District Plan* and Sydney's *A Metropolis of Three Cities* strategic plans, which focus on establishing a diverse mix of housing and enhancing strong connections to social and transport services.

2.2 Future Transport 2056

Future Transport 2056 provides a 40-year vision to deliver an integrated and overarching strategy on NSW's future transport system. The strategy considers rapid changes in technology and land use and aims to deliver movement and place outcomes that enable future communities and aids economic development of towns and cities. Specific infrastructure items included in the *Greater Sydney Services & Infrastructure Plan*, which forms part of *Future Transport 2056*, that are relevant to Frenchs Forest and its surrounding area include the following:

- Northern Beaches B-Line
- Northern Beaches Hospital road upgrades
- Improved bus services between Northern Beaches and Chatswood
- Consideration of the corridor between Mona Vale – Frenchs Forest – Harbour CBD
- Northern Beaches bus network redesign
- Western Harbour Tunnel and Beaches Link (subject to environmental assessment and approval)

2.3 Northern Beaches Hospital Precinct Structure Plan

Northern Beaches Council has endorsed a structure plan that sets out a 20-year vision to inform the growth and strategic intent of future development within the hospital precinct. Taking advantage of the Northern Beaches Hospital, the plan aims to guide the urban development of a new town centre, employment opportunities, and housing within the Frenchs Forest Planned Precinct. The *Northern Beaches Hospital Precinct Structure Plan* delivers the following outcomes:

- A new centrally located mixed-use town centre connected to the Northern Beaches Hospital
- Retaining the existing Warringah Aquatic Centre in its current location and enhancing the playing fields at Aquatic Reserve
- New active transport infrastructure
- Rezoning of approximately 35 hectares of land for residential, commercial, and business purposes over 20 years to support the Northern Beaches Hospital
- New dwellings within the precinct to include up to 10 per cent affordable housing units to support key workers and an additional 15 per cent for dwellings within the new town centre, allowing for approximately 600 new affordable units

2.4 Move – Northern Beaches Transport Strategy 2038

Northern Beaches Council has released *Move - Northern Beaches Transport Strategy 2038* in order to generate discussion and engage with key stakeholders regarding the challenges and opportunities for transport in the Northern Beaches Local Government Area (LGA) over the next 20 years.

Key directions from the strategy include the creation of accessible and liveable places, partnering with NSW Government to implement rapid bus services between Dee Why and Chatswood and working towards a high frequency mass transit service for the Northern Beaches in the long term.

2.5 Northern Beaches Hospital road upgrade project

Supporting the opening of the new Northern Beaches Hospital, Roads and Maritime Services (Roads and Maritime) is progressing with new road upgrade works. The works are being delivered in two stages:

Stage 1 Hospital Connectivity Work – The provision of upgrades to Frenchs Forest Road East, Frenchs Forest Road West, and Naree Road and associated intersections in order to enhance the connectivity of the new hospital. The works include:

- Widening of Frenchs Forest Road East, Frenchs Forest Road West, and Naree Road and associated intersection upgrades
- Bus stop upgrades
- Provision of a new right turn from Wakehurst Parkway southbound to Frenchs Forest Road West

Stage 2 Network Enhancement Work – Upgrades to improve the capacity of the broader road network and facilitate the large volume movement of people and goods through the area. The works include:

- Grade separation along Warringah Road (at Forest Way, Hilmer Street, and Wakehurst Parkway). This involves the widening of Warringah Road to incorporate a 1.2 kilometre 'slot' for through traffic between Dee Why and Chatswood
- Construction of new pedestrian bridges across Warringah Road west of Forest Way (removal and replacement) and west of Hilmer Street
- New shared paths and footpaths along sections of Warringah Road, Wakehurst Parkway, Forest Way, Aquatic Drive, and Allambie Road

2.6 Northern Beaches Hospital Connectivity and Network Enhancements – Existing Traffic and Transport Assessment

Roads and Maritime commissioned a traffic and transport study to assess the existing traffic and transportation conditions of the Northern Beaches Hospital precinct road network as part of Stage 1 and Stage 2 of the *Northern Beaches Hospital Road Connectivity and Network Enhancement Project Environmental Impact Statement*.

The existing traffic and transportation reports indicated that the precinct experiences high levels of congestion with major delays along Forest Way and Warringah Road. Public transport services provided via the Northern Beaches bus network are frequently affected by these delays.

The report identified that development of the Northern Beaches Hospital precinct required upgrades to Frenchs Forest Road East, Frenchs Forest Road West, and intersection-based bus priority treatments.

The transport impacts resulting from the Stage 1 and Stage 2 connectivity works were assessed, with findings indicating that both stages of the works would provide substantial improvements to both vehicle movements and public transport operations through the precinct.

Walking and cycling connectivity resulting from shared path and footpath infrastructure works on Forest Way, Warringah Road, and Aquatic Drive, in conjunction with intersection crossing and overbridge upgrades, would provide safe, active transport routes between key residential, commercial, and service areas along the corridor.

It should be noted that this study did not incorporate traffic flows from Beaches Link as the project was not being progressed at the time.

2.7 Beaches Link

Western Harbour Tunnel and Beaches Link is a NSW Government initiative to provide additional road network capacity across Sydney Harbour and improve connectivity with the Northern Beaches. The Beaches Link component of the project would provide an integrated transport solution aimed to improve car and bus journey times to and from the Northern Beaches. The project would also improve access between the Northern Beaches and key centres of employment, including commercial hubs within Sydney CBD, North Sydney, Artarmon, and Macquarie Park.

The *Beaches Link Scoping Report* identifies a program of works including 7.5 kilometre twin tolled motorway tunnels connecting the Warringah Freeway at Cammeray and the Gore Hill Freeway at Artarmon to Burnt Bridge Creek Deviation at Balgowlah, and Wakehurst Parkway between Seaforth and Warringah Road at Frenchs Forest. Figure 2.1 shows the proposed alignment at a conceptual level.

The scoping report indicates that new additional public transport routes could be developed in response to Beaches Link, supporting social and economic development within the Frenchs Forest Strategic Centre and Health and Education Precinct. Estimated travel time savings that could be delivered by Beaches Link include:

- Brookvale to Sydney CBD reduced by up to 40 minutes
- Dee Why to Sydney Airport reduced by up to 45 minutes
- Manly to Macquarie Park reduced by up to 35 minutes
- Manly to Parramatta reduced by up to 45 minutes
- Seaforth to North Sydney reduced by up to 35 minutes

It is noted that at the time of writing, Beaches Link is subject to environmental assessment and planning approvals and detailed traffic and transport data has not been made available. As such, the transport assessment in this report incorporates Roads and Maritime's traffic improvement estimates for the assessment of Beaches Link.

Figure 2.1: Beaches Link concept (Source: Roads and Maritime)



It is likely that Beaches Link, if approved, would change traffic patterns through the Frenchs Forest Planned Precinct. It is anticipated that further investigation of Beaches Link would involve the development of an integration plan to ensure that planning for the Frenchs Forest Planned Precinct takes into account any potential change to traffic patterns that Beaches Link would generate.

In addition, the integration plan would also update land use and background traffic growth assumptions to align with those used in the environmental assessment of Beaches Link which would be more recent than those used for this study. This would allow further planning of the Frenchs Forest Planned Precinct to proceed with more recent population and employment data and ensure that the transport strategy for the precinct is aligned with the objectives of Beaches Link.

2.8 Transport principles and objectives

Planning of the transport network for the Frenchs Forest Planned Precinct will be informed by a guiding set of principles, based on the outcomes outlined in *Future Transport 2056*. These principles seek to ensure that the future residents, workers, and visitors within the precinct have the benefit of choosing travel modes in line with their own preferences and purpose. These principles cannot be achieved without a complementary approach to land use planning, whereby the *Northern Beaches Hospital Precinct Structure Plan* takes advantage of current infrastructure works and supports a multimodal transport network that enhances the accessibility of key locations.

The development of the precinct will be undertaken with the aim of achieving a Green Star Communities rating from the Green Building Council of Australia. Following the principles set out below will help achieve the transport related targets in the Green Star criteria.

Principle 1: Provide multiple transport options

Provide multiple high-quality transport options, that reach a variety of destination/s, in support of residents and worker's lifestyles in a 24/7 economy.

Principle 2: Encourage the use of sustainable modes of transport

The provision of high-quality public and active transport linkages forms an inter-connected network, minimising the reliance on private vehicles in accessing centres within and outside the region. Ensure the proposed transport system is economically and environmentally sustainable and supports emissions reductions.

Principle 3: Support liveable communities and successful places

Ensure an integrated land use and transport outcome to benefit higher density mixed-use communities within strategic centres, enabling supportive walking catchments in close proximity to high quality public transport opportunities. Use transport to enhance the amenity and economic success of communities and places.

Principle 4: Provide safe and accessible services

Ensure that the transport network is accessible to everyone regardless of age, mobility and personal circumstances. Provide services which prioritise the safety of all customers using or accessing the transport network.

Principle 5: Protect productive transport corridors that support a strong economy

Protect productive freight and work-orientated commuter transportation in transport corridors by minimising traffic impacts to connections between key centres. Provide a transport system that supports NSW's future \$1.3 trillion economy.

Our planning approach also considers the substantial technological change that is likely to occur during the timeframe of this strategy. Some of the changes expected to impact transportation and land use in the future may include the impacts of driverless vehicles on urban networks, the disruption of the car-sharing economy on vehicle ownership, the changing workforce of the future, as well as many other potential future scenarios. Regardless of any of these changes, the development of sound planning principles to guide and facilitate positive transportation and land use interactions will always be required.

3. Land use and transport context

3.1 Land use

The existing land use within the suburb of Frenchs Forest is predominately residential, with the Frenchs Forest Planned Precinct serving as a catalyst for a new strategic centre offering business, commercial, health, and community services. More detailed analysis on the land use context within the Frenchs Forest - Belrose catchment area is discussed in this section.

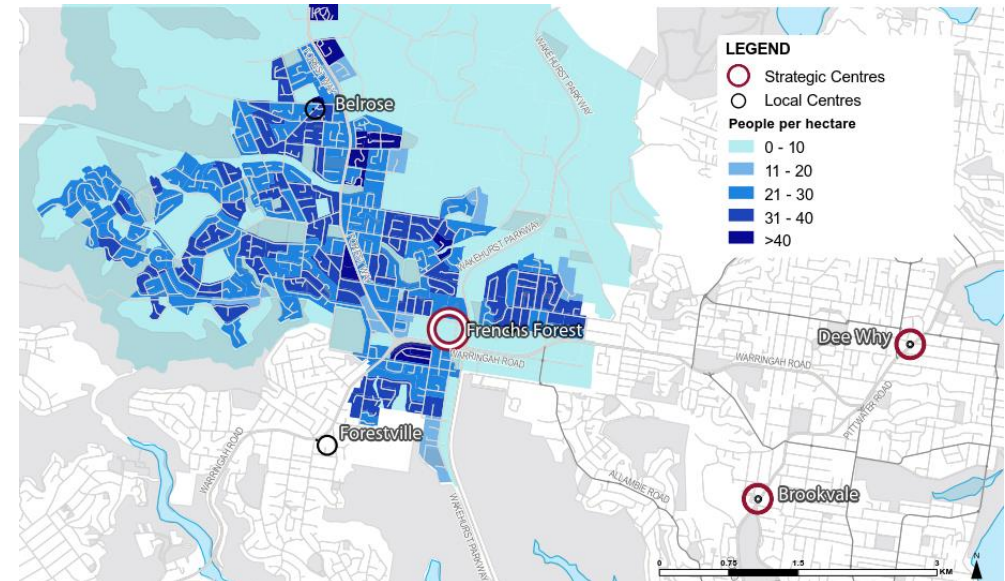
3.1.1 Population and employment distribution

The suburb of Frenchs Forest covers an approximate area of 840 hectares with a 2016 State Suburb population of 13,473 (estimated residential population). Across the wider Frenchs Forest – Belrose Statistical Area Level 2 (SA2) catchment, the population is 26,366 (estimated residential population). The distribution and density of this population across the SA2 area is shown in Figure 3.1.

Major employment in the region is located directly to the east where a number of business parks combine, providing major local employment opportunities. At a broader catchment area level, Frenchs Forest – Belrose provides additional local employment in the catchment of other strategic centres such as Brookvale-Dee-Why and Chatswood. The total number of employed persons in the labour force within the Frenchs Forest – Belrose catchment is 12,642.

The *North District Plan* estimates the number of jobs available within Frenchs Forest in 2016 is approximately 9,300 jobs, with a 2036 Baseline Target of 12,000 jobs, and a 2036 Higher Target of 13,000 jobs.

Figure 3.1: Existing population distribution in Frenchs Forest - Belrose



3.1.3 Retail, education and community facilities

Within the immediate Frenchs Forest Planned Precinct catchment is zoning that caters to a mixture of health, education, residential, retail, commercial, and social functions. In relation to local commercial enterprise, to the immediate west of the site is the Forestway Shopping Centre. This local shopping centre comprises two major supermarkets, a variety of local bank branches, franchises, and specialty retailers.

Larger retail centres located in suburbs within a 6 kilometre radius of the Frenchs Forest Planned Precinct include Westfield Warringah Mall, Dee Why Grand, and Stockland Balgowlah Shopping Centre. Smaller local centres include The Centre at Forestville, Dee Why Village Plaza, and Glenrose Village Shopping Centre. The area also has access to broader retail and employment centres in Chatswood and Artarmon.

Social infrastructure and community orientated facilities within or in proximity to the Frenchs Forest Planned Precinct includes the Northern Beaches Hospital and Warringah Aquatic Centre. A list of the current community, educational, aged and recreational facilities close to the Frenchs Forest Planned Precinct and Northern Beaches Hospital include:

- The Forest High School
- Frenchs Forest Public School
- Davidson High School
- St Augustine's College
- Killarney Heights High School
- Forestville Montessori School
- Warringah Aquatic Centre
- Lionel Watts Sports & Community Centre
- Sunnyfield Frenchs Forest Community Services Hub 1
- Forestville Library and Glen Street Library

Northern Beaches Hospital

Northern Beaches Hospital opened in 2018 and will form a key component of the Frenchs Forest precinct. It will support the function of Frenchs Forest as a strategic centre. The hospital will lead to major employment opportunities for local residents with up to 1,300 jobs to be created.

There will also be opportunities for the Frenchs Forest precinct to leverage off the transport infrastructure and public transport service improvements being delivered as part of the hospital development.

Figure 3.2 illustrates the location of all key retail and social infrastructure facilities surrounding Frenchs Forest.

Figure 3.2: Key centres, retail, education and community facilities



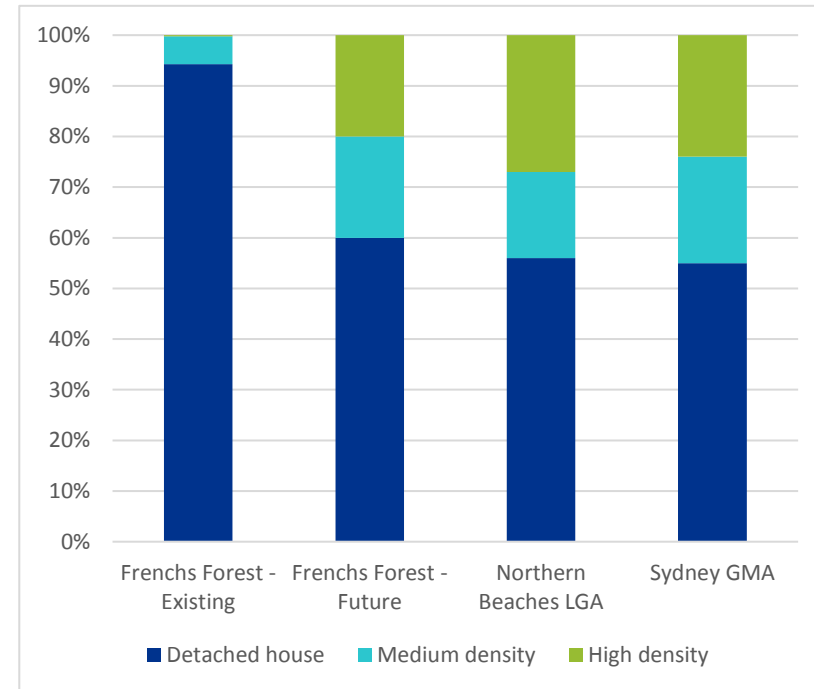
3.1.4 Character

There are approximately 4,127 dwellings within Frenchs Forest (based on 2016 Census data) consisting primarily of single detached houses, townhouses, and a low number of medium and high-density apartment blocks. These dwellings range in age from older single detached homes dating back to the 1950's, newer single detached homes built recently, 2000's era townhouses, and medium density apartments. More recently, there has been a slight increase and investment in apartments within Frenchs Forest, with more development likely to increase the supply of higher density dwelling types in the future.

Current levels of medium or high-density dwellings in Frenchs Forest are low in contrast to the wider surrounding area. About 43 per cent of dwellings in the Northern Beaches LGA were classified as medium or high-density in the 2016 Census. Currently, 5% of dwellings in Frenchs Forest can be classified as medium or high-density dwellings. Conversely, 45 per cent of dwellings in the Sydney Greater Metropolitan Area (GMA) are medium or high-density, much higher than in Frenchs Forest.

The delivery of housing in the Frenchs Forest Planned Precinct is expected to substantially increase the number of medium and high-density dwellings in the suburb. The delivery of this housing stock will ensure that the precinct develops into a compact, efficient, and sustainable strategic centre and will provide more affordable and diverse options for prospective residents of the precinct. Figure 3.3 outlines the existing and potential future dwelling mix in Frenchs Forest, along with existing compositions for the Northern Beaches LGA and Sydney GMA.

Figure 3.3: Dwelling type comparison



3.2 Transport network

3.2.1 Public transport network

There is an established bus network serving Frenchs Forest that provides access to key surrounding destinations. Buses are the principal form of public transport with key routes connecting to rail services and the transport interchange at Chatswood. Most services are relatively frequent but are often subject to delays due to network congestion. On a typical weekday, approximately 1,000 bus trips commence in the Frenchs Forest area in the AM peak 2-hour period¹. Figure 3.4 outlines the four major bus corridors through the precinct. Table 3.1 lists all bus services through the area along with existing service frequencies.

Figure 3.4: Current major bus corridors, Frenchs Forest

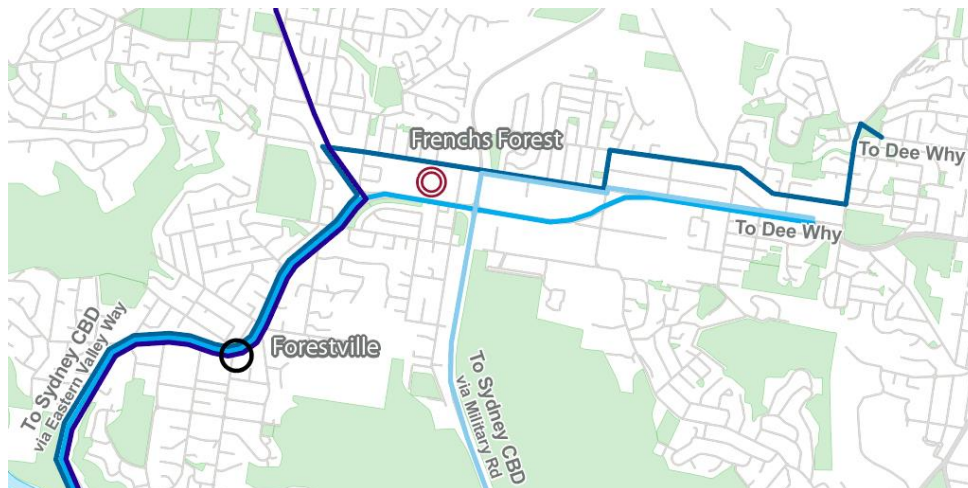


Table 3.1: Existing bus services and peak hour frequencies

Route	Description	AM peak hour services		PM peak hour services	
		Inbound	Outbound	Inbound	Outbound
136	Chatswood to Manly	6	6	6	6
137	Chatswood to Bantry Bay	0	1	1	0
141	Austlink to Manly via Frenchs Forest and Seaforth	1	1	1	2
142	Allambie to Manly	2	2	1	2
169	Manly to City (Wynyard) via Narraweena	1	2	2	0
173	Narraweena to Milsons Point	2	0	0	2
193	Warringah Mall to Austlink via Frenchs Forest	2	3	3	2
260	Terrey Hills to North Sydney	3	0	0	2
270	Terrey Hills to City (QVB)	2	4	2	3
271	Belrose to City (QVB))	6	0	2	6

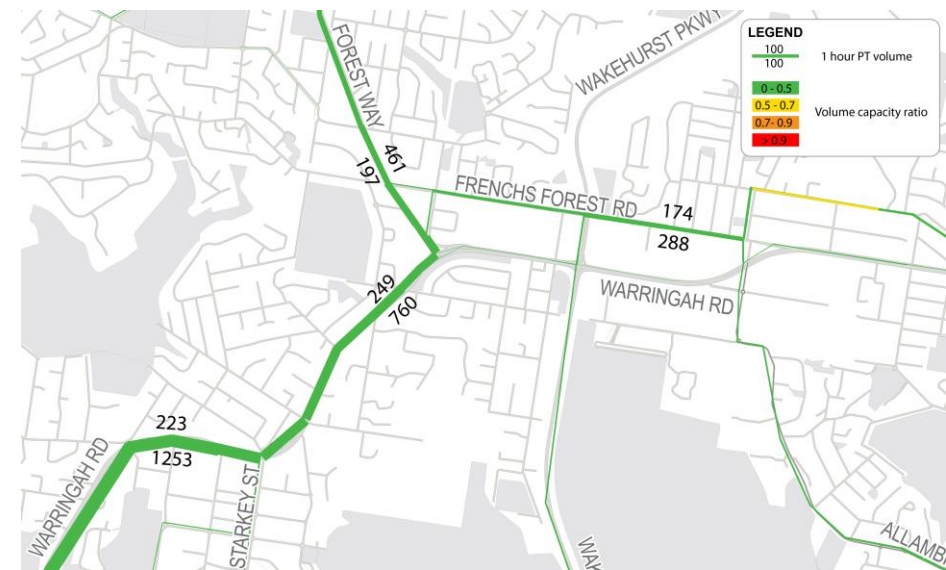
¹ Opal data, Transport for NSW

Route	Description	AM peak hour services		PM peak hour services	
		Inbound	Outbound	Inbound	Outbound
274	City (QVB) to Davidson via Frenchs Forest	3	0	0	4
279	Frenchs Forest to Chatswood	2	0	1	1
280	Warringah Mall to Chatswood	4	6	4	3
281	Davidson to Chatswood	2	0	1	2
282	Davidson & Belrose to Chatswood	0	0	1	2
283	Belrose to Chatswood	3	0	2	1
284	Duffys Forest to Terrey Hills & Chatswood	4	2	1	1
E60	Mona Vale to Chatswood	3	0	0	2
E66	Allambie to City (Wynyard)	5	0	0	2
E69	Manly to City (Wynyard) via Narrabeena	10	0	5	6
L70	Terrey Hills to City (QVB)	3	0	0	3

Existing bus demands in the study area have been obtained from Transport for New South Wales' (Transport for NSW) Public Transport Project Model (PTPM). Existing bus demands and the volume capacity ratio for the AM peak hour are shown in Figure 3.5. In this context, the volume capacity ratio is the ratio between bus demand and bus capacity.

PTPM data shows that the existing bus routes in the area generally operate with spare capacity in the AM peak period. It is also noted that there is a large difference between the demands in the peak and off-peak directions. Buses travelling south-west on Warringah Road in the AM period carry up to 85 per cent of the total demand along the corridor. The delivery of jobs and services in Frenchs Forest via the development of the Frenchs Forest Planned Precinct is likely to increase demand in the off-peak direction and provide a better balance of trips along Warringah Road.

Figure 3.5: 2017 AM peak hour bus demand (PTPM)



3.2.2 Road network

The existing road network surrounding Frenchs Forest comprises primary arterial and sub-arterial roads. A major component of the Frenchs Forest Planned Precinct road network is Warringah Road, which functions as a six-lane, 70 km/h carriageway, providing direct east-west connections to the Brookvale – Dee Why and Chatswood strategic centres as well as Sydney CBD. Forest Way is a six-lane, 70 km/h arterial road connecting Frenchs Forest – Belrose to Mona Vale Road in the north, which in turn connects to Warriewood and Mona Vale to the east and St Ives/Pymble and Macquarie Park to the west. Wakehurst Parkway provides north-east connectivity towards Narrabeen and to the south via Seaforth, the Spit Bridge, and Cremorne towards the Sydney CBD.

North of the precinct, Frenchs Forest Road East and Frenchs Forest Road West are two-lane roads providing east – west connectivity between Forest Way, Wakehurst Parkway, and Warringah Road. Frenchs Forest Road East and Frenchs Forest Road West have a sign-posted speed limit of 50 km/h, with a school zone operating outside the Forest High School during school periods. Table 3.2 outlines existing 2-way traffic volumes along these key corridors.

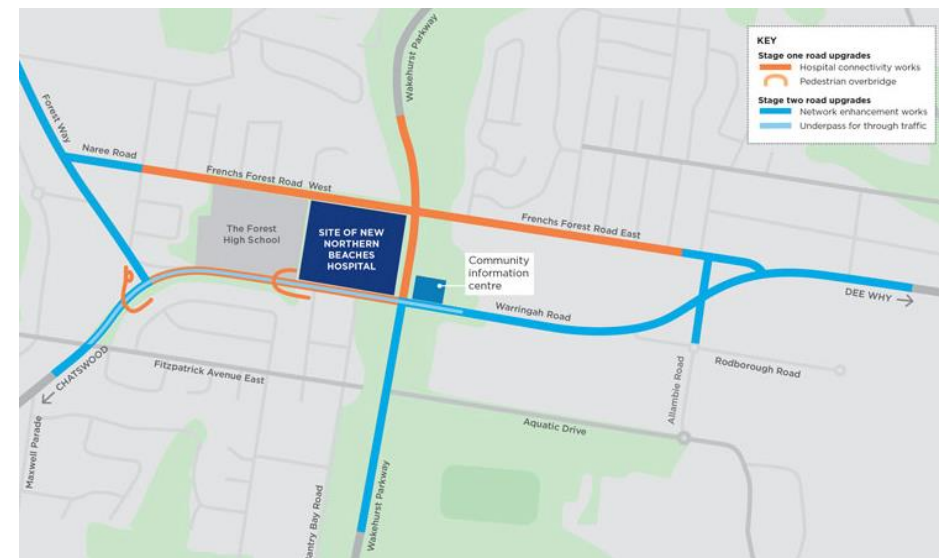
Table 3.2: AM peak hour traffic volumes, Frenchs Forest

Road	Type	AM peak volume (vehicles / hour)
Frenchs Forest Road East	Sub-arterial	1,640
Frenchs Forest Road West	Sub-arterial	1,131
Forest Way	Arterial	3,092
Warringah Road	Arterial	5,365
Wakehurst Parkway	Arterial	1,971

The NSW Government has committed \$500 million to upgrade roads in support of the Northern Beaches Hospital as shown in Figure 3.6. Road upgrades include road widening along Frenchs Forest Road East and Frenchs Forest Road West, providing access to the new hospital, intersection improvements with bus priority measures, grade separation on Warringah Road at Forest Way, Hilmer Street and Wakehurst Parkway, new pedestrian bridges, and bus stop upgrades. The project will provide local and regional road users an improved travel experience with increased road network capacity to ease congestion and safer connectivity for pedestrians and cyclists.

Potential further linkages with Beaches Link would enhance connectivity with the existing roads along the Warringah Freeway, Gore Hill Freeway, and Wakehurst Parkway.

Figure 3.6: Northern Beaches Hospital road upgrades (Source: Roads and Maritime)



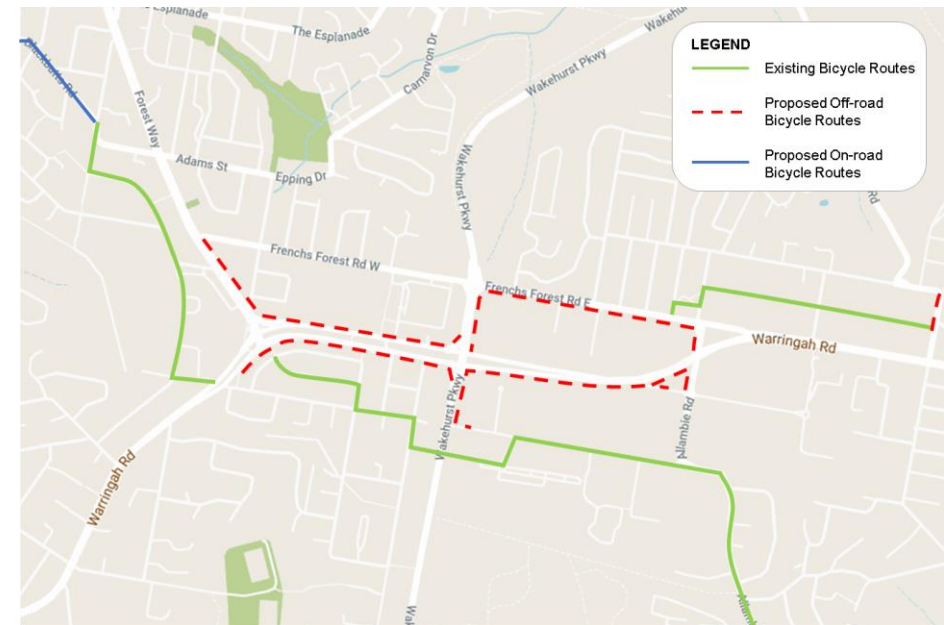
3.2.3 Active transport network

The street network in Frenchs Forest provides walking access to local destinations. However, the large block sizes limit permeability. Key desire lines focus pedestrians towards the Skyline Shops along Frenchs Forest Road East, around key bus stops for services at Rabbett Street, and towards Forestway Shopping Centre. Infrastructure supporting active transport and public transport interchange in this area includes footpath treatments and a signalised pedestrian crossing of Forest Way providing access to the shopping centre.

The pedestrian network surrounding the Frenchs Forest Planned Precinct is being upgraded to improve existing levels of service and cater for future growth. As part of the Northern Beaches Hospital road upgrade project being undertaken by Roads and Maritime, there will be the provision of shared paths and new footpaths on sections of Warringah Road, Wakehurst Parkway, Forest Way, Aquatic Drive, and Allambie Road, as per Figure 3.7.

The project will include new shared path bridge connections and crossings at Warringah Road (west of Forest Way) and across Warringah Road (west of Hilmer Street). Project completion is estimated to be in 2020. Figure 3.7 outlines the existing and proposed cycling infrastructure in the immediate area surrounding the precinct, including works currently being undertaken by Roads and Maritime.

Figure 3.7: Current and future cycling infrastructure (Source: Northern Beaches Council)



The cycle network within the Frenchs Forest Planned Precinct and the surrounding area is limited and incomplete. The Northern Beaches Council *Warringah Bike Plan (2010)* and the *Warringah Pedestrian Access and Mobility Plan (2011)* considered the primary routes for active transport within the precinct to be as follows:

- Frenchs Forest Road East between Wakehurst Parkway and Warringah Road
- Allambie Road between Mortain Avenue and Frenchs Forest Road East and Aquatic Drive
- Rodborough Road

A secondary route at Warringah Road, between Wakehurst Parkway and Allambie Road, and a collector route at Warringah Road, between Wakehurst Parkway and Starkey Street, Forestville have also been identified. Planning for an active travel strategy, continuing initial work completed in the 2015 *Warringah Bike Plan* update, is scheduled to be undertaken by Northern Beaches Council through a series of network planning workshops and community engagement.

Connecting Northern Beaches is a program being delivered by Northern Beaches Council in partnership with the NSW Government which will provide \$22 million worth of active walking paths and cycleways. These will build upon Roads and Maritime's connectivity improvements currently under construction. New cycleways on Tristram Road and Blackbutts Road will connect directly with new shared paths on Warringah Road and Frenchs Forest Road East.

Key regional cycling routes related to Frenchs Forest are summarised in Table 3.3.

Table 3.3: Key regional cycling routes related to Frenchs Forest (Source: Warringah Council Bike Plan 2010 & Warringah PAMP 2011, Roads and Maritime Cycleway Finder 2018)

Route	Length	Type of facilities	Difficulty	Grade
Frenchs Forest Road East between Wakehurst Parkway and Warringah Road	420 metres	Shared path	Low	Not steep
Frenchs Forest Road West and Naree Road between Wakehurst Parkway and Forest Way	500 metres	Shared path (under construction)	Low	Not steep
Allambie Road between Mortain Avenue and Frenchs Forest Road East, Aquatic Drive	223 metres	Road shoulder	Moderate	Not steep
	425 metres	Shared path	Low	Not steep
Rodborough Road	589 metres	On-road, mixed traffic	Moderate	Not steep
Warringah Road between Wakehurst Parkway and Allambie Road)	878 metres	Shared path (under construction)	Moderate (Low, post Roads and Maritime upgrades)	Not steep
Warringah Road between Wakehurst Parkway and Starkey Street, Forestville	2.13 kilometres	Shared path (under construction)	Low	Not steep
Karingal Crescent Reserve	677 metres	Shared path	Low	Not steep

3.3 Movement hierarchy

Transport for NSW's Movement and Place framework allows the planning and management of the road-based transport network to be undertaken with a strong appreciation of the various movement needs and place functionalities of road corridors.

The existing transport network in the vicinity of the proposed Frenchs Forest Planned Precinct is heavily focused towards facilitating the movement of people and goods. There is very limited place functionality in the existing network. As a result, a standard Movement and Place assessment of the existing network has not been undertaken. Instead, the hierarchy of the various movement corridors has been assessed.

The existing road network hierarchy is shown in Figure 3.8 and comprises:

- Warringah Road, which forms the major movement corridor through the study area and is classified as a primary arterial road accommodating high traffic volumes and providing inter-regional connectivity.
- Forest Way and Wakehurst Parkway, which are arterial roads serving as important connections to other primary arterial corridors (Mona Vale Road and Pittwater Road respectively).
- Naree Road, Frenchs Forest Road East, Frenchs Forest Road West, and Allambie Road, which function as sub-arterial connections, providing efficient access between local streets and the higher order road network.

A full Movement and Place analysis of the future network is presented in Section 5.7.

Figure 3.8: Existing road network hierarchy



3.4 Demographics

Census data from 2016 has been used for the following assessment of demographic factors including age, country of birth, education, and employment.

3.4.1 Age

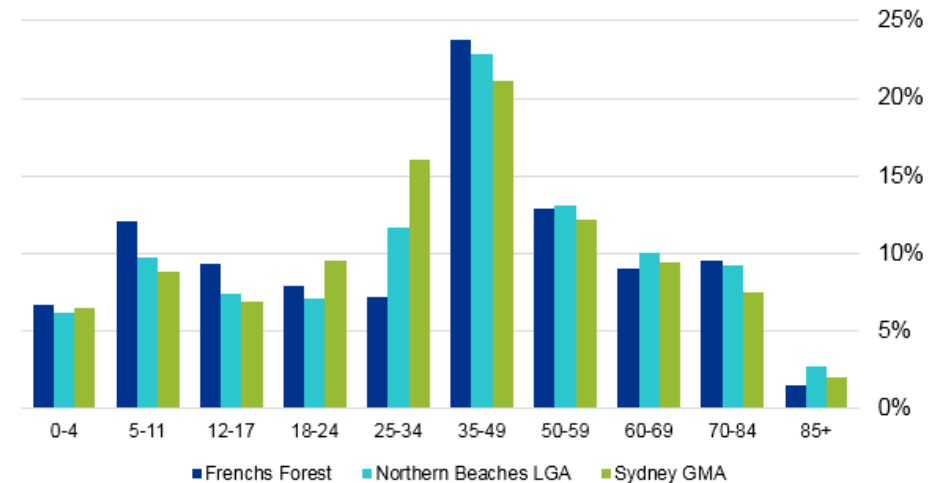
Frenchs Forest has an equivalent resident population age to the Northern Beaches LGA, with a median age of 40 years. Figure 3.9 outlines the age profile of Frenchs Forest residents compared to the Northern Beaches LGA and the Sydney GMA.

There is a higher proportion of people aged between 0 to 24 years, 35 to 49 years, and 70 to 84 years in Frenchs Forest compared to the Northern Beaches LGA, while there are a lower proportion of people aged 25 to 34 years and 50 to 69 years.

Compared to the Sydney GMA, there is a substantially higher proportion of children and people aged 35-59 in Frenchs Forest, indicating that the area is more likely to have families with children compared to other areas of Sydney. This reveals that there is likely to be a high volume of trips generated by education and recreational activities in the Frenchs Forest precinct. Allowing for and encouraging these trips to be undertaken by active or public transport will be critical to the success of the precinct.

The largest difference occurs in the 25-34 age bracket, with Frenchs Forest containing less than half of the Sydney GMA average.

Figure 3.9: Age profile of Frenchs Forest, Northern Beaches, and Sydney GMA



3.4.3 Education and employment

Figure 3.10 outlines qualifications completed by Frenchs Forest residents, compared with the Northern Beaches LGA.

Compared with Northern Beaches LGA, Frenchs Forest residents have completed similar levels of bachelor or higher-degree qualifications. A slightly higher proportion of Frenchs Forest residents have no qualification, 33 per cent compared with 31 per cent in Northern Beaches LGA.

Compared to the Sydney GMA, Frenchs Forest residents are more likely to hold some form of formal qualification. The proportion of residents with a diploma or higher in Frenchs Forest is 48 per cent compared to 42 per cent for the Sydney GMA.

Figure 3.11 outlines the top employment industries in Frenchs Forest compared with the Northern Beaches LGA and Sydney GMA.

Employment trends in Frenchs Forest are generally similar to the Northern Beaches LGA. About 14 per cent of employed Frenchs Forest residents work in professional services. Health care and social assistance is the second largest industry in Frenchs Forest at 11 per cent, similar to the Northern Beaches LGA.

Compared to the Sydney GMA, Frenchs Forest has a higher proportion of people working in white collar industries such as the professional services and finance sectors. Such jobs tend to be located in major centres with strong public transport connections and high non-car mode shares such as the Sydney CBD and Chatswood. Frenchs Forest has a lower proportion of people working in sectors such as health care, construction, and manufacturing.

Employment in the sectors of wholesale trade, accommodation and food services, professional, scientific and technical services, and health care and social assistance have increased since 2011 in Frenchs Forest.

Figure 3.10: Completed qualifications

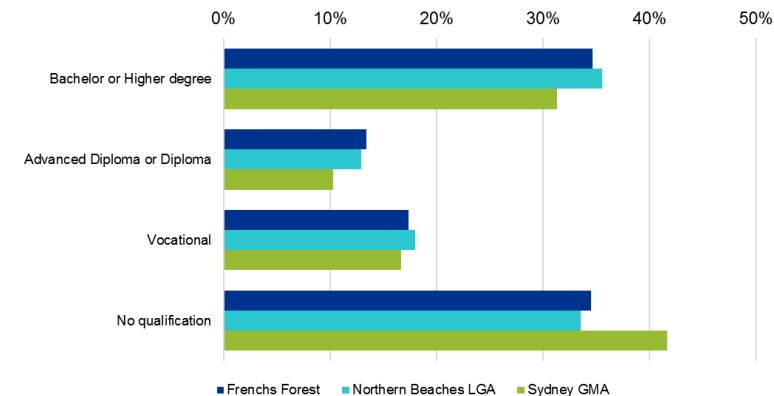
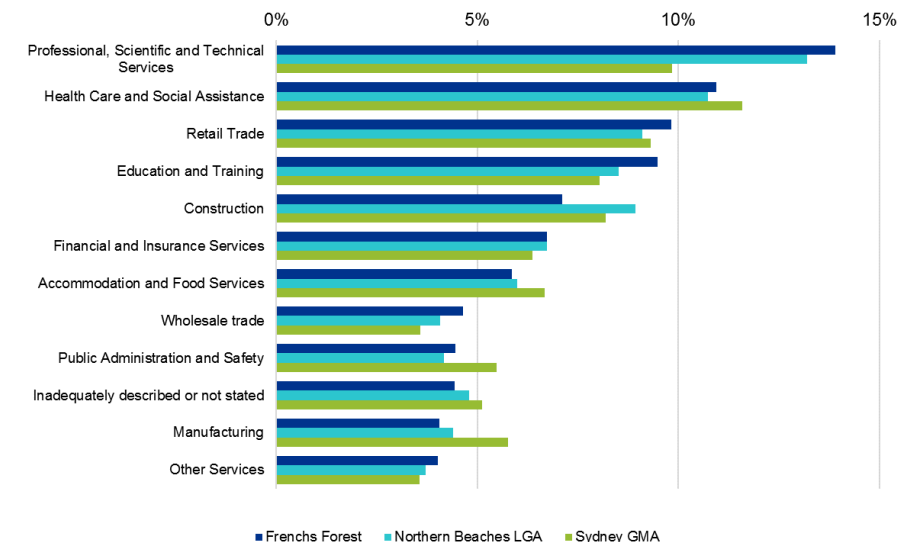


Figure 3.11: Top 10 employment industries



3.5 Travel behaviour

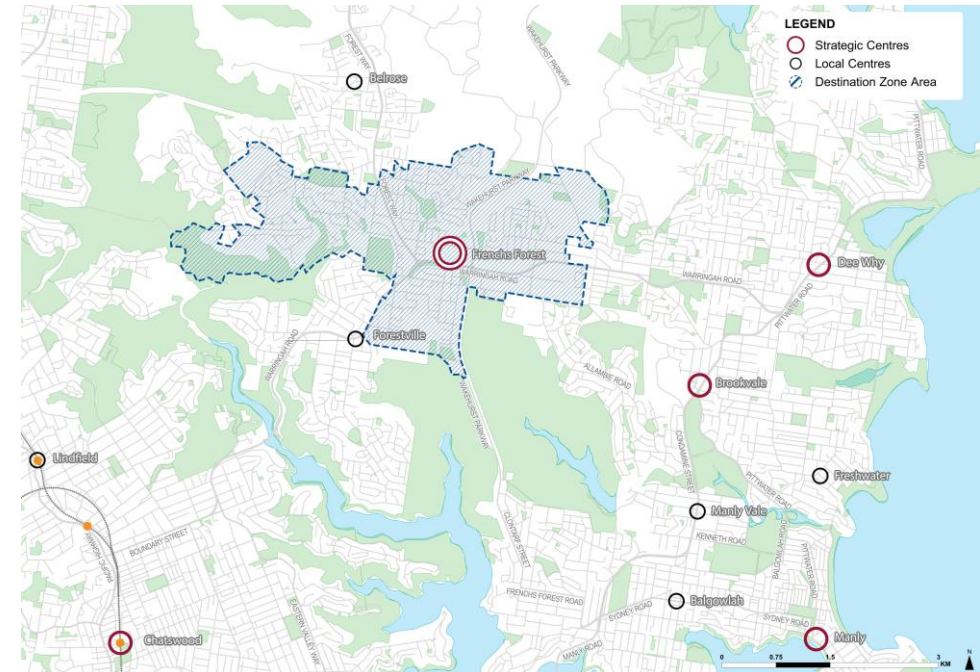
Current travel behaviour, including mode share and key work trip destinations has been analysed using data from the 2016 Census. This data is aggregated into Destination Zones (DZ).

The DZs representing the areas surrounding the Frenchs Forest precinct are listed below:

- 114280001
- 114280002
- 114282810
- 114282812
- 114282813
- 114282814
- 114282815

The geographic representation of these DZs are shown in Figure 3.12.

Figure 3.12: DZs representing the Frenchs Forest Planned Precinct area



3.5.1 Mode share

Figure 3.13 shows current Journey to Work (JTW) mode share for travel into and out of the Frenchs Forest Planned Precinct. The data represents the mode of travel for all employed people who travelled to work on census day.

The majority of work trips are undertaken by private vehicle across the Frenchs Forest area with 76 per cent and 87 per cent of outgoing (resident) and incoming (employee) trips respectively. A majority of the public transport mode share is in the form of bus travel and accounts for 14 per cent (outgoing) and 4 per cent (incoming). A lower proportion of trips are undertaken by train, with 3 per cent of the incoming and outgoing trips catered for on the heavy rail network. The need to interchange to train via bus and/or car travel acts as a disincentive against public transport usage.

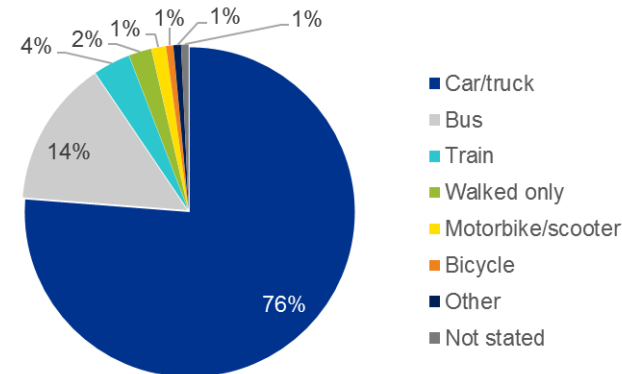
Active transport accounts for a low proportion of work travel, with 3 per cent of outgoing trips and 1 per cent of incoming trips undertaken by either walking or cycling.

Whilst not included in this data, a substantial proportion (9 per cent) of employed people within Frenchs Forest did not travel to work on census day whilst 7 per cent of workers worked from home. Generally, across the region, the proportion of people working from home and/or not travelling to work in peak periods is likely to increase into the future. At a Frenchs Forest precinct level, the creation of a new mixed-use town centre in conjunction with enhanced bus services is likely to reduce the existing high level of car reliance and increase the bus, walking, and cycling mode share.

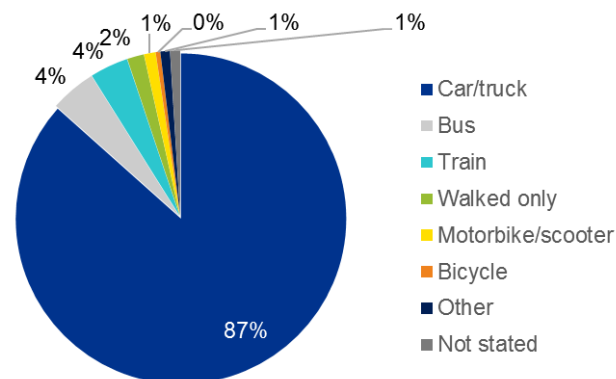
The planning of future transport infrastructure and services in the Frenchs Forest precinct will need to be undertaken in a manner which promotes non-car modes and seeks to reduce the currently high level of car use for both incoming and outgoing trips.

Figure 3.13: 2016 JTW mode share in the Frenchs Forest Planned Precinct area (Source: ABS Census 2016)

Frenchs Forest suburb JTW outgoing mode share



Frenchs Forest suburb JTW incoming mode share



3.5.2 Workers and residents

Figure 3.14 outlines the top 10 JTW origins and destinations for people working or residing in the Frenchs Forest Planned Precinct. The locations shown are Statistical Area Level 3 (SA3).

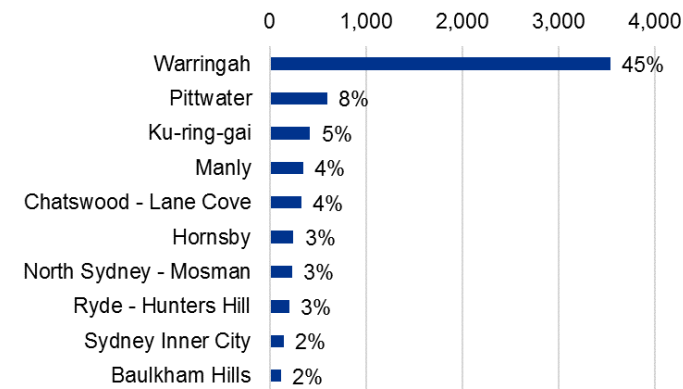
The highest proportions of travel by persons employed within Frenchs Forest are from Warringah (45 per cent), Pittwater (8 per cent), and Ku-ring-gai (5 per cent). The highest proportions of persons residing in Frenchs Forest to work destinations outside are to Warringah (40 per cent), Sydney Inner City (18 per cent), and Chatswood – Lane Cove (9 per cent).

The lowest proportions of travel by persons employed within Frenchs Forest is from Baulkham Hills (2 per cent), Sydney Inner City (2 per cent), Ryde – Hunters Hill (3 per cent), North Sydney – Mosman, Chatswood – Lane Cove (4 per cent), and Manly (4 per cent). The lowest proportions of persons residing in Frenchs Forest to work destinations outside is to Parramatta (1 per cent), Botany (1 per cent), Ku-ring-gai (2 per cent), Manly (4 per cent), Pittwater (4 per cent), and Ryde – Hunters Hill (4 per cent).

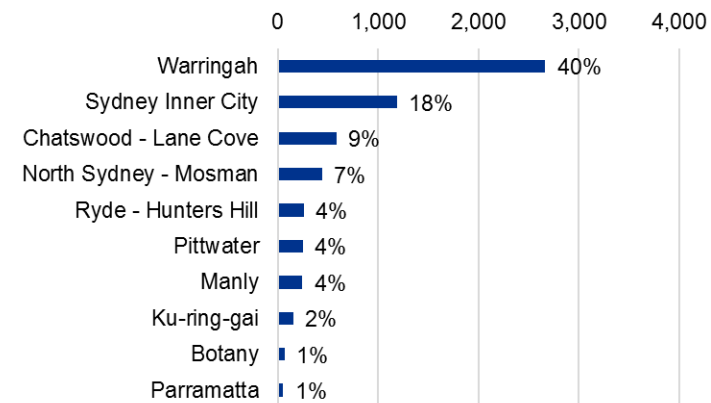
It is clear that work-based journeys coming into the precinct are predominantly from other locations in the Northern Beaches. Conversely, trips by residents of Frenchs Forest to their employment tend to be longer and are weighted towards the Sydney CBD and Chatswood-Lane Cove. Planning for transport infrastructure and services in the Frenchs Forest precinct will therefore need to cater to both local and longer distance trips.

Figure 3.14: 2016 JTW Top 10 origins and destinations in Frenchs Forest by SA3
(Source: ABS Census 2016)

Persons employed in Frenchs Forest top 10 places of residence (SA3)



Persons residing in Frenchs Forest top 10 places of work (SA3)



4. Frenchs Forest Planned Precinct

4.1 Background

In October 2012, the NSW Government identified the Northern Beaches Hospital site, together with the roadway at the intersection of Warringah Road and Wakehurst Parkway, as a State Significant Infrastructure site. The hospital was opened in October 2018 and has the capacity to employ 1,300 staff and provide 488 hospital beds. The NSW Government is also undertaking substantial road upgrades in the area to support the hospital.

The *North District Plan* identifies Frenchs Forest as a strategic centre and future health and education precinct. The emerging \$600m Northern Beaches Hospital and \$500m investment in improved transport links will be a catalyst for revitalisation and creating new homes and jobs in the area.

In August 2017, Northern Beaches Council endorsed the *Northern Beaches Hospital Precinct Structure Plan*. The structure plan proposes the phased delivery of approximately 5,000 new dwellings and 2,300 new jobs over the next 20 years. The structure plan shows the establishment of a new town centre on the Forest High School site adjacent to the new Hospital, with the high school to be relocated to the Aquatic Centre site on Aquatic Drive.

In June 2017, the Minister for Planning announced Frenchs Forest as a Planned Precinct to ensure it benefits from the Government's \$1b infrastructure investment in the area.

Phase 1 of the *Northern Beaches Hospital Precinct Structure Plan* (i.e. the Frenchs Forest Planned Precinct) includes the delivery of a town centre with the potential for at least 2,000 new homes and over 1,000 new jobs. The town centre will include a range of homes, cafés, restaurants, retail facilities, and open spaces next to the hospital.

4.2 Proposed land use

The proposed uses within the precinct respond to the needs of both the existing and future communities. The Frenchs Forest Planned Precinct will cater to a mixture of health, education, residential, retail, commercial, and social functions.

Table 4.1 shows the proposed land uses and yields for the precinct. An illustrative depiction of the proposed site plan for the precinct is shown in Figure 4.1.

Table 4.1: Proposed land uses

Land use	Dwellings/GFA
Residential	1,925 dwellings
Retail	19,287m ² GFA
Commercial	9,116m ² GFA
Community	17,350m ² GFA
University	8,175m ² GFA
Hotel	9,000m ² GFA
Aged care	9,532m ² GFA

Figure 4.1 Proposed town centre site layout (Chrofi/Architectus)



4.3 Future mode share

The development of a future mode share target has been undertaken through an extensive benchmarking process of locations with the following similar characteristics to Frenchs Forest:

- Reliance on bus services
- Population density
- Car ownership
- SEIFA socio-economic disadvantage index
- Public transport access to key centres

Comparable locations identified for use in the benchmarking process were:

- Lane Cove
- Dee Why
- Northbridge
- St Ives
- Gladesville
- Ryde
- Five Dock
- Concord

Existing mode shares of these benchmarked locations were combined to form a synthesised benchmark mode share. Development of a future mode share target considered the planned transport improvements as well as the differing demographics of people likely to live in the town centre, compared to existing residents of the wider suburb. The existing mode share data includes areas of Frenchs Forest with limited bus access whilst the future mode share target refers only to trips to/from the new town centre which will all have direct access to high quality bus services.

These factors, combined with the fact that there is limited scope in the road network for substantial trip growth, have resulted in a mode share target with the following differences to the synthesised mode share:

- Lower train use and higher bus use – to reflect the proposed transport services through the precinct
- Lower car mode share and higher walk only mode share – to reflect the willingness of town centre residents to use active transport as well as the availability of employment within the future precinct

A comparison of the synthesised benchmark, the existing Frenchs Forest suburb mode share and the future town centre target mode share are shown in Table 4.2. The full benchmarking process is documented in *Working Paper 1 – Land Use and Transport Context* (Jacobs, 2018)

Table 4.2: Benchmark and future target mode share

	Train	Bus	Car	Other	Walk
Synthesised benchmark	7%	19%	65%	6%	3%
Frenchs Forest – Suburb (current)	4%	14%	76%	4%	2%
Frenchs Forest – Planned Precinct (target)	6%	24%	60%	6%	4%

5. Road network impacts

This section outlines the potential impacts of the proposed development on the surrounding road network. These impacts have been primarily assessed through the use of a microsimulation Aimsun (Version 8.2.1) traffic model with the aim of identifying constraints in the network and testing possible infrastructure improvements to support the development of the Frenchs Forest Planned Precinct.

5.1 Traffic generation

The development of appropriate future traffic forecasts has been undertaken in two components:

- Background traffic not associated with the proposed development has been derived from supplied Roads and Maritime VISSIM models. The VISSIM models received were calibrated and validated and deemed appropriate for use as the basis for this investigation.
- Traffic generated by the proposed development in the precinct has been derived through the application of generation rates agreed with Roads and Maritime and which directly relate vehicle trips with the number of dwellings and the quantum of non-residential floor space.

Trip generation rates are an influential component of the transport assessment process, directly related to and impacting on mode share. Trip generation rates for developments are generally influenced by the following key factors:

- The quality of public transport services and facilities
- Active transport links and street environment
- Levels of car parking provision and car ownership
- Demographics of the area
- Density and intensity of development
- Activities in the surrounding urban environment.

A benchmarking process was undertaken with comparable sites chosen based on the above factors along with an analysis of rates provided in Roads and Maritime's *Guide to Traffic Generating Developments* and more recent surveys of high-density sites without direct access to mass transit (Bitzios, 2017). This process was documented in *Working Paper 1 – Land Use and Transport Context* (Jacobs, 2018).

Consultation with Roads and Maritime led to agreement on the traffic generation rates and Phase 1 total peak hour traffic shown in Table 5.1.

Table 5.1: Traffic generation rates and peak hour vehicle trips

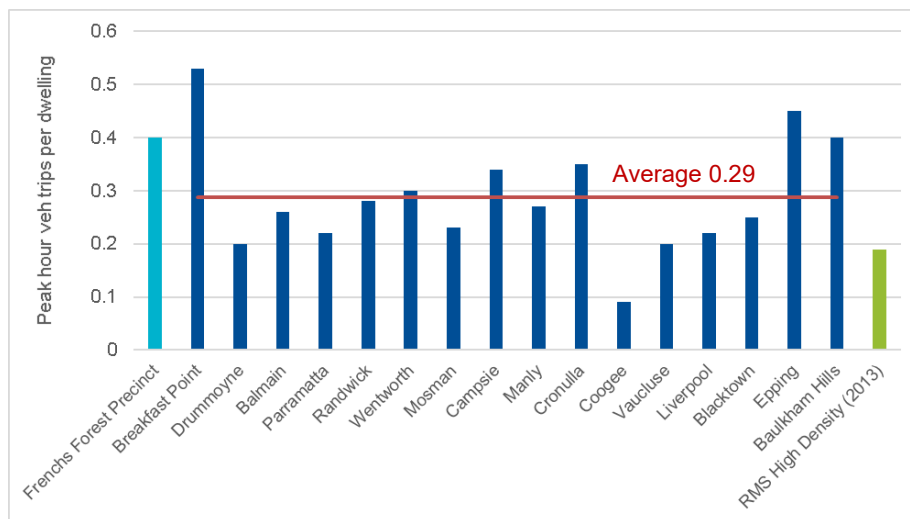
Land use	Dwellings/GFA	AM rate	AM trips/hr	PM rate	PM trips/hr
Residential – high-density	1,726 dwellings	0.4 per dwelling	690	0.45 per dwelling	777
Residential – med-density	199 dwellings	0.5 per dwelling	100	0.55 per dwelling	109
Commercial	9,116m ² GFA	1.6 per 100m ²	146	1.2 per 100m ²	109
Retail – supermarket	5,007m ² GLFA	3.4 per 100m ²	170	9.8 per 100m ²	491
Retail – other	11,466m ² GLFA	2.2 per 100m ²	252	6.1 per 100m ²	699
Hotel	9,000m ² GFA	0.3 per 100m ²	27	0.3 per 100m ²	27
Education	8,175m ² GFA	0.8 per 100m ²	65	0.8 per 100m ²	65
Aged care / community	26,882m ² GFA	1.0 per 100m ²	269	1.6 per 100m ²	430
Total			1,720		2,705

Precinct yields, current at the time the Aimsun models were developed, have been used for the modelling assessment documented in this report. However, as the project has evolved, these yields have been revised and are shown in Table 4.1 and Table 5.1.

The number of vehicle trips generated with the revised yields (as shown in Table 5.1) was determined to be similar or lower than the number of vehicle trips incorporated into the Aimsun models. Therefore, the traffic modelling completed provides a conservative assessment, with modelling outcomes deemed to be consistent with the most recent yields. Appendix A outlines the yields and associated trip generation used for the modelling assessment.

A comparison between the AM high density rate for the future Frenchs Forest Planned Precinct and the Bitzios survey sites is shown in Figure 5.1. It is noted that the Frenchs Forest rate is substantially higher than the average rate and would be the third highest rate of all surveyed sites.

Figure 5.1: Traffic generation rate comparison (AM peak hour)



5.2 Traffic distribution and assignment

The distribution of traffic generated by the Frenchs Forest Planned Precinct has been derived from an analysis of origin-destination (O-D) patterns from the strategic Sydney Motorway Project Model (SMPM) provided by Roads and Maritime. The traffic generated by the process described in Section 5.1 has been assigned an origin or destination in the Aimsun model based on the distribution of an equivalent trip in SMPM, allowing the development of an O-D matrix for all trips to/from the precinct. An example of the distribution of trips in the AM peak is shown in Figure 5.2.

This matrix was assigned in the Aimsun model using a Dynamic User Equilibrium (DUE) method. DUE uses simulated delays to generate route costs for all O-D pairs, rather than a mathematical estimate of delay based on a speed/flow curve used in static assignment. The assignment iterates over several model runs until an equilibrium is reached where all paths between any origin and destination have equivalent costs.

Figure 5.2: AM peak traffic distribution from Frenchs Forest Planned Precinct



5.3 Scenarios

The assessment of road network impacts has been undertaken by comparing the operation of the network assuming the full development of the Frenchs Forest Planned Precinct (Project scenario) with a scenario where no land use changes are made (Do Minimum scenario).

‘Do Minimum’ scenario:

- Northern Beaches Hospital roadworks complete (Stage 1 and 2)
- No Beaches Link
- Forest High School remains operational in current location
- No dwelling or employment uplift in the Frenchs Forest Planned Precinct
- Traffic demands unchanged from Roads and Maritime’s Northern Beaches Hospital Connectivity and Network Enhancement (NBHCaNE) VISSIM model

‘Project’ scenario:

- Northern Beaches Hospital roadworks complete (Stage 1 and 2)
- No Beaches Link
- Relocated Forest High School with capacity increase and associated road upgrades including signalised Wakehurst Parkway/Aquatic Drive intersection
- Additional right-turn lane from Forest Way northbound to Naree Road
- Traffic demands from Roads and Maritime’s NBHCaNE VISSIM model combined with demands from land use uplift in the Frenchs Forest Planned Precinct

Both scenarios have been assessed using a 2026 and 2036 forecast year.

An additional scenario was assessed to quantify the potential impact of Beaches Link assuming the full development of the Frenchs Forest Planned Precinct using a 2036 forecast year (Beaches Link scenario). These results are detailed in Section 5.5.4.

‘Beaches Link’ scenario:

- Northern Beaches Hospital roadworks complete (Stage 1 and 2)
- Beaches Link
- Relocated Forest High School with capacity increase and associated road upgrades including signalised Wakehurst Parkway/Aquatic Drive intersection
- Additional right-turn lane from Forest Way northbound to Naree Road
- Traffic demands from Roads and Maritime’s NBHCaNE VISSIM model combined with demands from land use uplift in Frenchs Forest Planned Precinct

5.4 Desired service criteria

Flow density

The Aimsun traffic model simulates the impacts of traffic constraints resulting from either saturation flows in midblock sections or due to capacity limitations at intersections. When traffic demand exceeds capacity, traffic queues form, and these are depicted within the model as increases in flow density. Flow density is the average number of vehicles per kilometre on each section of road.

In this context, the road network flow density was used to examine key capacity constraints within the future road network. Higher densities indicate vehicles are closer together and therefore travelling more slowly and spending more time queuing. The assessment of network performance on the basis of flow density was used to identify potential capacity constraints in the network.

Intersection level of service

The performance of an urban road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. It is therefore appropriate to consider intersection operation as a measure of the capacity of the road network.

The criteria for evaluating the operational performance of intersections is defined in Table 5.2 and comes from Roads and Maritime’s *Guide to Traffic Generating Developments (2002)*. The criteria for evaluating the performance of intersections is based on the average intersection delay during the peak hour. This average vehicle delay is equated to a corresponding level of service (LoS) from A (best) to F (worst).

Table 5.2: Level of service definitions

LoS	Average delay/ vehicle (sec/veh)	Traffic signals roundabout	Give way stop signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents would cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

(Source: *Guide to Traffic Generating Developments, RMS 2002*)

Travel time

Warringah Road is a regional movement corridor of strategic importance which carries more than 50,000 vehicles per day through the study area. It is also a key bus corridor with more than 40 services per hour in each direction projected by 2036. The efficiency and productivity of the corridor will need to be protected and the Frenchs Forest Planned Precinct will need to be implemented in a way that does not lead to substantial travel time increases through the study area compared to a Do Minimum scenario.

5.5 Future network performance – Phase 1

The following section discusses the network performance over the peak hour (8-9am and 5-6pm for the morning and evening peak respectively). The performance of intersections at an approach level are provided in Appendix B.

2026 AM – density and intersection level of service

Figure 5.3 and Figure 5.4 outline the results of the Aimsun modelling for the 2026 AM scenarios. Flow density and intersection level of service results are depicted.

Results of the Do Minimum scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service D or better with the exception of Warringah Road/Wakehurst Parkway which is forecast to operate at level of service E.
- Some minor localised congestion is observed on the westbound Warringah Road approach to Starkey Street.

Results of the Project scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service D or better with the exception of Warringah Road/Wakehurst Parkway and Warringah Road/Forest Way which are forecast to operate at level of service E, primarily due to additional traffic performing the right-turn from Warringah Road to Forest Way.
- Some localised increased density is observed on the westbound Warringah Road approach to Forestville Avenue and on Forest Way, compared to the Do Minimum scenario.

Figure 5.3: 2026 AM Do Minimum – density and level of service

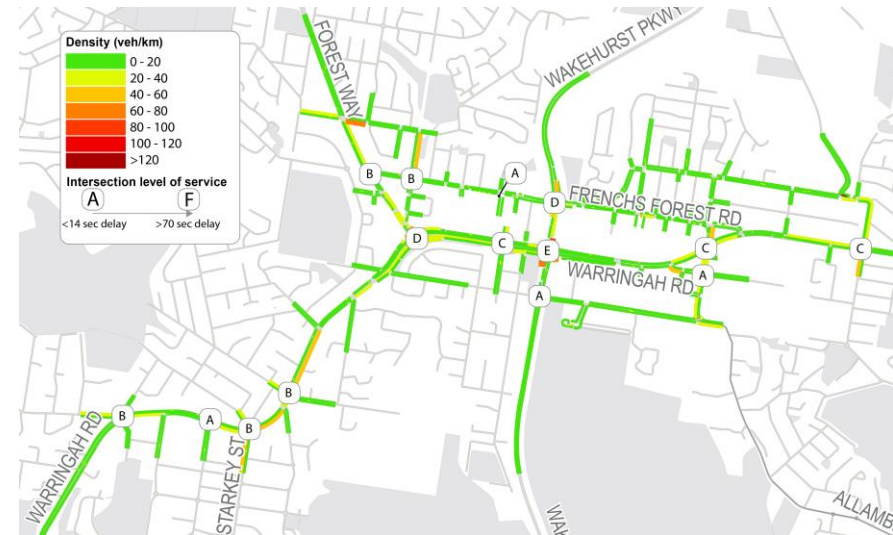
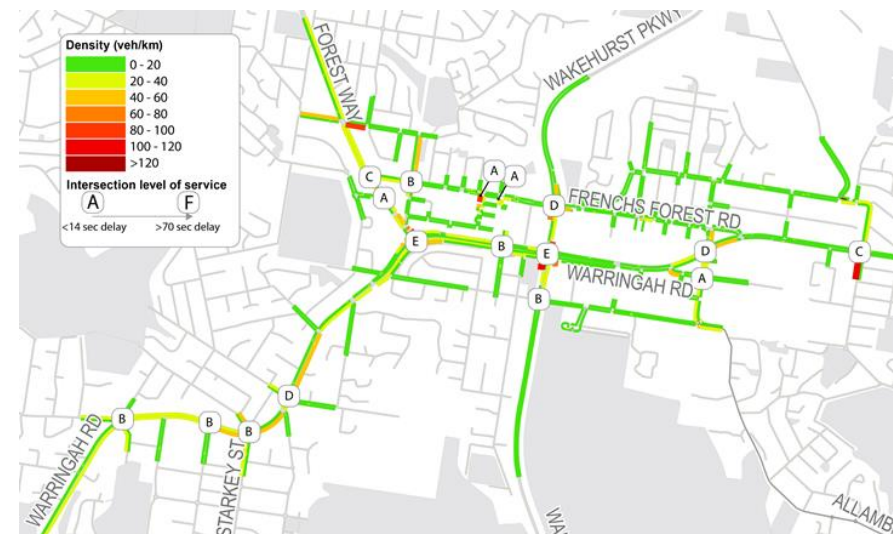


Figure 5.4: 2026 AM Project – density and level of service



2026 PM – density and intersection level of service

Figure 5.5 and Figure 5.6 outline the results of the Aimsun modelling for the 2026 PM scenarios. Flow density and intersection level of service results are depicted.

Results of the Do Minimum scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service D or better with the exception of Warringah Road/Forest Way which is forecast to operate at level of service E.
- Some minor localised congestion is observed on the westbound Adams Street approach to Forest Way.

Results of the Project scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service D or better with the exception of Warringah Road/Forest Way and Warringah Road/Wakehurst Parkway which are forecast to operate at level of service E and Warringah Road/Forestville Avenue which is forecast to operate at level of service F. This is primarily due to additional traffic travelling westbound along Warringah Road.
- Some localised increased density is observed on the eastbound Warringah Road approach to Forestville Avenue and Starkey Street and the southbound Wakehurst Parkway approach to Aquatic Drive compared to the Do Minimum scenario.

Figure 5.5: 2026 PM Do Minimum – density and level of service

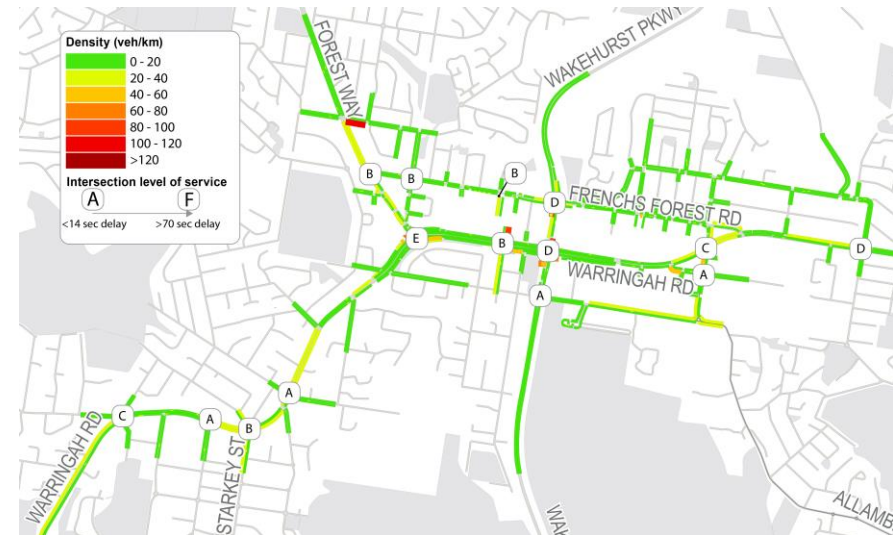


Figure 5.6: 2026 PM Project – density and level of service



2036 AM – density and intersection level of service

Figure 5.7 and Figure 5.8 outline the results of the Aimsun modelling for the 2036 AM scenarios. Flow density and intersection level of service results are depicted.

Results of the Do Minimum scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service D or better with the exception of Warringah Road/Forest Way and Warringah Road/Wakehurst Parkway which are forecast to operate at level of service E.
- Some localised congestion is observed on the westbound Warringah Road approach to Starkey Street and the eastbound Arthur Street approach to Forestville Avenue.

Results of the Project scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service E or better with the exception of Warringah Road/Forest Way which is forecast to operate at level of service F, primarily due to additional traffic performing a right-turn from Warringah Road to Forest Way.
- Localised increased density is observed on both eastbound and westbound Warringah Road approaches to Starkey Street, southbound on Forest Way and the Adams Street approaches to Forest Way, compared to the Do Minimum scenario.

Figure 5.7: 2036 AM Do Minimum – density and level of service

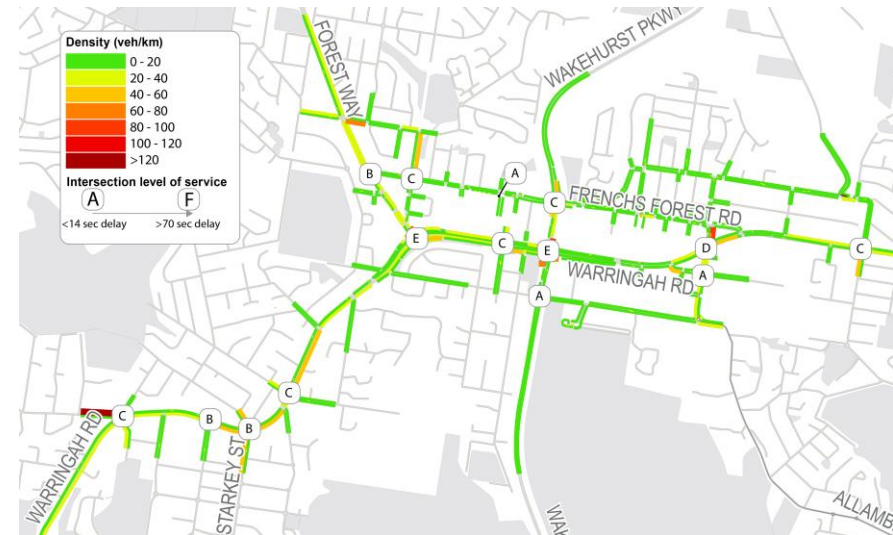


Figure 5.8: 2036 AM Project – density and level of service



2036 PM – density and intersection level of service

Figure 5.9 and Figure 5.10 outline the results of the Aimsun modelling for the 2036 PM scenarios. Flow density and intersection level of service results are depicted.

Results of the Do Minimum scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service D or better with the exception of Warringah Road/Wakehurst Parkway which is forecast to operate at level of service E.
- Some minor localised congestion is observed on the Warringah Road approaches to Starkey Street and the westbound Adams Street approach to Forest Way.

Results of the Project scenario show:

- The road network generally operates satisfactorily with no major delays.
- All intersections in the study area perform at level of service E or better with the exception of Warringah Road/Forestville Avenue and Warringah Road/Wakehurst Parkway which are forecast to operate at level of service F.
- Wakehurst Parkway/Aquatic Drive worsens, primarily due to the southbound traffic constrained to a single lane and additional traffic performing the right-turn from Aquatic Drive to Wakehurst Parkway.
- Localised increased density is observed on the eastbound Warringah Road approach to Forestville Avenue and Starkey Street, the southbound Wakehurst Parkway approach to Aquatic Drive, and the Russell Avenue approach to Forest Way, compared to the Do Minimum scenario.

Figure 5.9: 2036 PM Do Minimum – density and level of service

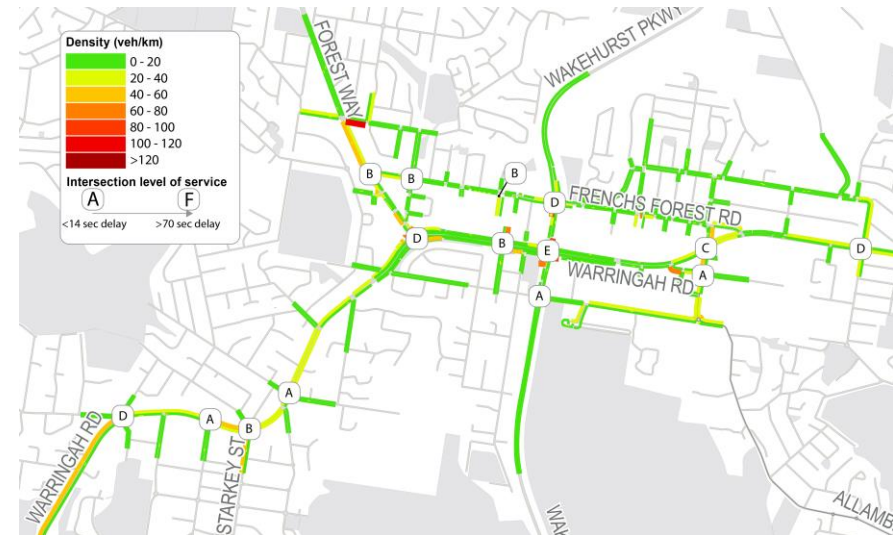
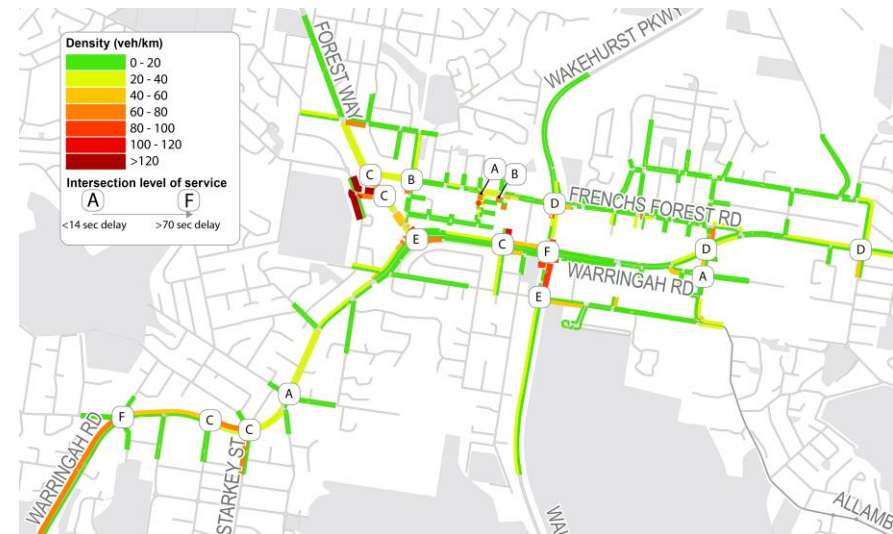


Figure 5.10: 2036 PM Project – density and level of service



Warringah Road travel time

Warringah Road is a regional movement corridor of strategic importance which carries more than 50,000 vehicles per day through the study area. It is also a key bus corridor with more than 40 services per hour in each direction projected by 2036. The travel time on Warringah Road has therefore been identified as a key measure of future network performance.

Figure 5.11 outlines the modelled segment of Warringah Road for which travel time results have been analysed. Table 5.3 outlines the results of the Phase 1 2026 and 2036 travel time results for both the Do Minimum and Project scenarios.

Results demonstrate that:

- Modelled travel time increases in all Project scenarios compared to the do minimum results.
- Travel times increase by over 10 per cent in westbound direction during the AM peak and in the eastbound direction during the PM peak in both 2026 and 2036.

It should be noted that future transport strategies and plans, including Beaches Link, may change travel patterns around the precinct as well as travel times on Warringah Road. The impacts of Beaches Link are discussed in Section 5.5.4.

Figure 5.11: Warringah Road travel time segment



Table 5.3: Phase 1 – Warringah Road travel time results

Year	Approach and period	Do Minimum (mm:ss)	Project (mm:ss)	Change
2026	Eastbound AM	06:41	06:56	3.74%
	Westbound AM	06:12	06:50	10.22%
	Eastbound PM	07:50	09:05	15.96%
	Westbound PM	05:35	05:54	5.67%
2036	Eastbound AM	06:43	07:05	5.46%
	Westbound AM	06:51	08:33	24.82%
	Eastbound PM	08:18	09:53	19.08%
	Westbound PM	05:42	06:02	5.85%

Summary of network statistics

Table 5.4 and Table 5.5 show a summary of the network statistics for the Do Minimum and Project scenarios for 2026 and 2036.

The results demonstrate a clear trend of:

- An increase in vehicle kilometres travelled, vehicle hours travelled, delay, and unreleased vehicles from the Do Minimum scenario to Project scenario and from 2026 to 2036.
- A reduction in average speed from the Do Minimum scenario to Project scenario and from 2026 to 2036.

Table 5.4: Network statistics for 2026 scenarios

	2026			
	AM Do Minimum	AM Project	PM Do Minimum	PM Project
Vehicle kilometres travelled	99,064	106,184	105,068	113,492
Vehicle hours travelled	2,771	3,278	2,896	3,427
Average speed (km/h)	35.8	32.4	36.3	33.1
Delay (sec)	55	67	56	65
Unreleased vehicles	0	1	29	121

Table 5.5: Network statistics for 2036 scenarios

	2036			
	AM Do Minimum	AM Project	PM Do Minimum	PM Project
Vehicle kilometres travelled	103,120	110,538	109,267	116,425
Vehicle hours travelled	3,051	3,841	3,119	3,775
Average speed (km/h)	33.8	28.8	35.0	30.8
Delay (sec)	64	82	59	80
Unreleased vehicles	0	138	11	475

Development traffic distribution

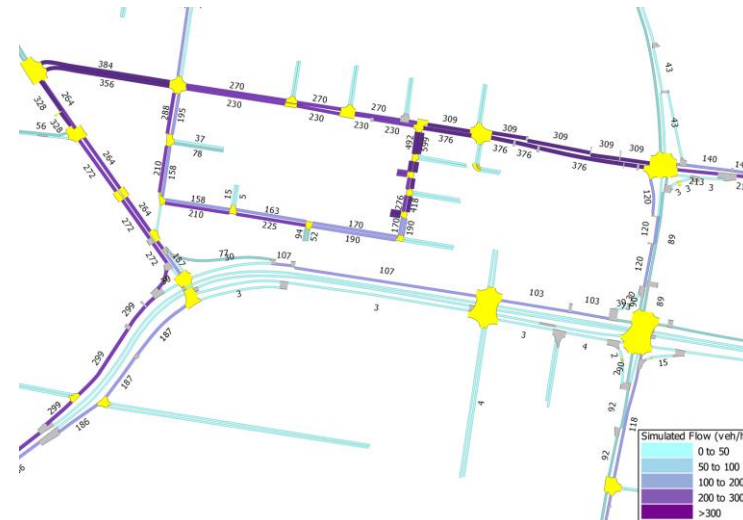
Figure 5.12 and Figure 5.13 show the distribution of traffic that is generated by the proposed town centre. It is noted that the overall distribution of traffic is based on strategic modelling outputs whilst the route choice within the study area is calculated by the Aimsun model, as outlined in Section 5.2.

- The majority of vehicle trips generated by the development travel to/from the south-western area of the study area. Key attractors such as Chatswood, Macquarie Park, North Sydney, and Sydney CBD are all located in this direction.
- Frenchs Forest Road East, Frenchs Forest Road West, Forest Way, and Warringah Road west of Forest Way are the main corridors which are forecast to experience an increase in traffic as a result of the development.
- The northern section of the main town centre access road is forecast to carry traffic generated by the development of approximately 900 vehicles per hour in the AM peak and 1,100 vehicles per hour in the PM peak. The implications of these flows are highlighted in Section 5.5.3.

Figure 5.12: Development traffic distribution – AM



Figure 5.13: Development traffic distribution - PM



5.5.1 The Forest High School relocation

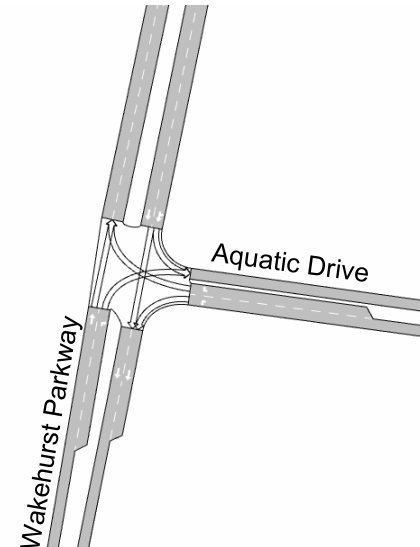
As part of the *Northern Beaches Hospital Precinct Structure Plan*, The Forest High School is proposed to be relocated, with the existing school site to be redeveloped as a new town centre. A potential site for the high school relocation has been identified at Warringah Aquatic Reserve, which is being investigated by School Infrastructure NSW.

This scenario would generate and attract additional traffic on the roads surrounding the Warringah Aquatic Reserve. Furthermore, the capacity of the school is forecast to increase from 1,000 to 1,500 people. Input demand in the model was adjusted to account for the increase in trips generated by and attracted to the relocated school.

To support the additional traffic generated by the high school, the Wakehurst Parkway/Aquatic Drive intersection would be upgraded. Preliminary modelling included a signalised intersection with provision of a right-turn from Aquatic Drive westbound onto Wakehurst Parkway northbound. Pedestrian crossings were assumed on the southern and eastern legs of the intersection. This intersection design is shown below in Figure 5.14.

It should be noted that there are some major services on Aquatic Drive that may need to be relocated to accommodate the upgrade of Wakehurst Parkway/Aquatic Drive.

Figure 5.14: Signalised Wakehurst Parkway/Aquatic Drive intersection



The high school relocation, increased capacity and upgrade of the Wakehurst Parkway/Aquatic Drive intersection was modelled in the Project scenario. A comparison of the Do Minimum scenario and Project scenarios from Section 5.5 show:

- A decrease in performance of the Wakehurst Parkway/Aquatic Drive intersection for the AM and PM peaks in 2026 and 2036. However, the Wakehurst Parkway/Aquatic Drive intersection operates satisfactorily with no substantial delays, with the exception of the PM peak in 2036, which is forecast to operate at level of service E.
- The Warringah Road/Allambie Road intersection operates at either level of service C or D in all scenarios.
- The Allambie Road/Rodborough Road roundabout continues to operate at level of service A in all scenarios.

5.5.2 Naree Road/Forest Way intersection

The *Northern Beaches Hospital Precinct Structure Plan* identifies the potential for an upgrade of the Naree Road/Forest Way intersection. The full proposed works include:

- Extension of Naree Road to Grace Avenue, in order to support development on the western side of Forest Way.
- Additional right-turn lane from Forest Way northbound to Naree Road.
- Removing access between Forest Way and the eastern end of Russell Avenue.

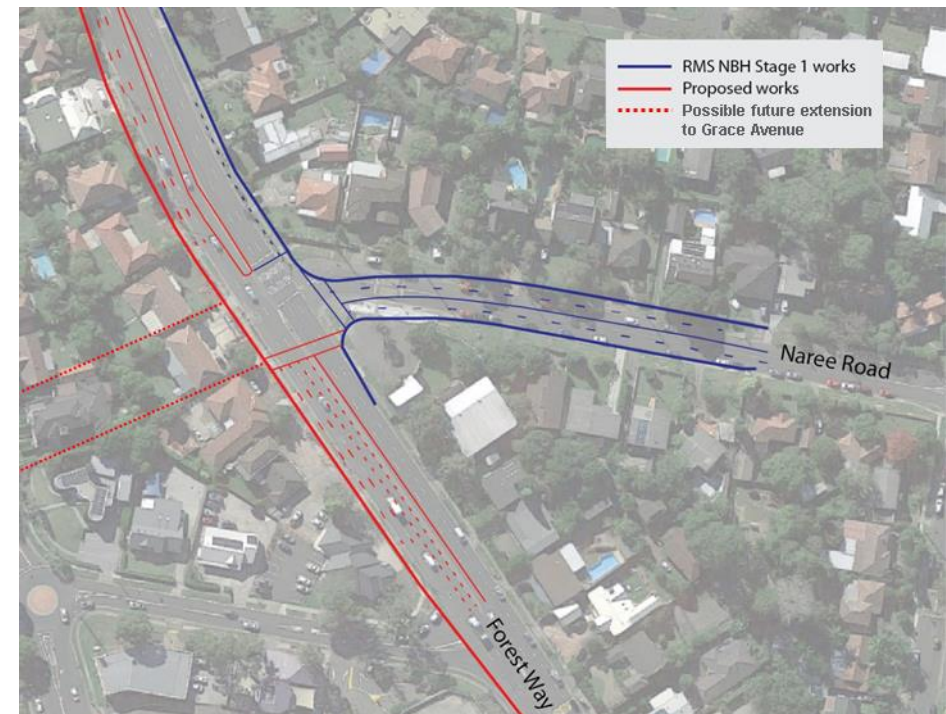
Traffic modelling undertaken as part of this study includes the additional right-turn lane from Forest Way northbound to Naree Road. Analysis of the modelling results in relation to the full proposed works are presented below:

- In the 2036 Project and Beaches Link scenarios, northbound queues on Forest Way are forecast to propagate past Russell Avenue, leading to increased delays for all vehicles turning out of Russell Avenue. Right-turning vehicles from Forest Way onto Russell Avenue are forecast to add some minor delays to southbound vehicles on Forest Way due to the occasional overflow of the right turn lane.
- Removing access from Russell Avenue to Forest Road, and vice versa, may provide road safety benefits. Northern Beaches Council have advised that the existing Russell Avenue intersection has a poor crash history.
- The proposed works would require large amounts of land acquisition and total construction costs would be substantial.

The full proposed works are not considered necessary to support the traffic impacts of the development of the Planned Precinct. Only the additional right-turn lane from Forest Way northbound to Naree Road would be required to accommodate trips generated by the development. The additional capacity would also reduce delays to an acceptable level for vehicles turning out of Russell Avenue.

A sketch of the proposed works is shown in Figure 5.15.

Figure 5.15: Proposed Naree Road/Forest Way intersection works (sketch only)



Given the land use surrounding the Naree Road/Forest Way intersection, a number of constraints need to be considered should the additional right-turn lane be constructed. This includes the following:

- Partial property acquisitions along the southern side of Naree Road and along the eastern and western side of Forest Way would be required in order to accommodate the additional right-turn lane.
- At the Forest Alliance Church, located on the south-east corner of Naree Road and Forest Way, road widening would require the reconstruction of the recently completed car park retaining wall and would likely result in a reduction in car parking spaces at the property.
- Construction would also necessitate the relocation of utilities, overhead electrical systems, and existing infrastructure.

The introduction of Beaches Link and infrastructure outlined in the *Beaches Link Scoping Report* may change traffic patterns around the precinct. In particular, the opportunity for faster and more frequent public transport may alter mode share and reduce private vehicle usage at Frenchs Forest. As a result, the need for an additional right turn lane at the Naree Road/Forest Way intersection should be examined further in the Beaches Link integration works with the Frenchs Forest.

The full proposed works should also be investigated further in order to support any future development west of Forest Way, such as those proposed in the full *Northern Beaches Hospital Precinct Structure Plan*.

5.5.3 Internal road network and town centre access

Roads and Maritime's *Guide to Traffic Generating Developments* provides guidance on the recommended environmental capacities of local and collector roads. The advised maximum flow is 500 veh/hr for a residential road. Iterative traffic modelling of a staged town centre build out has demonstrated that the access road begins to exceed the 500 veh/hr limit when approximately 70 per cent of the proposed town centre development has been delivered.

The projected maximum flows on the main town centre access road (1,000 in AM and 1,200 in PM) exceeds this capacity. However, it should be noted that the main access road will also serve commercial, retail, and other land uses. The *Guide to Traffic Generating Developments* stipulates that trunk collector and spine roads with no direct property access can carry higher traffic flows. However, minimising flows on the main access road will ensure the safety and amenity of local roads within the precinct.

Several options have been considered in order to provide additional access to/from the town centre and reduce traffic flows on the main town centre access road. These are shown in Figure 5.16 and are as follows:

- 1) Additional access on Holland Crescent and Frenchs Forest Road West
- 2) Additional access on Bluegum Crescent (west) and Frenchs Forest Road West
- 3) Combination of Option 1 and Option 2

The above options have been tested in the Aimsun model in order to determine their ability to reduce flows on the main access road.

Table 5.6 provides the results of this testing and shows the maximum hourly flow on the main access road in both the AM and PM peak periods.

It is observed that Option 2 is more effective at reducing flows on the access road than Option 1. This is due to the proximity of the Bluegum Crescent (west) access to land uses within the town centre. Access to the town centre via Holland Crescent access is not as direct, and therefore does not reduce traffic flows on the main access road as effectively as an access via Bluegum Crescent. When compared to Option 2, the combination option does not further reduce traffic flow on the main access road by a large amount and hence does not justify an additional access at Holland Crescent. A detailed list of opportunities and constraints for all options is provided in Table 5.7.

Table 5.6: Town centre access options testing

Option	Maximum flow on main access road (veh/hr)	
	AM	PM
Original layout	1,008	1,194
1 – Original layout with Holland Crescent access	855	1,094
2 – Original layout with Bluegum Crescent (west) access	786	945
3 – Option 1 and Option 2	760	887

Figure 5.16: Additional access options

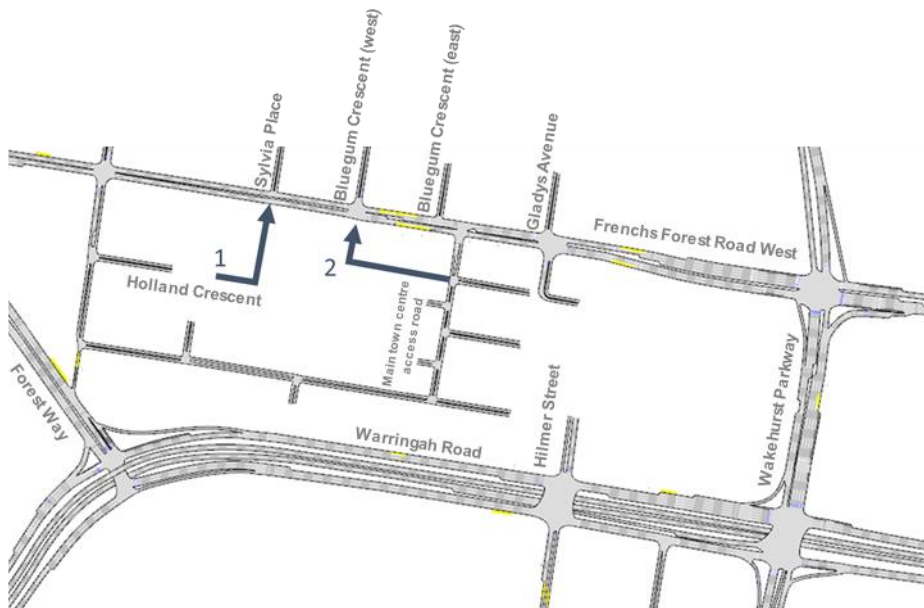


Table 5.7: Town centre access options summary

Option	Opportunities	Constraints
Original layout	<ul style="list-style-type: none"> Easiest to implement Least impact to wider road network 	<ul style="list-style-type: none"> Traffic concentrated at northern end of precinct –exceeds Roads and Maritime’s limits No direct access to Warringah Road Requires closely spaced intersection to Northern Beaches Hospital access
1 – Original layout with Holland Crescent access	<ul style="list-style-type: none"> Reduces internal flows by up to 150 vehicles per hour during the AM and PM peak periods New intersection operates satisfactorily during the AM and PM peak periods 	<ul style="list-style-type: none"> Loss of proposed green space Still results in traffic concentrated at northern end of precinct No direct access to Warringah Road Located away from Frenchs Forest Planned Precinct land uses
2 – Original layout with Bluegum Crescent (west) access	<ul style="list-style-type: none"> Reduces internal flows by up to 250 vehicles per hour during the AM and PM peak periods Located close to Frenchs Forest Planned Precinct land uses Utilises existing traffic signals and access to The Forest High School carpark on the south approach Modified intersection operates satisfactorily during the AM and PM peak periods 	<ul style="list-style-type: none"> Loss of proposed green space Still results in traffic concentrated at northern end of precinct No direct access to Warringah Road
3 – Original layout with Holland Crescent access and Bluegum Crescent (west) access	<ul style="list-style-type: none"> Reduces internal flows by up to 310 vehicles per hour during the AM and PM peak periods Bluegum Crescent (west) access utilises existing traffic signals and access to The Forest High School carpark on the south approach and Bluegum Crescent (west) access located close to Frenchs Forest Planned Precinct land uses Both access intersections operate satisfactorily during the AM and PM peak periods 	<ul style="list-style-type: none"> Loss of proposed green space Still results in traffic concentrated at northern end of precinct No direct access to Warringah Road

Impact of Bluegum Crescent (west) access

Based on the above assessment, it is recommended that the Bluegum Crescent (west) access option be investigated further and considered for implementation to support the full development of the Frenchs Forest Planned Precinct. To further increase street capacity and improve pedestrian amenity, measures to improve safety are recommended, including traffic calming measures and / or a reduced speed limit.

An assessment of impacts of the Bluegum Crescent (west) access on the performance of the road network has been undertaken. Table 5.8 compares the peak hour intersection performance of the original layout and the Bluegum Crescent (west) option at select intersections in the precinct.

Table 5.8: Surrounding intersection performance

Intersection	2026 AM peak hour LoS		2026 PM peak hour LoS	
	Original layout	Option 2	Original layout	Option 2
Warringah Road/Forest Way	E	E	E	E
Warringah Road/Hilmer Street	B	B	C	B
Naree Road/Forest Way	C	C	C	C
Frenchs Forest Road West/Rabbett Street	B	D	B	B
Frenchs Forest Road West/Town Centre	A	A	A	A
Wakehurst Parkway/Frenchs Forest Road West	D	D	C	D

The modelling undertaken shows that the new intersection is forecast to perform at level of service A in the AM and PM peak. No major impacts to the performance of surrounding intersections is anticipated due to the additional access at Bluegum Crescent (west).

Other access options previously considered and assessed as part of this study are shown in Appendix C. This includes a connection at Hilmer Street, which had the largest reduction in flow on the main access road. This is due to its connection with an existing signalised intersection, providing the opportunity for vehicles to perform a right-turn onto Warringah Road to exit the town centre, a movement not provided by any other option. However, this access requires Health Infrastructure/Healthscope approval and hence is not currently available for consideration. As such, the Hilmer Street connection should be instead considered and investigated as a potential future option, subject to Health Infrastructure/Healthscope approval.

5.5.4 Beaches Link

The following section outlines the results of the Aimsun modelling for the Beaches Link scenario.

As discussed earlier in this report, Beaches Link is still subject to environmental assessment and approval. Possible impacts at Frenchs Forest due to Beaches Link may include:

- Additional traffic travelling via Wakehurst Parkway south of Warringah Road to access the new tunnels, and a reduction of traffic on Warringah Road.
 - At Warringah Road/Wakehurst Parkway, a greater proportion of vehicles would travel to and from Wakehurst Parkway from Warringah Road.
 - At Warringah Road/Forest Way, a greater proportion of vehicles would turn left into Warringah Road from Forest Way or turn right into Forest Way from Warringah Road.
- Opportunities for improved public transport services operating via Beaches Link and the associated mode shift.

Roads and Maritime estimates that Beaches Link would reduce traffic on Roseville Bridge and Warringah Road by about 25 per cent. This traffic would be redirected to Wakehurst Parkway, which would be widened into a four-lane road between Warringah Road and 300 metres north of Kirkwood Street.

If Beaches Link is approved, the traffic impacts of Beaches Link should be investigated further in the Beaches Link integration works with the Frenchs Forest Planned Precinct to ensure that planning takes into account any potential changes to traffic patterns in Frenchs Forest.

Table 5.9 outlines the travel time results for Beaches Link when compared to the 2036 Do Minimum and Project scenarios.

Table 5.9: Warringah Road travel time results with Beaches Link

Year	Approach and period	Do Minimum (mm:ss)	Project (mm:ss)	Beaches Link (mm:ss)	Change from Project	Change from Do Minimum
2036	Eastbound AM	06:43	07:05	06:51	-3.3%	1.99%
	Westbound AM	06:51	08:33	06:54	-19.3%	0.73%
	Eastbound PM	08:18	09:53	07:51	-20.6%	-5.42%
	Westbound PM	05:42	06:02	05:46	-4.4%	1.17%

Modelling results show:

- When compared to the Project scenario, Beaches Link would reduce travel times by a substantial amount on Warringah Road.
- When compared to the Do Minimum scenario, travel times on Warringah Road increase only slightly in the eastbound AM peak and the westbound AM and PM peaks.

Figure 5.17 and Figure 5.18 outline the intersection level of service and flow density results of the Aimsun modelling for the Beaches Link scenarios.

Results of the AM Beaches Link scenario shows:

- All intersections in the study area perform at level of service E or better with the exception of Warringah Road/Wakehurst Parkway, Warringah Road/Forest Way, and Warringah Road/Allambie Road.
- Compared to the Project scenario, level of service improves on Warringah Road west of Forest Way and Naree Road/Forest Way. Level of service also improves at Wakehurst Parkway/Aquatic Drive as a result of the widened Wakehurst Parkway.
- Compared to the Project scenario, level of service worsens on Warringah Road between Forest Way and Wakehurst Parkway, primarily due to additional traffic performing the right-turn from Warringah Road to Forest Way and the right-turn from Warringah Road to Wakehurst Parkway.
- Some localised congestion is observed on the southbound Rabbett Street approach to Frenchs Forest Road West, the westbound Warringah Road approach to Forest Way and the approaches to Warringah Road/Allambie Road.

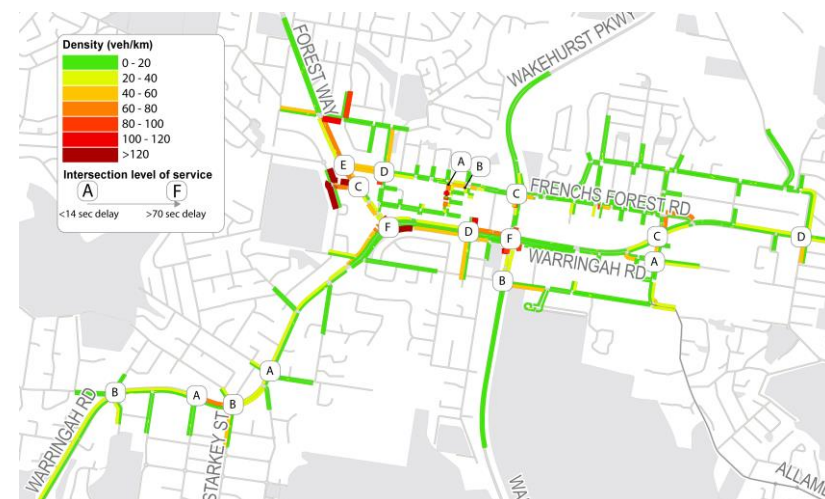
Results of the PM Beaches Link scenario shows:

- All intersections in the study area perform at level of service D or better with the exception of Naree Road/Forest Way which is forecast to operate at level of service E and Warringah Road/Wakehurst Parkway and Warringah Road/Forest Way, which are forecast to operate at level of service F.
- Compared to the Project scenario, level of service improves on Warringah Road west of Forest Way. Level of service also improves at Wakehurst Parkway/Aquatic Drive as a result of the widened Wakehurst Parkway.
- Some localised increased density is observed on the westbound Warringah Road approach to Forest Way and the Russell Avenue approach to Forest Way.

Figure 5.17: 2036 AM Beaches Link – density and level of service



Figure 5.18: 2036 PM Beaches Link – density and level of service



5.6 Future network performance – full structure plan

Whilst the transport assessment presented in this report is focused on the Phase 1 development, a high-level strategic analysis of the impacts of the full structure plan yield (approximately 4,500 dwellings) has also been undertaken. Figure 5.19 and Figure 5.20 outline the results of the Aimsun modelling for the 2036 AM and PM Project scenarios. Flow density and intersection level of service results are depicted.

AM results show:

- Substantial congestion and delay on Warringah Road. Westbound traffic volumes approaching Starkey Street leads to intersection performance of level of service F at Warringah Road/Currie Road.
- Substantial congestion and delay on Forest Way. Southbound traffic volumes approaching Warringah Road leads to intersection performance of level of service F. This intersection is also impacted by queues on Warringah Road propagating back to Forest Way.
- Warringah Road/Wakehurst Parkway intersection performs at level of service F compared to level of service E in the Project scenario.

PM results show:

- Substantial congestion and delay on Warringah Road. Eastbound traffic volumes approaching Starkey Street leads to intersection performance of level of service F at Warringah Road/Forestville Avenue. Over 500 vehicles are unable to access the road network at this location as a result of this congestion.

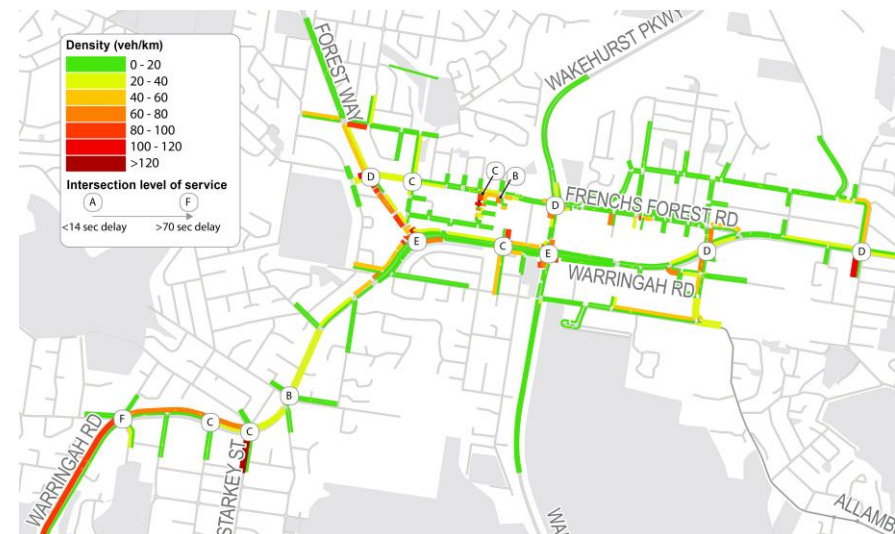
Overall results demonstrate that the full structure plan yield would have major impacts to the road network. It is also noted that the level of road infrastructure required to serve this demand (i.e. widening of Warringah Road) is unlikely to be feasible or cost effective due to substantial land requirements.

A large mode share shift from private car to public transport would be necessary to support the delivery of the full structure plan.

Figure 5.19: 2036 AM full structure plan – density and level of service



Figure 5.20: 2036 PM full structure plan – density and level of service



5.7 Movement and Place

The road network has many functions including:

- Connecting communities through the movement of people and goods
- Supporting places and public spaces in urban areas and regional centres
- Facilitating economic growth and prosperity
- Facilitating social activities such as events and celebrations.

In recognition of these various functions, the *NSW Road Planning Framework* (Transport for NSW, 2018) provides guidance for street planning. It proposes five different road types as shown and described in Figure 5.21 and Table 5.10. Ultimately, the classification of a road to one of these types is based on a road's movement need and place function.

Places for people perform intense place functions with substantial local pedestrian movements. Vibrant streets are important places for street life and transport. Local streets are important places for people as they provide the principal opportunity for formal and informal connections with neighbours and the local community. They must also provide good local access. Movement corridors provide safe, reliable and efficient movement between centres, neighbourhoods, and places.

Figure 5.21: Movement and Place road classification matrix (Source: Transport for NSW)

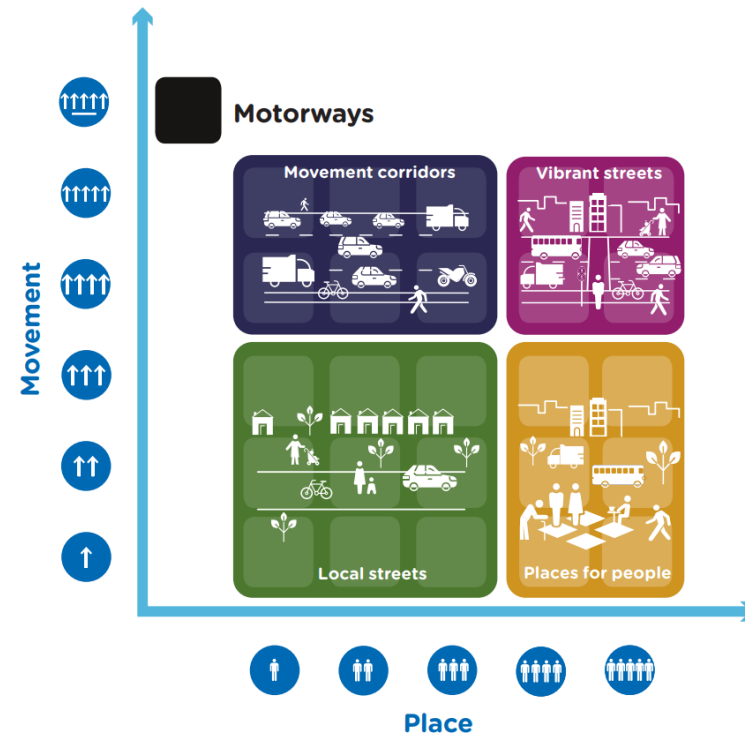


Table 5.10: Road network functions (Source: Transport for NSW)

Motorways	Motorways move people and goods over long distances.
Movement corridors	Movement corridors are main roads providing safe, reliable, and efficient movement between our regional centres and within our urban areas.
Vibrant streets	Vibrant streets combine high demand for movement and high pedestrian activity with often limited road space within our urban areas and regional centres.
Places for people	Places for people combine higher pedestrian activity and lower levels of vehicle movements, creating places of value for local communities and visitors.
Local streets	Local streets are part of the fabric of the suburban neighbourhoods where we live our lives and facilitate local community access.

The overall approach to the road network for the Frenchs Forest Planned Precinct includes:

- Maintaining the existing strong movement functions of Warringah Road, Forest Way, and Wakehurst Parkway. This includes encouraging regional through traffic to use these major movement corridors.
- Frenchs Forest Road West would have a higher place function at its interface with the town centre and become a vibrant street.
- Streets within the town centre would have a higher place function with large amounts of active frontage. Several internal streets would be designed as places for people.

The aspirational Movement and Place framework in and around the town centre is shown in Figure 5.22.

Figure 5.22: Aspirational Movement and Place framework in and around the town centre



5.8 Recommended infrastructure

The analysis of road network impacts presented in this section has led to the identification of the following infrastructure items required to support the Frenchs Forest Planned Precinct.

- Provision of internal street network including a signalised intersection with Frenchs Forest Road West
- Additional access at Bluegum Crescent (west) to reduce flows on the main access road
- Naree Road/Forest Way intersection upgrade to provide an additional right turn lane on the Forest Way northbound approach (subject to further investigation alongside Beaches Link)

6. Public transport network

The provision of reliable and efficient public transport services will be vital to the success of the Frenchs Forest Planned Precinct. The principles and objectives outlined in Section 2.8 can only be met if future residents of the precinct are provided with attractive public transport options that minimises private car use and facilitates a vibrant, safe, and welcoming town centre.

Data from Transport for NSW's PTPM has been used to assess the demand for future public transport services in the study area. Results from the 2036 Do Minimum scenario are presented in Figure 6.1 and shows that bus services along Forest Way, Frenchs Forest Road East, Frenchs Forest Road West, and Warringah Road would generally operate with spare seating and standing capacity, demonstrated by volume to capacity ratios generally less than 0.5.

Figure 6.2 outlines the projected demands from the 2036 Project scenario. It is noted that the proposed development of the Frenchs Forest Planned Precinct would lead to increased demands along public transport corridors surrounding the study area. In particular, demand along Warringah Road is forecast to increase by 400-600 people/hr in the peak direction. However, as reflected in the results of the 2036 Project scenario from PTPM, forecast future bus service frequencies would be adequate to cater for this demand with no road segments predicted to operate with volume to capacity ratios greater than 0.9.

Figure 6.1: 2036 Do Minimum AM peak period public transport demand (PTPM)

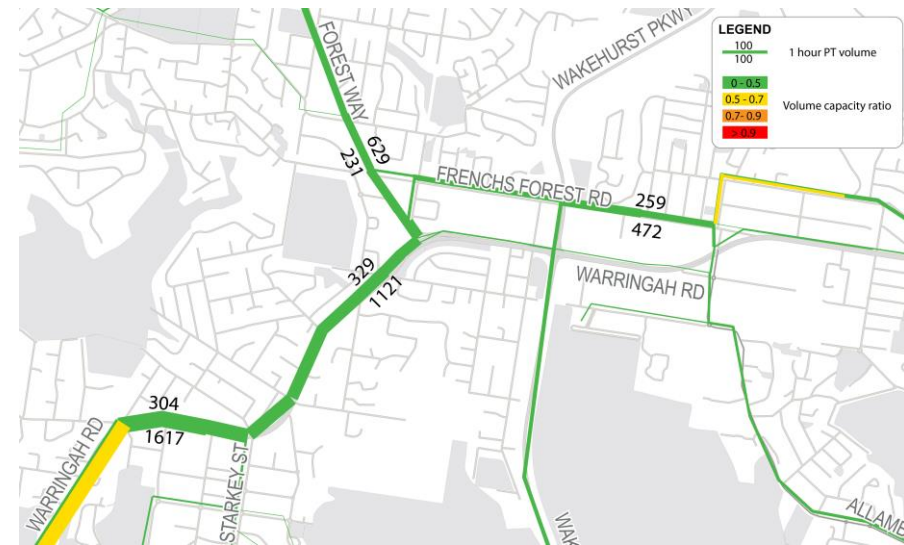
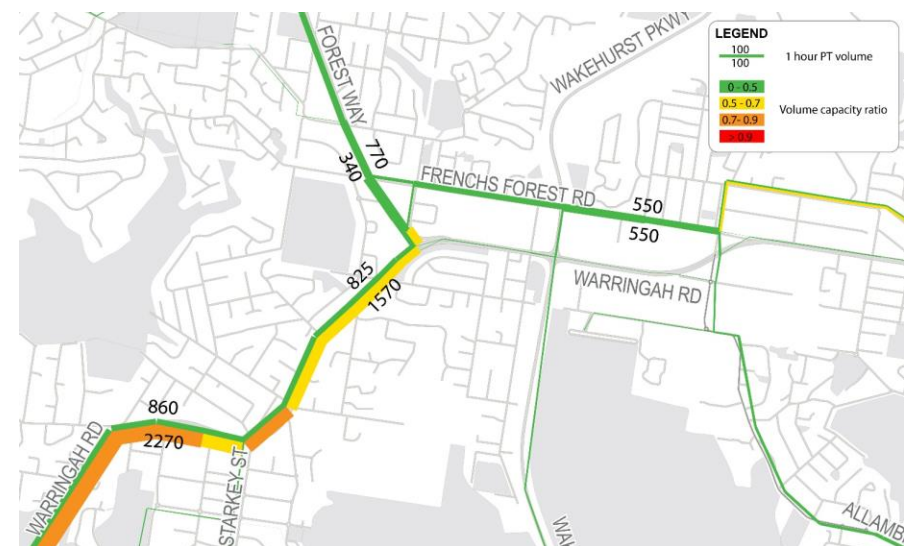


Figure 6.2: 2036 Project AM peak period public transport demand (PTPM)



6.1 Future public transport improvements

6.1.1 Current Government commitments

Future Transport 2056 identified the Chatswood to Dee Why via Frenchs Forest suburban route as an important corridor and listed improved bus services along the corridor as a key initiative for investigation within 10 years.

Detailed investigations into the form of these improvements have yet to be undertaken, so the long-term vision for this corridor is not currently known. It is however reasonable to assume that any improvements along this corridor would provide benefits to the Frenchs Forest Planned Precinct.

In terms of access within the Frenchs Forest Planned Precinct, the focal point for east-west routes is likely to continue to be Frenchs Forest Road West. East-west buses, such as route 136, provide front door access to the hospital and an additional stop is planned to the west of the hospital access to serve the future town centre.

If improved services were to operate along Warringah Road, new bus stops with direct access to the town centre would likely be required. A pedestrian overpass is being investigated as a potential way of providing this direct access. The overpass would directly link the southern town centre gateway to Warringah Road bus stops and also provide disabled/wheelchair access.

Figure 6.3 shows the potential location of the overpass along with examples of similar structures that have been implemented elsewhere. It is noted that this infrastructure is not an existing Government commitment and investigations into feasibility and funding sources are yet to be undertaken.

Figure 6.3: Proposed overpass to potential Warringah Road bus stops (Chrofi/Architectus)



6.1.2 Potential longer-term initiatives

Looking further ahead, the provision of a metro or heavy rail line in the Northern Beaches would enable substantial growth in the region and potentially provide large accessibility improvements to Frenchs Forest. However, a mass transit connection is not included in *Future Transport 2056*, so transport in this region is likely to be road-based for the foreseeable future. Investigation of potential long-term improvements will be necessary in order to support planning of the full *Northern Beaches Hospital Precinct Structure Plan*.

6.1.3 PTPM modelling of notional public transport improvements

As noted in Section 5.6, a major mode shift to public transport would be required in order to facilitate the delivery of the full *Northern Beaches Hospital Precinct Structure Plan* yield. Sensitivity testing of various notional public transport scenarios using PTPM has been undertaken in order to provide a strategic assessment of potential mode share changes should higher capacity public transport be available in the precinct in the future. Infrastructure and services tested in PTPM include:

- Rapid bus service between Dee Why and Chatswood, delivered through the conversion of a Warringah Road general traffic lane to a fully separated bus lane.
- Rail connection between Dee Why and Chatswood.

Modelling results forecast that a rapid bus connection would improve the attractiveness of public transport services to/from Frenchs Forest and reduce the reliance on private vehicle travel. However, it is not clear if the scope of this travel behaviour change would be enough to support the full structure plan yield of more than 5,000 dwellings. The results of PTPM modelling of the rapid bus option also shows that vehicle demand on Warringah Road would exceed available capacity, with volume to capacity ratios of up to 1.46 observed to the west of Frenchs Forest.

Results of modelling the rail connection between Dee Why and Chatswood demonstrate a major mode shift towards public transport. Up to 15 per cent of total trips from the Frenchs Forest precinct in the AM peak would shift from private vehicles to public transport compared to a bus-only scenario. The rail line is forecast to draw substantial patronage throughout the Northern Beaches, which indicates there may be major benefits for the region.

Further investigation will be required to determine the necessary infrastructure and servicing to support the full structure plan development. The modelling noted above shows there is potential for a reduction in private vehicle reliance. However, a coordinated plan including demand management and a diverse mix of land-uses will be necessary in order to deliver an acceptable transport outcome.

6.2 Recommended infrastructure and services

The assessment of the public transport network has led to the identification of the following infrastructure items required to support the Frenchs Forest Planned Precinct.

- New high-quality bus stop facilities on Frenchs Forest Road West to the west of the town centre access road
- Improved bus services between Northern Beaches and Chatswood (as per *Future Transport 2056*)
- Overpass from the southern town centre gateway across Warringah Road to connect to new Warringah Road bus stops (pending outcome of investigation into improved bus services)
- Work with Transport for NSW to further assess long term public transport options for the precinct (required in order to support development of the full *Northern Beaches Hospital Precinct Structure Plan*)

7. Active transport network

The active transport network (shown in Figure 7.1 and Figure 7.2) aims to create a more fine-grained and permeable street network structure that supports walkability within the precinct and to key local destinations. Key features include:

- As part of the Northern Beaches Hospital road upgrade project being undertaken by Roads and Maritime, a number of shared paths and new footpaths are under construction on sections of Warringah Road, Wakehurst Parkway, Forest Way, Aquatic Drive, and Allambie Road.
- Connections via Frenchs Forest Road West and Warringah Road to the existing strategic cycle network for travel to Dee Why, Brookvale, Manly, Warriewood, and Mona Vale.
- The existing pedestrian bridge over Warringah Road west of Wakehurst Parkway would be modified to link with a key desire line and act as a gateway to the precinct from the south.
- A new pedestrian bridge over Warringah Road west of Hilmer Street would improve connectivity between the town centre and existing land uses located south of Warringah Road. The bridge would also connect the town centre to a future rapid bus service stop on the southern side of Warringah Road and provide disabled/wheelchair access.
- Within the town centre (shown in Figure 7.2), a logical network of accessible pedestrian routes based on desire lines, legibility, connecting places of interest and utilising existing green spaces.

Figure 7.1: Walking and cycling improvements under construction (Roads and Maritime)

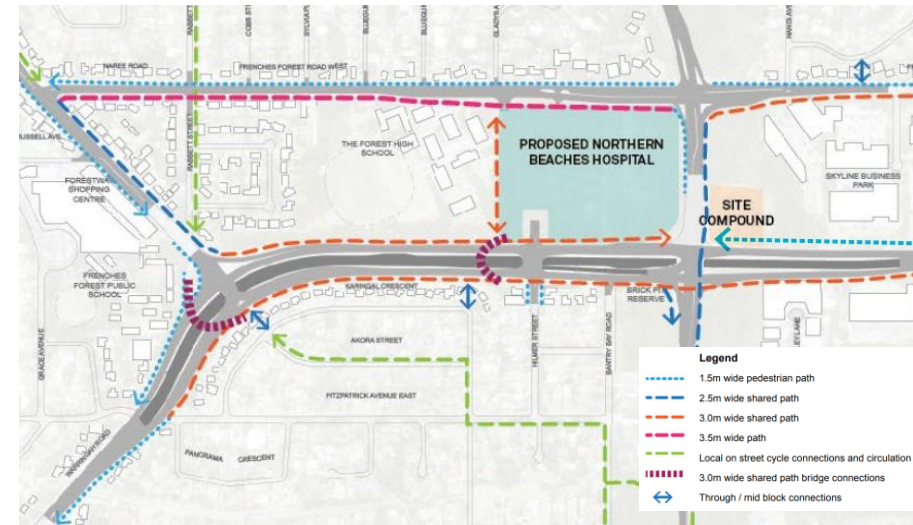
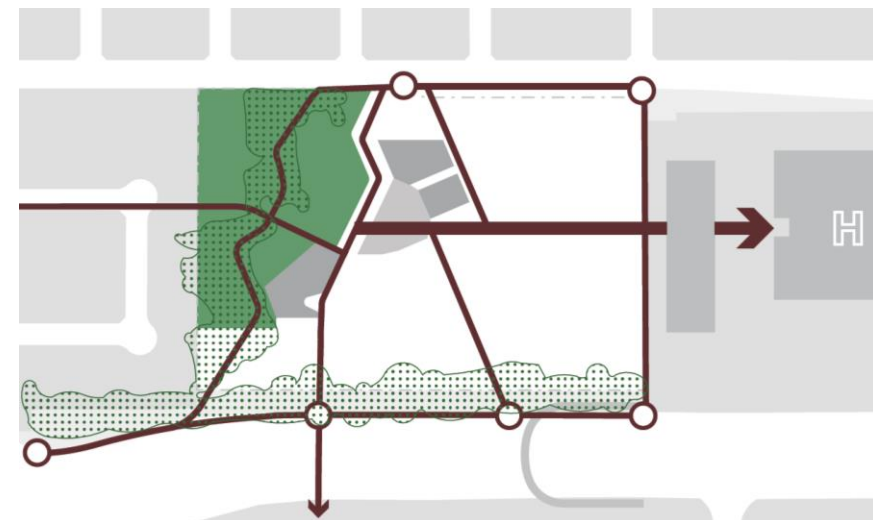


Figure 7.2: Proposed pedestrian links within the town centre (Chrofi/Architectus)



8. Travel demand management

The success of the overall Frenchs Forest Planned Precinct requires the identification of demand management options that could potentially address future congestion problems. In order to enable the desired changes to travel behaviour, a number of headline demand management options are discussed in the sections below. All of these support the overall transport principles and objectives of the precinct.

Car-sharing

Car-sharing is an effective approach for encouraging reduced levels of car ownership. Car-sharing is best suited to high-density, mixed use environments that provide a range of alternative transport options. Many car-share providers provide a membership car-share service that enables efficient online car booking and rental for registered users.

The service allows users to book, and have on-demand access to, a shared car or vehicle as their needs require. Cars are accessed through smart card technology with cars located in designated reserved spaces in established strategic locations. For example, GoGet has previously partnered with Parramatta City and City of Ryde councils to facilitate car-share schemes with policy dedicated to promoting car-share use.

Specific policy actions used to encourage car-share use were orientated towards management of kerb and off-street car-share parking. Research² has shown that car-share not only allows existing trips to be undertaken more efficiently, but also leads users to re-evaluate their need for car travel and instead choose more sustainable modes.

Travel Choices

Travel Choices is a simple framework designed to reduce peak hour travel, allow people to move around more efficiently and improve business productivity. The key actions are as follows:

- **Remode:** use public transport as driving may no longer be your best option
- **Retime:** avoid travel during the peak, especially between 8-9am and 5-6pm
- **Reduce:** minimise the number of times you need to travel, especially by car
- **Reroute:** use the city's preferred driving routes where possible

Retiming and reducing are effective ways for people to avoid driving in the AM and PM peak. A number of approaches within the Travel Choices framework could be applicable to managing demand for private vehicles in the Frenchs Forest Planned Precinct.

Transport Management Association

The Frenchs Forest Planned Precinct could be supported by the establishment of a Transport Management Association (TMA) charged with managing the delivery and monitoring of the precinct's transport outcomes. The TMA's responsibilities in terms of travel demand management may include personalised travel planning, travel information, and liaison with transport providers.

² Phillip Boyle and Associates, *The Impact of Car Share Services in Australia*, 2016

8.1 Parking

Off-street parking rates

Car parking controls can be used as a policy tool to manage travel demand and reduce dependence on private vehicles. The approach to recommending parking rates for Frenchs Forest is aimed at promoting non-car modes and recognises the likely demographics of future town centre residents. Northern Beaches Council Development Control Plan (DCP) parking rates for residential land uses as well as proposed rates for commercial and retail land uses in the Frenchs Forest precinct are outlined in Table 8.1 along with a comparison of the existing rates in the 2011 Warringah DCP.

Table 8.1 : Proposed maximum parking rates by category and development

Land use	Unit	Proposed rate	Warringah DCP 2011 rate
Residential	spaces per 1-bedroom dwelling	0.6	1
	spaces per 2-bedroom dwelling	1	1.2
	spaces per 3 or more-bedroom dwelling	1.5	1.5
	visitor space per dwelling	0.1	0.2
Commercial/ Office	space per 40m ² GFA	1	1
Retail	spaces per 100m ² GLFA	6.1	6.1

Car-sharing rates have also been developed based on benchmarking and an assessment of potential use by future residents. Car-share schemes are generally more successful in higher density areas with limited off-street parking availability and high-quality public transport connections. Residential car-share parking rates are specified in the DCP for the Frenchs Forest precinct. Retail and commercial rates for car sharing spaces in new

developments are based on City of Sydney's DCP 2012 but have been adjusted to reflect that car ownership in the Frenchs Forest precinct will be substantially higher than the City of Sydney. Rates for each category and development type are outlined in Table 8.2.

Table 8.2 : Proposed car-share rates by category and development

Land use	Car-share provision
Residential	2 per 15 dwellings
Retail/Commercial	1 per 50 car spaces

Unbundling and decoupling

Unbundled parking is parking that is separated from the cost or rent of a dwelling or building. This is not only more equitable but can also reduce the total amount of parking required for the building. If unbundled parking was to be introduced in the Frenchs Forest precinct, it is recommended that a complementary reduction in parking requirements is considered. For buildings with unbundled parking, a parking rate reduction of 15 per cent is proposed.

Decoupled parking is parking that is spatially separated from the building to which the parking services. It is also generally unbundled from the sale or rental of an apartment or building. The shift towards lower car ownership rates and emergence of the autonomous vehicle will reduce the need for parking and investment in underground parking. In particular, parking stations/basement parking may lose value as vehicles may no longer need to be parked or housed at origin or destination locations.

If decoupled parking is to be pursued in the Frenchs Forest precinct, it is recommended that:

- Parking should be spatially decoupled from buildings where possible.
- Sites should be identified for decoupled parking to reduce the need for on-site, underground parking.
- Decoupled parking should be built above ground and managed flexibly as the corridor transitions towards low car ownership and use.

For buildings with decoupled, unbundled parking, a parking rate reduction of 30 per cent on parking rates is proposed. Decoupled parking could be transitioned to other uses when the demand for parking is no longer required, including where new public transport infrastructure is delivered.

On-street parking

On-street parking in the precinct is recommended to feature a mixture of time restrictions with limited, if any, provision of unrestricted parking. This provides parking for visitors to the area and discourages resident car ownership. This policy also complements the off-street parking approach.

The amount of unrestricted on-street parking should be limited as far as possible to ensure space is allocated efficiently and long-term free parking is avoided. An 85 per cent occupancy rate is the generally agreed optimum target when designing pricing of restricted on-street parking. This aims to ensure adequate turnover of spaces, particularly around retail uses. On-street parking will be a critical component of the urban fabric of the Frenchs Forest precinct and should be designed to support the vision for the local streets.

9. Conclusion

Jacobs has been engaged by DPIE to undertake a traffic and transport assessment of the Frenchs Forest Planned Precinct. In August 2017, the Northern Beaches Council endorsed the *Northern Beaches Hospital Precinct Structure Plan* that outlined the establishment of a new town centre adjacent to the Northern Beaches Hospital. This report assesses the transport impacts of Phase 1 of the structure plan and includes the delivery of a town centre with the potential for at least 2,000 new homes, cafés, restaurants, retail facilities, and open spaces next to the hospital.

Assessment of road network impacts under the Project scenario (without Beaches Link) shows that:

- The future road network during the AM and PM peak hours in 2026 and 2036 generally operates satisfactorily.
- Intersections perform at level of service D or better with the exception of Naree Road/Forest Way, Wakehurst Parkway/Aquatic Drive, and at some intersections along Warringah Road.
- Travel times on Warringah Road increase substantially in the westbound direction during the AM peak and in the eastbound direction during the PM peak in both 2026 and 2036.

Assessment of road network impacts under the Beaches Link scenario shows that:

- The future network generally operates satisfactorily.
- Performance of intersection on Warringah Road west of Forest Way improves substantially and the Wakehurst Parkway/Aquatic Drive intersection also improves as a result of road widening of Wakehurst Parkway.

- Intersections perform at level of service D or better with the exception of Frenchs Forest Road West/Wakehurst Parkway, Naree Road/Forest Way, and at some intersections along Warringah Road between Forest Way and Allambie Road.
- Travel times on Warringah Road decrease substantially compared to the Project scenario and increase slightly compared to the Do Minimum scenario.

To support the Frenchs Forest Planned Precinct, a number of transport infrastructure and services is recommended. These are detailed in Section 9.1 and include the following:

- An additional town centre access on Bluegum Crescent (west).
- An additional right-turn lane at the Naree Road/Forest Way intersection. It is recognised that a number of constraints exist should this be implemented. Therefore, the feasibility of this upgrade should be investigated further.
- In the short-term, new high-quality bus stop facilities on Frenchs Forest Road West to the west of the town centre access road.
- In the medium to long-term, improved bus services between Northern Beaches and Chatswood. If future bus services are planned to travel via Warringah Road, bus stops on Warringah Road should be connected to direct pedestrian access via the town centre.
- Travel demand management such as aggressive parking controls, dynamic pricing, de-coupled and/or unbundled parking, car-sharing, the Travel Choices framework, and establishment of a TMA.

9.1 Implementation plan

Table 9.1 provides a summary of the proposed transport infrastructure and services required to support the Frenchs Forest Planned Precinct.

Table 9.1 : Implementation plan

Id	Item	Description	Timing	Comments
Road network				
R1	Internal street network	Provision of internal town centre street network including signalised intersection with Frenchs Forest Road West.	Ongoing	Required for Phase 1
R2	Additional access at Bluegum Crescent (west)	Provision of an additional access to the town centre at Bluegum Crescent (west). This connection is required to minimise flows on the main north-south access road.	By approx. 70% development	Required for Phase 1
R3	Naree Road/Forest Way intersection upgrade	Investigate the feasibility and effectiveness of the intersection upgrade to provide an additional right turn lane on the Forest Way northbound approach.	Short-medium term	Required for Phase 1
Public transport network				
P1	New bus stop facilities	New high-quality bus stop facilities on Frenchs Forest Road West to the west of town centre access road.	Short term	Required for Phase 1
P2	Improved bus services between Northern Beaches and Chatswood	Investigation of improved bus services via Warringah Road between Northern Beaches and Chatswood (as per <i>Future Transport 2056</i>). High quality, direct and reliable services would help minimise car use and would support further development in the areas surrounding the town centre.	Short – medium term	Required for Phase 1
P3	Overpass/pedestrian bridge to connect to new Warringah Road bus stops	If future improved bus services are planned to run via Warringah Road, new bus stops on Warringah Road with direct access to the town centre would be recommended. A pedestrian overpass linking the southern town centre gateway to Warringah Road bus stops has been proposed as a potential way of providing this direct access. This would be subject to further detailed investigation	Medium – long term	Pending outcome of investigation into P2

Id	Item	Description	Timing	Comments
P4	Work with Transport for NSW to further assess long term public transport options for the precinct	A Northern Beaches metro or heavy rail line would facilitate substantial growth in the region and provide large accessibility improvements to Frenchs Forest. A mass transit connection such as this however is not included in <i>Future Transport 2056</i> .	Long term	Not required for Phase 1. Substantial improvements required to support development of full <i>Northern Beaches Hospital Structure Plan</i>
Active transport				
A1	Internal pedestrian network	A logical network of accessible pedestrian routes throughout the town centre, based on desire lines, legibility, connecting places of interest, and utilising existing green spaces.	Short term	Required for Phase 1
A2	New shared paths	As part of the Northern Beaches Hospital road upgrade project currently undertaken by Roads and Maritime, a network of shared paths and new footpaths on sections of Warringah Road, Wakehurst Parkway, Forest Way, Aquatic Drive, and Allambie Road.	Short term	Construction scheduled for completion in 2020
A3	Modification of existing pedestrian bridge over Warringah Road	The existing pedestrian bridge over Warringah Road west of Wakehurst Parkway would be modified to link with a key desire line and act as a gateway to the precinct from the south.	Short – medium term	Required for Phase 1
Travel demand management				
T1	Parking controls	Consideration of aggressive parking controls, dynamic pricing, de-coupled/unbundled parking, or similar measures in order to constrain private car use.	Short term	Required for Phase 1
T2	Car-sharing	Provision of car-share vehicles, both on and off-street, in order to reduce car ownership and avoid short car trips which could comfortably be undertaken by other modes.	Short term	Required for Phase 1
T3	Transport Management Association	Consideration into the formation of a Transport Management Association in order to provide information to residents and visitors and monitor the transport characteristics of the precinct.	Short term	Required for Phase 1

Appendix A. Modelled land use and precinct yields

Land use	Dwellings/GFA	AM rate	AM trips/hr	PM rate	PM trips/hr
Residential – high-density	1,901 dwellings	0.4 per dwelling	760	0.45 per dwelling	855
Residential – med-density	231 dwellings	0.5 per dwelling	116	0.55 per dwelling	127
Commercial	16,895m ² GFA	1.6 per 100m ²	270	1.2 per 100m ²	203
Retail – supermarket	2,550m ² GLFA	3.4 per 100m ²	88	9.8 per 100m ²	251
Retail – other	12,800m ² GLFA	2.2 per 100m ²	276	6.1 per 100m ²	778
Hotel	11,300m ² GFA	0.3 per 100m ²	34	0.3 per 100m ²	34
Education	24,450m ² GFA	0.8 per 100m ²	196	0.8 per 100m ²	196
Aged care / community	15,375m ² GFA	1.0 per 100m ²	154	1.6 per 100m ²	246
Total			1,890		2,690

Appendix B. Detailed level of service (peak hour)

B.1 Level of service for 2026 scenarios

	2026 AM Peak Do Min (8-9am)			2026 AM Peak Project (8-9am)			2026 PM Peak Do Min (5-6pm)			2026 PM Peak Project (5-6pm)		
	Vol	Delay	LoS	Vol	Delay	LoS	Vol	Delay	LoS	Vol	Delay	LoS
1_Warringah Road/Forestville Ave_North	347	93.3	F	367	76.4	F	244	75.7	F	228	91.4	F
1_Warringah Road/Forestville Ave_East	3751	13.6	A	4021	15.1	B	2544	8.8	A	2756	9.3	A
1_Warringah Road/Forestville Ave_South	160	52.2	D	152	88.7	F	96	67.3	E	80	105.6	F
1_Warringah Road/Forestville Ave_West	2447	17.0	B	2540	13.0	A	4097	58.3	E	4408	109.5	F
Warringah Road/Forestville Ave	6705	19.9	B	7080	19.1	B	6981	41.0	C	7472	71.9	F
2_Warringah Road/Darley St_North	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A
2_Warringah Road/Darley St_East	3824	8.9	A	4117	13.3	A	2539	7.5	A	2785	9.8	A
2_Warringah Road/Darley St_South	192	66.7	E	192	57.9	E	212	55.5	D	215	54.8	D
2_Warringah Road/Darley St_West	2505	15.0	B	2605	35.3	C	4174	11.7	A	4474	17.6	B
Warringah Road/Darley St	6521	12.9	A	6914	22.8	B	6925	11.5	A	7474	15.8	B
3_Warringah Road/Starkey St_North	236	72.2	F	232	90.2	F	128	67.2	E	123	67.3	E
3_Warringah Road/Starkey St_East	3764	20.1	B	4107	24.8	B	2636	18.5	B	2931	21.8	B
3_Warringah Road/Starkey St_South	483	93.5	F	491	87.0	F	595	65.5	E	618	74.3	F
3_Warringah Road/Starkey St_West	2358	7.0	A	2503	9.2	A	3956	19.6	B	4261	26.7	B
Warringah Road/Starkey St	6841	22.6	B	7333	25.7	B	7315	23.8	B	7933	29.2	C
4_Warringah Road/Currie Road_North	2150	29.7	C	2190	51.8	D	1591	10.2	A	1715	11.0	A
4_Warringah Road/Currie Road_North2	1438	53.7	D	1679	85.2	F	1020	28.4	B	1088	34.5	C
4_Warringah Road/Currie Road_East	206	61.5	E	203	63.7	E	130	61.3	E	133	62.6	E
4_Warringah Road/Currie Road_South	2745	6.3	A	2868	8.3	A	4195	4.2	A	4550	5.1	A
4_Warringah Road/Currie Road_West	186	68.3	E	173	74.3	F	117	63.3	E	137	61.4	E

Warringah Road/Currie Road	6725	27.3	B	7113	43.0	D	7053	11.1	A	7623	12.7	A
5_Warringah Road/Forest Way_North	1077	37.6	C	1540	48.6	D	745	42.7	C	959	58.6	E
5_Warringah Road/Forest Way_EastR	869	58.3	E	1042	86.5	F	1506	50.8	D	1526	54.7	D
5_Warringah Road/Forest Way_EastTh	296	47.1	D	60	59.0	E	331	33.5	C	192	32.0	C
5_Warringah Road/Forest Way_West	486	72.0	F	545	94.0	F	891	90.5	F	815	86.8	F
Warringah Road/Forest Way	2728	51.4	D	3187	69.0	E	3473	57.6	E	3492	62.0	E
6_Warringah Road/Hilmer Street_North	148	76.2	F	157	57.7	E	273	166.9	F	249	160.8	F
6_Warringah Road/Hilmer Street_East	1052	27.2	B	1070	17.5	B	1574	20.8	B	1525	18.4	B
6_Warringah Road/Hilmer Street_South	236	64.8	E	226	58.4	E	242	58.7	E	326	60.8	E
6_Warringah Road/Hilmer Street_West	1591	25.6	B	1758	26.7	B	1963	9.7	A	1959	17.4	B
Warringah Road/Hilmer Street	3027	31.7	C	3211	27.4	B	4052	27.5	B	4059	30.0	C
7_Warringah Road/Wakehurst Parkway_North	1159	97.9	F	1191	91.0	F	976	67.1	E	826	82.0	F
7_Warringah Road/Wakehurst Parkway_EastTh	693	76.8	F	590	67.5	E	994	70.7	F	858	49.3	D
7_Warringah Road/Wakehurst Parkway_EastL	110	49.9	D	244	49.5	D	58	31.6	C	185	26.2	B
7_Warringah Road/Wakehurst Parkway_SouthTh	583	59.8	E	650	120.3	F	506	54.8	D	654	74.2	F
7_Warringah Road/Wakehurst Parkway_SouthL	282	33.8	C	450	38.0	C	360	33.2	C	523	43.4	D
7_Warringah Road/Wakehurst Parkway_SouthR	30	82.6	F	53	80.9	F	94	68.1	E	87	77.2	F
7_Warringah Road/Wakehurst Parkway_WestTh	1344	54.4	D	1493	55.3	D	1412	58.1	E	1426	95.4	F
7_Warringah Road/Wakehurst Parkway_WestL	268	13.2	A	323	11.9	A	698	7.7	A	677	6.9	A
Warringah Road/Wakehurst Parkway	4469	66.2	E	4994	69.3	E	5098	53.2	D	5236	63.7	E
8_Warringah Road/Allambie Road_North	518	55.6	D	520	52.8	D	306	68.9	E	561	49.6	D
8_Warringah Road/Allambie Road_East	2079	41.2	C	2327	47.2	D	1910	33.2	C	2103	43.1	D
8_Warringah Road/Allambie Road_South	512	48.1	D	550	44.7	D	678	55.4	D	728	49.0	D
8_Warringah Road/Allambie Road_West	2015	36.5	C	2156	45.4	D	2245	29.4	C	2346	36.2	C
Warringah Road/Allambie Road	5124	41.5	C	5553	46.8	D	5139	36.6	C	5738	41.7	C

9_Warringah Road/Government Road_North	408	42.1	C	456	34.0	C	353	68.5	E	429	61.9	E
9_Warringah Road/Government Road_East	2502	19.6	B	2706	20.8	B	2370	44.4	D	2550	34.7	C
9_Warringah Road/Government Road_South	298	75.6	F	287	272.7	F	300	48.6	D	271	60.3	E
9_Warringah Road/Government Road_West	1741	39.4	C	1758	36.7	C	2383	44.4	D	2486	48.6	D
Warringah Road/Government Road	4949	31.8	C	5207	41.2	C	5406	46.2	D	5736	44.0	D
10_Frenchs Forest Road/Wakehurst Parkway_North	1077	63.6	E	1052	69.5	E	595	56.7	D	648	51.7	D
10_Frenchs Forest Road/Wakehurst Parkway_NorthL	197	4.0	A	188	5.0	A	156	2.1	A	215	5.8	A
10_Frenchs Forest Road/Wakehurst Parkway_East	459	21.2	B	615	37.5	C	386	43.6	D	485	36.4	C
10_Frenchs Forest Road/Wakehurst Parkway_EastL	91	17.4	B	82	14.4	B	170	18.6	B	114	28.8	B
10_Frenchs Forest Road/Wakehurst Parkway_South	514	68.8	E	474	76.3	F	968	81.9	F	944	67.1	E
10_Frenchs Forest Road/Wakehurst Parkway_SouthL	128	42.6	C	287	48.3	D	123	36.9	C	240	30.5	C
10_Frenchs Forest Road/Wakehurst Parkway_West	770	27.3	B	1114	29.9	C	908	34.9	C	1230	30.3	C
Frenchs Forest Road/Wakehurst Parkway	3236	44.0	D	3812	47.6	D	3306	51.3	D	3876	42.2	C
11_Frenchs Forest Road/Hospital_North	0	0.0	A	30	91.9	F	0	0.0	A	25	96.4	F
11_Frenchs Forest Road/Hospital_East	925	5.0	A	1293	10.5	A	689	7.5	A	1146	17.6	B
11_Frenchs Forest Road/Hospital_South	79	66.7	E	82	63.2	E	364	62.9	E	304	50.6	D
11_Frenchs Forest Road/Hospital_West	733	2.2	A	1047	4.5	A	588	4.0	A	934	13.1	A
Frenchs Forest Road/Hospital	1737	6.6	A	2452	10.7	A	1641	18.5	B	2409	20.9	B
12_Frenchs Forest Road/Town Centre_North	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A
12_Frenchs Forest Road/Town Centre_East	374	0.2	A	539	1.1	A	521	0.2	A	774	2.2	A
12_Frenchs Forest Road/Town Centre_South	74	0.8	A	498	23.6	B	83	3.2	A	561	25.7	B
12_Frenchs Forest Road/Town Centre_West	739	0.3	A	694	3.1	A	531	0.3	A	940	3.4	A
Frenchs Forest Road/Town Centre	1187	0.3	A	1731	8.4	A	1135	0.4	A	2275	8.5	A
13_Frenchs Forest Road/Rabbett Street_North	620	40.6	C	621	41.1	C	239	30.0	C	421	30.8	C

13_Frenchs Forest Road/Rabbett Street_East	356	18.1	B	586	13.5	A	460	13.9	A	694	13.1	A
13_Frenchs Forest Road/Rabbett Street_South	87	33.5	C	168	49.4	D	62	30.3	C	234	27.5	B
13_Frenchs Forest Road/Rabbett Street_West	286	9.9	A	358	12.6	A	366	4.6	A	886	22.9	B
Frenchs Forest Road/Rabbett Street	1349	27.7	B	1733	26.7	B	1127	15.2	B	2235	21.9	B
14_Frenchs Forest Road/Forest Way_North	2196	15.1	B	2488	24.6	B	1992	14.7	B	2057	33.8	C
14_Frenchs Forest Road/Forest Way_East	145	72.1	F	488	54.0	D	188	59.4	E	683	48.5	D
14_Frenchs Forest Road/Forest Way_South	1168	14.0	A	1314	31.5	C	2224	16.7	B	2554	28.8	B
Frenchs Forest Road/Forest Way	3509	17.1	B	4290	30.0	C	4404	17.6	B	5294	33.3	C
15_Wakehurst Parkway/Aquatic Drive_North	1157	6.3	A	1428	18.8	B	1405	6.1	A	1487	53.0	D
15_Wakehurst Parkway/Aquatic Drive_East	143	1.8	A	196	68.9	E	143	11.6	A	273	93.2	F
15_Wakehurst Parkway/Aquatic Drive_South	1037	4.6	A	1124	14.5	B	1027	5.2	A	1094	11.9	A
Wakehurst Parkway/Aquatic Drive	2337	5.3	A	2748	20.6	B	2575	6.1	A	2854	41.1	C
16_Allambie Road/Rodborough Road_North	1257	7.7	A	1438	6.0	A	871	1.5	A	1233	0.9	A
16_Allambie Road/Rodborough Road_East	297	8.1	A	286	6.3	A	691	5.9	A	750	9.2	A
16_Allambie Road/Rodborough Road_South	949	6.4	A	904	9.2	A	911	6.8	A	784	20.1	B
16_Allambie Road/Rodborough Road_West	12	9.5	A	66	4.0	A	43	7.8	A	33	9.7	A
Allambie Road/Rodborough Road	2515	7.2	A	2694	7.0	A	2516	4.7	A	2800	8.6	A

B.2 Level of service for 2036 scenarios

	2036 AM Peak Do Min (8-9am)			2036 AM Peak Project (8-9am)			2036 PM Peak Do Min (5-6pm)			2036 PM Peak Project (5-6pm)		
	Vol	Delay	LoS	Vol	Delay	LoS	Vol	Delay	LoS	Vol	Delay	LoS
1_Warringah Road/Forestville Ave_North	364	343.7	F	362	98.2	F	227	96.5	F	239	68.9	E
1_Warringah Road/Forestville Ave_East	3824	16.1	B	4215	19.4	B	2792	9.4	A	2608	10.3	A
1_Warringah Road/Forestville Ave_South	189	96.4	F	174	57.5	E	78	109.3	F	98	64.7	E
1_Warringah Road/Forestville Ave_West	2532	18.6	B	2666	16.5	B	4335	114.9	F	4083	67.7	E
Warringah Road/Forestville Ave	6909	36.5	C	7417	23.1	B	7432	74.7	F	7028	46.4	D
2_Warringah Road/Darley St_North	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A
2_Warringah Road/Darley St_East	3898	12.7	A	4260	16.8	B	2798	12.9	A	2601	8.7	A
2_Warringah Road/Darley St_South	207	59.3	E	247	57.2	E	222	53.7	D	214	54.4	D
2_Warringah Road/Darley St_West	2577	19.4	B	2672	48.0	D	4424	44.5	D	4141	14.7	B
Warringah Road/Darley St	6682	16.7	B	7179	29.8	C	7444	32.9	C	6956	13.7	A
3_Warringah Road/Starkey St_North	243	104.5	F	246	110.6	F	123	67.1	E	122	64.2	E
3_Warringah Road/Starkey St_East	3862	25.0	B	4275	31.6	C	2962	22.8	B	2682	16.8	B
3_Warringah Road/Starkey St_South	471	125.3	F	463	167.8	F	634	116.2	F	606	71.2	F
3_Warringah Road/Starkey St_West	2438	7.1	A	2571	10.1	A	4235	29.4	C	3945	20.2	B
Warringah Road/Starkey St	7014	28.3	B	7555	35.2	C	7954	34.5	C	7355	23.9	B
4_Warringah Road/Currie Road_North	2310	47.4	D	2375	122.8	F	1746	12.4	A	1715	9.6	A
4_Warringah Road/Currie Road_North2	1413	71.0	F	1696	158.6	F	1109	39.4	C	956	30.4	C
4_Warringah Road/Currie Road_East	231	64.3	E	221	63.3	E	135	62.3	E	126	60.9	E
4_Warringah Road/Currie Road_South	2810	7.0	A	2943	8.0	A	4547	5.1	A	4201	5.0	A
4_Warringah Road/Currie Road_West	192	82.3	F	176	69.7	E	137	62.0	E	118	64.1	E
Warringah Road/Currie Road	6956	37.4	C	7411	82.4	F	7674	13.7	A	7116	11.5	A

5_Warringah Road/Forest Way_North	1074	44.9	D	1573	54.0	D	983	70.9	F	770	45.5	D
5_Warringah Road/Forest Way_EastR	1009	72.4	F	947	145.0	F	1596	63.2	E	1467	49.8	D
5_Warringah Road/Forest Way_EastTh	246	43.5	D	136	56.6	D	208	28.4	B	255	25.5	B
5_Warringah Road/Forest Way_West	556	71.7	F	447	66.8	E	819	75.8	F	874	82.6	F
Warringah Road/Forest Way	2885	59.6	E	3103	83.8	F	3606	66.2	E	3366	55.5	D
6_Warringah Road/Hilmer Street_North	200	79.1	F	144	62.5	E	218	192.8	F	270	114.8	F
6_Warringah Road/Hilmer Street_East	1134	30.3	C	1036	18.9	B	1557	27.7	B	1488	22.4	B
6_Warringah Road/Hilmer Street_South	262	57.9	E	273	63.3	E	313	64.5	E	241	59.2	E
6_Warringah Road/Hilmer Street_West	1765	27.0	B	1620	25.9	B	1763	21.8	B	1944	11.9	A
Warringah Road/Hilmer Street	3361	33.6	C	3073	28.6	B	3851	37.3	C	3943	25.8	B
7_Warringah Road/Wakehurst Parkway_North	1248	82.3	F	1506	58.3	E	979	129.9	F	952	90.0	F
7_Warringah Road/Wakehurst Parkway_EastTh	733	91.2	F	434	74.2	F	817	72.8	F	941	73.0	F
7_Warringah Road/Wakehurst Parkway_EastL	87	44.5	D	130	45.8	D	109	47.6	D	32	20.1	B
7_Warringah Road/Wakehurst Parkway_SouthTh	631	58.4	E	720	100.2	F	777	60.2	E	527	54.6	D
7_Warringah Road/Wakehurst Parkway_SouthL	342	29.0	C	563	43.1	D	658	25.8	B	365	31.0	C
7_Warringah Road/Wakehurst Parkway_SouthR	40	78.5	F	59	61.9	E	100	67.3	E	94	74.8	F
7_Warringah Road/Wakehurst Parkway_WestTh	1480	66.8	E	1425	45.7	D	1169	144.1	F	1418	66.9	E
7_Warringah Road/Wakehurst Parkway_WestL	325	16.4	B	312	13.9	A	691	9.3	A	673	7.2	A
Warringah Road/Wakehurst Parkway	4886	67.1	E	5149	57.4	E	5300	82.5	F	5002	60.3	E
8_Warringah Road/Allambie Road_North	552	78.2	F	541	50.3	D	515	68.8	E	394	63.2	E
8_Warringah Road/Allambie Road_East	2325	51.5	D	2446	51.8	D	2132	43.5	D	2010	38.6	C
8_Warringah Road/Allambie Road_South	539	43.5	D	600	53.5	D	659	46.3	D	743	51.3	D
8_Warringah Road/Allambie Road_West	2136	35.5	C	2324	43.0	D	2387	37.9	C	2350	33.3	C
Warringah Road/Allambie Road	5552	47.2	D	5911	48.4	D	5693	43.8	D	5497	39.8	C
9_Warringah Road/Government Road_North	432	36.2	C	453	36.3	C	437	80.8	F	403	60.3	E

9_Warringah Road/Government Road_East	2715	23.0	B	2854	24.2	B	2599	41.5	C	2439	39.5	C
9_Warringah Road/Government Road_South	305	96.9	F	276	176.9	F	271	128.5	F	292	49.4	D
9_Warringah Road/Government Road_West	1855	37.0	C	1810	36.9	C	2494	56.4	D	2420	57.5	E
Warringah Road/Government Road	5307	33.2	C	5393	37.3	C	5801	54.9	D	5554	49.4	D
10_Frenchs Forest Road/Wakehurst Parkway_North	1057	58.6	E	1104	66.9	E	652	70.3	F	628	56.4	D
10_Frenchs Forest Road/Wakehurst Parkway_NorthL	202	5.5	A	161	4.1	A	198	5.1	A	149	2.0	A
10_Frenchs Forest Road/Wakehurst Parkway_East	469	25.4	B	687	57.1	E	480	35.3	C	443	39.2	C
10_Frenchs Forest Road/Wakehurst Parkway_EastL	109	18.6	B	161	28.9	B	154	37.0	C	170	19.4	B
10_Frenchs Forest Road/Wakehurst Parkway_South	562	68.0	E	539	47.3	D	1000	61.6	E	966	69.2	E
10_Frenchs Forest Road/Wakehurst Parkway_SouthL	156	43.8	D	273	66.1	E	303	15.5	B	124	36.3	C
10_Frenchs Forest Road/Wakehurst Parkway_West	885	28.8	B	1373	59.7	E	1351	39.0	C	945	37.6	C
Frenchs Forest Road/Wakehurst Parkway	3440	42.9	C	4298	56.7	D	4138	45.6	D	3425	47.7	D
11_Frenchs Forest Road/Hospital_North	0	0.0	A	53	85.8	F	19	89.9	F	0	0.0	A
11_Frenchs Forest Road/Hospital_East	876	4.7	A	1340	11.6	A	1216	16.7	B	783	8.6	A
11_Frenchs Forest Road/Hospital_South	68	76.6	F	110	70.2	F	257	57.6	E	401	65.5	E
11_Frenchs Forest Road/Hospital_West	858	3.3	A	1273	5.8	A	1069	9.6	A	586	6.6	A
Frenchs Forest Road/Hospital	1802	6.7	A	2776	12.7	A	2561	18.4	B	1770	20.8	B
12_Frenchs Forest Road/Town Centre_North	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A
12_Frenchs Forest Road/Town Centre_East	335	0.3	A	537	2.5	A	732	3.6	A	611	0.2	A
12_Frenchs Forest Road/Town Centre_South	71	0.4	A	382	16.8	B	443	25.8	B	83	3.4	A
12_Frenchs Forest Road/Town Centre_West	844	0.2	A	805	2.8	A	976	4.2	A	529	0.3	A
Frenchs Forest Road/Town Centre	1250	0.3	A	1724	5.8	A	2151	8.4	A	1223	0.5	A

13_Frenchs Forest Road/Rabbett Street_North	660	52.9	D	627	60.5	E	585	24.4	B	260	35.5	C
13_Frenchs Forest Road/Rabbett Street_East	293	18.4	B	567	27.6	B	644	20.0	B	548	16.6	B
13_Frenchs Forest Road/Rabbett Street_South	79	31.0	C	311	25.1	B	464	33.9	C	68	25.0	B
13_Frenchs Forest Road/Rabbett Street_West	377	12.5	A	597	18.5	B	816	35.3	C	362	5.5	A
Frenchs Forest Road/Rabbett Street	1409	33.7	C	2102	34.5	C	2509	28.6	B	1238	17.8	B
14_Frenchs Forest Road/Forest Way_North	2382	18.8	B	2518	75.9	F	1913	42.6	C	2050	19.5	B
14_Frenchs Forest Road/Forest Way_East	137	82.6	F	581	60.3	E	636	51.5	D	375	70.2	F
14_Frenchs Forest Road/Forest Way_South	1302	15.5	B	1273	24.8	B	2574	31.7	C	2155	21.4	B
Frenchs Forest Road/Forest Way	3821	19.9	B	4372	58.9	E	5123	38.2	C	4580	24.5	B
15_Wakehurst Parkway/Aquatic Drive_North	1230	6.4	A	1385	34.9	C	1302	87.5	F	1432	6.7	A
15_Wakehurst Parkway/Aquatic Drive_East	143	3.0	A	478	45.2	D	602	75.3	F	165	15.0	B
15_Wakehurst Parkway/Aquatic Drive_South	1147	4.4	A	1188	59.3	E	1156	27.7	B	1072	6.9	A
Wakehurst Parkway/Aquatic Drive	2520	5.3	A	3051	46.0	D	3060	62.5	E	2669	7.3	A
16_Allambie Road/Rodborough Road_North	281	6.6	A	1525	7.0	A	1126	0.7	A	706	6.0	A
16_Allambie Road/Rodborough Road_East	1232	6.4	A	284	4.0	A	770	7.8	A	849	1.2	A
16_Allambie Road/Rodborough Road_South	952	5.2	A	745	11.2	A	574	9.0	A	926	11.1	A
16_Allambie Road/Rodborough Road_West	23	5.0	A	18	7.1	A	32	9.3	A	36	9.2	A
Allambie Road/Rodborough Road	2488	5.9	A	2572	7.9	A	2502	4.9	A	2517	6.3	A

B.3 Level of service for 2036 Beaches Link scenarios

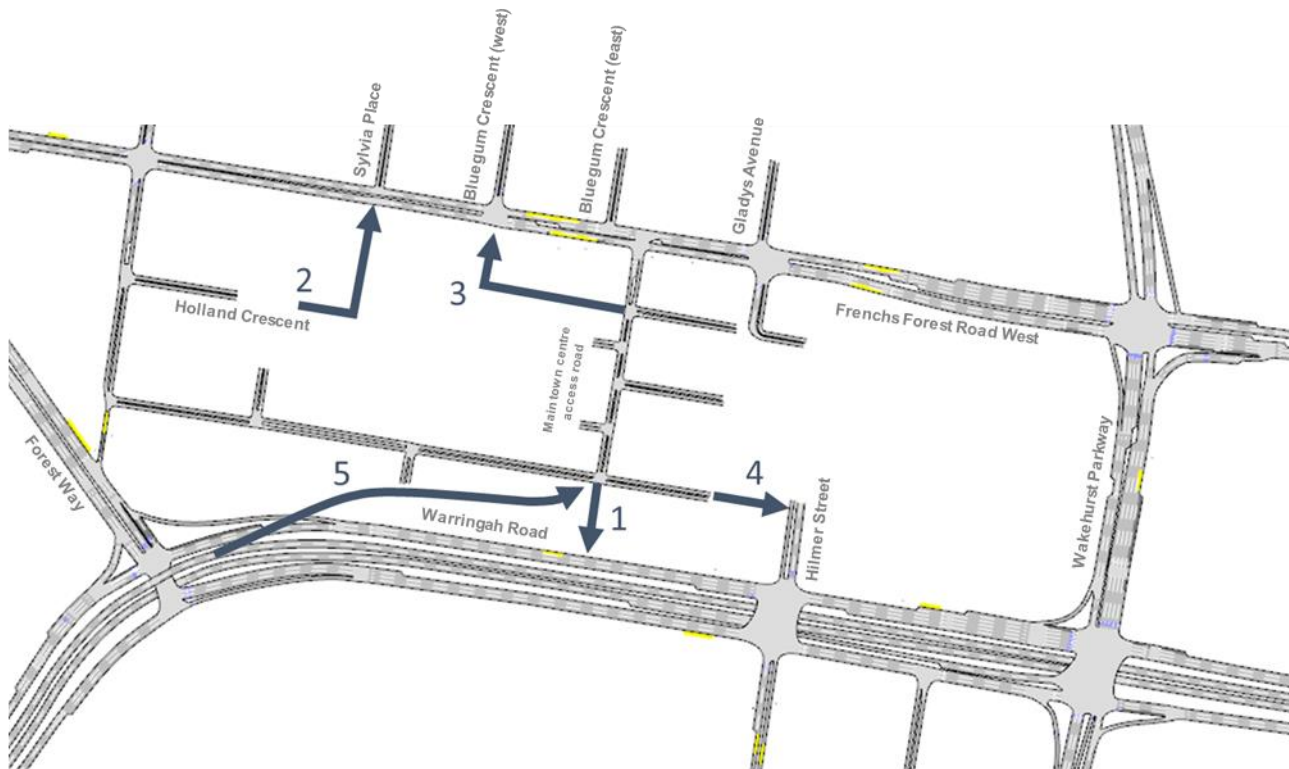
	2036 AM Peak Beaches Link (8-9am)			2036 PM Beaches Link (5-6pm)		
	Vol	Delay	LoS	Vol	Delay	LoS
1_Warringah Road/Forestville Ave_North	340	120.6	F	202	101.4	F
1_Warringah Road/Forestville Ave_East	2999	12.8	A	2144	10.3	A
1_Warringah Road/Forestville Ave_South	178	185.6	F	97	142.6	F
1_Warringah Road/Forestville Ave_West	2355	15.6	B	4052	30.8	C
Warringah Road/Forestville Ave	5872	25.4	B	6495	27.9	B
2_Warringah Road/Darley St_North	0	0.0	A	0	0.0	A
2_Warringah Road/Darley St_East	3139	7.8	A	2253	7.3	A
2_Warringah Road/Darley St_South	202	67.2	E	212	63.6	E
2_Warringah Road/Darley St_West	2496	11.5	A	4115	13.5	A
Warringah Road/Darley St	5837	11.4	A	6580	13.0	A
3_Warringah Road/Starkey St_North	237	94.1	F	148	66.5	E
3_Warringah Road/Starkey St_East	3180	14.1	B	2486	21.4	B
3_Warringah Road/Starkey St_South	458	177.1	F	617	73.6	F
3_Warringah Road/Starkey St_West	2434	5.8	A	3981	23.2	B
Warringah Road/Starkey St	6309	25.7	B	7232	27.8	B
4_Warringah Road/Currie Road_North	1737	20.6	B	1571	9.9	A
4_Warringah Road/Currie Road_North2	1310	48.9	D	861	30.0	C
4_Warringah Road/Currie Road_East	226	63.4	E	131	67.4	E
4_Warringah Road/Currie Road_South	2840	6.8	A	4343	4.4	A
4_Warringah Road/Currie Road_West	188	58.7	E	140	69.7	E
Warringah Road/Currie Road	6301	22.9	B	7046	11.2	A

5_Warringah Road/Forest Way_North	1415	52.6	D	823	56.8	D
5_Warringah Road/Forest Way_EastR	985	215.3	F	1658	178.9	F
5_Warringah Road/Forest Way_EastTh	27	62.3	E	130	51.3	D
5_Warringah Road/Forest Way_West	487	71.5	F	913	83.0	F
Warringah Road/Forest Way	2914	110.9	F	3524	120.8	F
6_Warringah Road/Hilmer Street_North	161	108.6	F	141	306.5	F
6_Warringah Road/Hilmer Street_East	1078	12.0	A	1648	21.3	B
6_Warringah Road/Hilmer Street_South	286	99.3	F	324	142.5	F
6_Warringah Road/Hilmer Street_West	1634	177.7	F	2107	33.9	C
Warringah Road/Hilmer Street	3159	110.5	F	4220	46.5	D
7_Warringah Road/Wakehurst Parkway_North	1413	72.7	F	964	80.7	F
7_Warringah Road/Wakehurst Parkway_EastTh	399	85.3	F	715	68.8	E
7_Warringah Road/Wakehurst Parkway_EastL	352	45.5	D	373	34.1	C
7_Warringah Road/Wakehurst Parkway_SouthTh	857	62.8	E	1042	59.5	E
7_Warringah Road/Wakehurst Parkway_SouthL	725	30.9	C	904	39.9	C
7_Warringah Road/Wakehurst Parkway_SouthR	95	64.9	E	98	65.4	E
7_Warringah Road/Wakehurst Parkway_WestTh	1676	210.1	F	1562	143.2	F
7_Warringah Road/Wakehurst Parkway_WestL	219	35.5	C	606	9.0	A
Warringah Road/Wakehurst Parkway	5736	103.7	F	6264	75.6	F
8_Warringah Road/Allambie Road_North	625	67.3	E	532	57.6	E
8_Warringah Road/Allambie Road_East	2422	98.3	F	2065	40.5	C
8_Warringah Road/Allambie Road_South	562	47.2	D	721	47.4	D
8_Warringah Road/Allambie Road_West	2428	50.0	D	2442	38.9	C
Warringah Road/Allambie Road	6037	70.9	F	5760	42.3	C
9_Warringah Road/Government Road_North	513	47.2	D	377	72.9	F

9_Warringah Road/Government Road_East	2828	21.2	B	2554	41.1	C
9_Warringah Road/Government Road_South	188	293.5	F	268	134.3	F
9_Warringah Road/Government Road_West	1774	39.2	C	2513	55.6	D
Warringah Road/Government Road	5303	39.4	C	5712	53.9	D
10_Frenchs Forest Road/Wakehurst Parkway_North	1060	63.2	E	670	51.0	D
10_Frenchs Forest Road/Wakehurst Parkway_NorthL	166	5.9	A	166	4.1	A
10_Frenchs Forest Road/Wakehurst Parkway_East	784	48.8	D	509	36.2	C
10_Frenchs Forest Road/Wakehurst Parkway_EastL	141	24.4	B	123	29.1	C
10_Frenchs Forest Road/Wakehurst Parkway_South	533	61.6	E	936	67.2	E
10_Frenchs Forest Road/Wakehurst Parkway_SouthL	235	78.3	F	348	29.0	C
10_Frenchs Forest Road/Wakehurst Parkway_West	1535	97.7	F	1139	31.7	C
Frenchs Forest Road/Wakehurst Parkway	4454	69.8	E	3891	42.6	C
11_Frenchs Forest Road/Hospital_North	101	70.3	F	30	67.4	E
11_Frenchs Forest Road/Hospital_East	1334	14.0	A	1314	25.0	B
11_Frenchs Forest Road/Hospital_South	87	69.6	E	146	55.6	D
11_Frenchs Forest Road/Hospital_West	1499	13.5	A	958	8.6	A
Frenchs Forest Road/Hospital	3021	17.2	B	2448	20.9	B
12_Frenchs Forest Road/Town Centre_North	0	0.0	A	0	0.0	A
12_Frenchs Forest Road/Town Centre_East	542	1.8	A	787	2.5	A
12_Frenchs Forest Road/Town Centre_South	457	13.2	A	442	25.1	B
12_Frenchs Forest Road/Town Centre_West	1082	16.6	B	860	2.9	A
Frenchs Forest Road/Town Centre	2081	12.0	A	2089	7.4	A
13_Frenchs Forest Road/Rabbett Street_North	770	95.1	F	437	75.9	F
13_Frenchs Forest Road/Rabbett Street_East	571	30.8	C	697	45.1	D
13_Frenchs Forest Road/Rabbett Street_South	455	33.2	C	486	42.5	C

13_Frenchs Forest Road/Rabbett Street_West	780	30.5	C	840	57.0	D
Frenchs Forest Road/Rabbett Street	2576	50.4	D	2460	54.1	D
14_Frenchs Forest Road/Forest Way_North	2428	57.6	E	2006	81.7	F
14_Frenchs Forest Road/Forest Way_East	727	53.4	D	770	77.3	F
14_Frenchs Forest Road/Forest Way_South	1277	25.1	B	2492	35.0	C
Frenchs Forest Road/Forest Way	4432	47.5	D	5268	59.0	E
15_Wakehurst Parkway/Aquatic Drive_North	2016	28.2	B	1964	17.2	B
15_Wakehurst Parkway/Aquatic Drive_East	604	48.5	D	517	89.9	F
15_Wakehurst Parkway/Aquatic Drive_South	1455	24.3	B	1770	23.1	B
Wakehurst Parkway/Aquatic Drive	4075	29.8	C	4251	28.5	B
16_Allambie Road/Rodborough Road_North	1696	5.6	A	1126	0.9	A
16_Allambie Road/Rodborough Road_East	298	6.3	A	767	8.7	A
16_Allambie Road/Rodborough Road_South	683	4.9	A	640	9.9	A
16_Allambie Road/Rodborough Road_West	46	7.0	A	38	7.0	A
Allambie Road/Rodborough Road	2723	5.5	A	2571	5.5	A

Appendix C. Town centre access options



Option	Opportunities	Constraints
Original layout	<ul style="list-style-type: none"> Easiest to implement Least impact to wider road network 	<ul style="list-style-type: none"> Traffic concentrated at northern end of precinct – exceeds Roads and Maritime's limits No direct access to Warringah Road Requires closely spaced intersection to Northern Beaches Hospital access
1 – Original layout with Warringah Road left in/left out access	<ul style="list-style-type: none"> Reduces internal road flows Allows for left in/left out access to/from Warringah Road 	<ul style="list-style-type: none"> Potential safety issue due to weaving conflicts for vehicles turning left into the precinct Further construction and road closures required on Warringah Road Loss of existing trees and green space
2 – Original layout with Holland Crescent access	<ul style="list-style-type: none"> Reduces internal road flows New intersection operates satisfactorily during the AM and PM peak periods 	<ul style="list-style-type: none"> Loss of proposed green space Still results in traffic concentrated at northern end of precinct No direct access to Warringah Road Located away from Frenchs Forest Planned Precinct land uses
3 – Original layout with Bluegum Crescent (west) access	<ul style="list-style-type: none"> Reduces internal road flows Located close to Frenchs Forest Planned Precinct land uses Utilises existing traffic signals and access to The Forest High School carpark on the south approach Modified intersection operates satisfactorily during the AM and PM peak periods 	<ul style="list-style-type: none"> Loss of proposed green space Still results in traffic concentrated at northern end of precinct No direct access to Warringah Road
4 – Original layout with Hilmer Street access	<ul style="list-style-type: none"> Low internal road flows i.e. good result for amenity and pedestrian safety Allows for direct access to/from Warringah Road 	<ul style="list-style-type: none"> Requires Health Infrastructure/Healthscope approval Requires allowance of the right turn from Hilmer Street onto Warringah Road
5 – Original layout with entry from Warringah Road slot access	<ul style="list-style-type: none"> Reduces internal road flows No impact to existing trees or green space 	<ul style="list-style-type: none"> Substantial cost and works on newly constructed asset Only allows movements into town centre