Northern Beaches Hospital
Transport Study

Detailed Transport Assessment

Prepared for Northern Beaches Council, Roads and Maritime Services and Transport for NSW

Issue | 22 November 2016

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Executive Summary

Arup was engaged by Northern Beaches Council (former Warringah Council), Roads and Maritime (RMS) and Transport for NSW (TfNSW) in 2015 to undertake a detailed transport assessment of the road network surrounding the Northern Beaches Hospital (NBH) to inform the finalisation of the draft Hospital Precinct Structure Plan.

The purpose of the Study was to undertake a strategic review of the preferred growth scenarios included in the draft Hospital Precinct Structure Plan from a transport network and operations perspective.

Following the community and business workshops on the draft Hospital Precinct Structure Plan held by Northern Beaches Council in October and November 2014, discussions were held with relevant NSW Government agencies to discuss the future transport requirements of the precinct over the next 20 years.

More traffic and transport modelling was identified as being required to ensure the future transport network could support the increased growth identified for the Strategic Centre in the draft Structure Plan, beyond what was identified by the new Hospital development.

This meant the preparation of the Draft Hospital Precinct Structure Plan was put on hold while a detailed transport assessment was undertaken. This process has enabled the identification of the level of growth that could be accommodated in the precinct over the next 20 years to be determined based on the function and operation of the traffic and transport networks surrounding the hospital precinct.

To support the opening of the new Northern Beaches Hospital at Frenchs Forest, Road and Maritime Services (RMS) is upgrading roads around the new hospital site. This includes the Stage 1 Connectivity Works being road works to enhance connectivity to the hospital, and Stage 2 Network Enhancement Works being works to improve the broader road network capacity.

The road upgrades cater for the additional traffic generated as a result of the new hospital development. However it does not cater for the additional growth anticipated in the draft Hospital Precinct Structure Plan as a result of Frenchs Forest being identified as a Strategic Centre. Further road upgrades will be needed to sustain Frenchs Forest as a successful strategic centre.

As part of this transport study, four growth scenarios were developed based on the challenges and opportunities identified. The scenarios altered the location and mix of land uses within the hospital precinct. The four scenarios were assessed based on a high level Multi Criteria Assessment (MCA) which reviewed the ability of each scenario to support the principles of:

- Integrating land use and transport.
- Encouraging public and active transport use.
- Facilitating accessible, pleasant and safe environments.
- Reducing the need to travel.

A high level assessment of how the road and transport networks surrounding the hospital precinct might respond to each growth scenario was undertaken, and the
potential need for infrastructure upgrades was identified. Based on this, a preferred scenario for the location and mix of land uses within the hospital precinct was identified.

The preferred scenario results in less residents and less workers being accommodated than was previously envisaged by the growth scenarios discussed during the community and business workshops in October and November 2014.

Modelling for the preferred growth scenario predicted the detailed traffic operations on the local road network in 2036 and was used to test if any local area road upgrades were required to further enhance traffic capacity and hence ensure the objectives were met for the strategic centre.

The modelling outcomes were:

- Results suggested Frenchs Forest Road West would accommodate the Strategic Centre’s traffic. The models’ improved signal phasing and signal coordination along the corridor can accommodate the increases in vehicle trips.
- Further investigations (land use and traffic modelling work) of the local road network is required to unlock additional capacity to ensure the Strategic Centre is effectively delivered.

Following adoption of the preferred growth scenario and Stage 2 traffic modelling assessment, further refinement occurred to consider two local issues associated with delivery of the structure plan and road network improvements:

- Relocation of The Forest High School to the Warringah Aquatic Centre site on Aquatic Drive.
- Adjustment to the urban density along the southern boundary of the RMS Stage 2 Network Enhancement Works to respond to the changing road environment.

Traffic assessment undertaken for both of these refinements found that they could be accommodated by the RMS road upgrade projects.

This Study has identified a preferred land use scenario with consideration of traffic and transport impacts to inform the draft Hospital Precinct Structure Plan. It has also provided the opportunity to align the NSW Government road network upgrades being implemented as part of the Northern Beaches Hospital with the development of the Northern Beaches Hospital Precinct as a Strategic Centre for the region taking account of the potential growth that would be stimulated as a result of this.
1 Introduction

1.1 The purpose of this study

Arup was engaged by Northern Beaches Council, Roads and Maritime (RMS) and Transport for NSW (TfNSW) in 2015 to undertake a detailed transport assessment of the road network surrounding the Northern Beaches Hospital (NBH) to inform the finalisation of the draft Hospital Precinct Structure Plan.

The purpose of the Study was to undertake a strategic review of the preferred growth scenarios included in the draft Hospital Precinct Structure Plan from a transport network and operations perspective.

Following the community and business workshops on the draft Hospital Precinct Structure Plan held by Northern Beaches Council in October and November 2014, discussions were held with relevant NSW Government agencies to discuss the future transport requirements of the precinct over the next 20 years.

More traffic and transport modelling was identified as being required to ensure the future transport network could support the increased growth identified for the Strategic Centre in the draft Structure Plan, beyond what was identified by the new Hospital development.

This meant the preparation of the Draft Hospital Precinct Structure Plan was put on hold while a detailed transport assessment was undertaken. This process has enabled the identification of the level of growth that could be accommodated in the precinct over the next 20 years to be determined based on the function and operation of the traffic and transport networks surrounding the hospital precinct.

The process involved developing and assessing four alternative growth scenarios to understand the impact and influence of development uplift on the surrounding transport network, and identify potential network improvement options that would support the future growth generated by the development of a Strategic Centre for the area.

The preferred growth scenario that was identified was then taken forward to the second stage of the process, undertaking a detailed traffic modelling assessment along the Frenchs Forest Road West corridor. This work has informed the development of the final Hospital Precinct Structure Plan.

This Study has provided the opportunity to align the NSW Government road network upgrades being implemented as part of the Northern Beaches Hospital, and the development of the Northern Beaches Hospital Precinct as a Strategic Centre for the region and the growth that would be stimulated as a result of this.
1.2 Project Working Group

The organisational chart shown in Figure 1 identifies the inter-agency structure of the Project Working Group (PWG) that guided the Northern Beaches Hospital Transport Study.

![PWG Organisational Structure](image)

1.3 The study area

The study area for the Northern Beaches Hospital Transport Study, shown in Figure 2, extended beyond the Hospital Precinct Structure Plan to ensure a holistic transport assessment was undertaken, taking into consideration the wider context and its influence and impact on the hospital precinct.

![Northern Beaches Hospital Transport Study – Study Area](image)
The study area encompassed the suburbs of Frenchs Forest, Forestville, Killarney Heights, part of southern Belrose, part of western Beacon Hill, and part of northern Allambie Heights.

The wider study area ensured that an integrated transport assessment could be undertaken, giving consideration to the travel behaviours of the community surrounding the hospital precinct to develop a clear understanding of the demands for travel in the region, and the influences on the transport network and its performance and operation within the hospital precinct.

1.4 Strategic context

1.4.1 Northern Beaches Hospital

On 2 May 2013 the NSW Minister for Health, The Hon. Jillian Skinner MP announced that expressions of interest would be invited from the private sector to design, construct, operate and maintain a world-class hospital at Frenchs Forest.

A new Level 5 hospital is currently being constructed at Frenchs Forest to serve the Northern Beaches community. The nine-storey high facility, includes a multi-storey 1,400 space car park and helipad. The project is valued at approximately $1 billion, including $400 million in road upgrades set to be completed before completion in 2018.

The new hospital will contain 488 hospital beds, bringing the total number of beds available on the Northern Beaches to 554, and employ 1,300 staff, increasing the existing workforce by 400. In addition, 700 jobs will be created during the construction of the hospital. Construction began in early 2015, and the hospital is scheduled to open in 2018.

1.4.2 Northern Beaches Hospital Road Connectivity and Network Enhancement Project

To support the opening of the new Northern Beaches Hospital at Frenchs Forest, RMS is upgrading roads around the new hospital site, with work planned to be completed in time for the hospital opening in 2018. These upgrades will provide customers with a better travel experience, increase the capacity of the road network and improve access through the area, including for pedestrians and cyclists.

The proposal involves a staged infrastructure application that sets out the Concept Proposal for works to arterial and sub-arterial roads in the Northern Beaches Hospital precinct at Frenchs Forest. The Concept Proposal includes:

- Stage 1 Connectivity Works being road works to enhance connectivity to the hospital, approved June 2015.
- Stage 2 Network Enhancement Works being works to improve the broader road network capacity, approved February 2016.
- Utility relocation and ancillary works for construction such as compound sites and sedimentation basins, for both stages of the proposal.
The Environmental Impact Statement (EIS) undertaken for the Stage 2 Network Enhancement Works outlines the employment and housing assumptions adopted in the modelling for the RMS’s Northern Beaches Hospital Road Connectivity and Network Enhancement project. The employment and housing assumptions adopted in the modelling are based on growth forecasts to the year 2028 by the Bureau of Transport Statistics (BTS).

The road upgrades cater for the additional traffic generated as a result of the new hospital development and background traffic growth. However, as outlined in Section 1.6, lower population yields were used in the RMS modelling than was developed as part of the original draft Hospital Precinct Structure Plan as a result of Frenchs Forest being identified as a Strategic Centre.

A key measure of the performance of the road network model is “unreleased demand”. This is a measure of the traffic demand that is unable to be accommodated by the capacity of the road network during the period of the model simulation, due to sustained high levels of congestion within the area over the model period. In reality, this presents itself as queuing on the approaches to the area network and an extended duration of congested conditions.

The modelling results provided in Chapter 5 of the Northern Beaches Hospital Stage 2 EIS - Network Enhancement Works Traffic and Transport Impact, indicate that under the Do Minimal Case, approximately 12-14 percent in 2018 and 10-17 percent in 2028 of the peak period traffic demands would be unable to enter the modelled study area during each three hour peak period. The 2012 Base Condition modelling indicates that currently only 2 percent of peak hour traffic demands are unable to enter the modelled study area during each of the peak periods. This indicates the existing road network is at capacity to service current demands, and unable to accommodate the predicted increase in background traffic volumes and additional traffic generated by the Northern Beaches Hospital development.

While the infrastructure upgrade proposed as part of Stage 1 Project will assist in alleviating the congestion, the additional infrastructure proposed as part of the Stage 2 Project is expected to mitigate the full impacts of the Northern Beaches Hospital development and background traffic growth.

As the design of the Stage 2 Project has been developed to accommodate the predicted increase in background traffic volumes and likely additional traffic generated by the Northern Beaches Hospital, it is not expected that there will be excess road capacity during the AM and PM peak periods to accommodate induced demands from other nearby roads.

It is further noted that whilst the Stage 2 Project includes upgrades that increases capacity on Warringah Road between Fitzpatrick Avenue and Allambie Road it does not increase the capacity of the broader Warringah Road or Forest Way corridors. In this regard it is predicted that increased congestion will be present at the adjacent intersections to the study area, including:

- Warringah Road/ Government Road
- Forest Way/ Adams Street
- Warringah Road/ Currie Road/ Brown Street.
Future works will be required at these intersections to alleviate the congestion caused by the additional traffic present on the network.

1.4.3 A Plan for Growing Sydney

In December 2014 the NSW Government released *A Plan for Growing Sydney*. This provides a 20 year planning and land use strategy for the Sydney metropolitan area. The strategy outlines four key objectives, those being:

- Improve access for Sydney’s residents between their homes, place of work, open space areas and their local centres.
- Make a wider variety of housing available to suit the changing demographics of Sydney.
- Deliver new infrastructure to support the growth of the city.
- Maintain a sustainable city which safeguards environmentally significant areas across Sydney.

The plan aims to balance the need to accelerate housing production with a desire for high levels of amenity and the creation of strong and resilient communities within a highly liveable city. The facilitation of more homes and jobs co-ordinated with infrastructure delivery in and around centres and along key public transport corridor is a key strategy for the achievement of these priorities.

Of particular relevance to the NBH Precinct, *A Plan for Growing Sydney* identifies the precinct as a Strategic Centre with the following objectives:

- Deliver a new Northern Beaches Hospital.
- Support health-related land uses and infrastructure around the Northern Beaches Hospital site.
- Work with council to protect capacity for employment growth beyond the Northern Beaches Hospital site.
- Work with council to provide capacity for additional mixed-use development in Northern Beaches Hospital Precinct including offices, health, retail, services and housing.
- Support the preparation of a precinct structure plan in partnership with council to guide future development of the area.
- Progress planning for road improvements supporting Northern Beaches Hospital Precinct, including underpasses on Warringah Road at Forest Way and Wakehurst Parkway.
- Progress planning for a new public transport interchange servicing Northern Beaches Hospital Precinct.
- Improve walking and cycling connections between the different parts of Northern Beaches Hospital Precinct and to its surrounding area.
1.4.4 Draft Hospital Precinct Structure Plan

The area around the Northern Beaches Hospital at Frenchs Forest was identified as a potential specialised precinct for health purposes, by the Department of Planning and Environment (DPE) as part of the 2013 Draft Metropolitan Strategy.

The area was identified as a specialist precinct by the NSW Government because of the potential for economic opportunities associated with the development of the new hospital.

In order to implement DPE’s strategic direction, in 2014, Northern Beaches Council engaged consultants, Hames Sharley, to prepare a Precinct Structure Plan to guide future land uses and development around the new Northern Beaches Hospital at Frenchs Forest.

The project considered the implications of the hospital project on the wider area, including the environmental, social, economic, traffic, transport and accessibility issues surrounding the hospital site, and a mix of open space and development opportunities.

The aim of the Draft Structure Plan is to create an innovative precinct that stimulates economic growth and provides friendly and accessible spaces for the public. One of the key features of the project is to identify sustainable transport options as part of the new health precinct.

Community consultation on the Draft Structure Plan was held in October and November 2014. Following this process, consultation was held with state agencies including RMS, TfNSW & DPE. Critical to these discussions was the need to obtain commitment from all state agencies prior to finalising the draft Structure Plan. This commitment was not reached with RMS & TfNSW who identified the need for a more detailed transport assessment. This included network modelling to understand the impacts of extra dwellings and businesses surrounding the hospital site on the wider transport network.

In order to help plan the best locations for housing and employment growth, and to ensure future transport infrastructure upgrades are available when needed, the draft Hospital Precinct Structure Plan was put on hold while this work was completed.

1.4.5 Northern Beaches Hospital Transport Study (This Study)

In 2015, RMS, TfNSW and Council agreed to carry out and fund a more detailed transport assessment including network modelling. Arup was engaged to undertake this work. The study involved a two stage process, which is outlined below.

Stage One

Stage One analysed the transport influencers and impacts on the Frenchs Forest Strategic Centre to help inform the identification of the most appropriate growth scenario for the precinct from a transport and accessibility perspective. A key component of this stage was the identification of four growth scenarios. Numerous meetings were held with the PWG to discuss and sign off on a preferred growth scenario. No commitment was obtained for any of the preferred
growth scenarios. In December 2015, RMS requested further detailed evaluation of scenarios. Arup completed this and agreement was reached at the following PWG meeting on 9 March 2016. Stage Two was then able to commence.

**Stage Two**

Stage Two involved a detailed evaluation of the preferred land use scenario using VISSIM modelling (microscopic multi-modal traffic flow simulation software package) to understand the impacts on the function and operation of the surrounding transport network from the proposed land use changes.

Once this work was completed and the results of a preferred growth scenario presented to the PWG for approval, Council was able to recommence the preparation of the draft Hospital Precinct Structure Plan.

Figure 3 below identifies the previous indicative work streams described above and how this Study precipitated.

![Figure 3: Indicative work streams](image)

**1.5 Methodology**

The employment and housing assumptions adopted in the modelling for RMS’s Northern Beaches Hospital Road Connectivity and Network Enhancement project was prior to the Northern Beaches Hospital precinct being identified as a Strategic Centre. It therefore did not include the level of growth that would normally be associated with a new ‘Strategic Centre’.

As a result, the road network surrounding the Northern Beaches Hospital development has a limited capacity to accommodate additional growth beyond what was assumed in the RMS model.

This report outlines the extent to which additional growth can be accommodated on the surrounding road network to inform the development of the draft Structure Plan for the wider precinct.

As outlined previously, this Study has been undertaken in two stages which are detailed in the following sections. A two stage process was identified by the PWG to ensure the future growth scenario to be taken forward to the traffic modelling...
assessment was informed by an initial high level integrated land use and transport assessment.

Since RMS had completed their analysis for the Northern Beaches Hospital Road Network Upgrades, the NSW Government had released updated land use forecasts, altering the previously expected growth for the future. An understanding of the new forecast growth for the precinct and the travel behaviours that would influence the impact of additional growth on the function and operation of the surrounding transport networks was required to inform the development of achievable growth scenarios.

1.5.1 Stage One – Identification of a preferred growth scenario

Stage One involved the following:

- A review of existing strategic land use and transport plans and policies for the area.
- Understanding the two traffic models previously created by RMS for the Northern Beaches Hospital Road Network Upgrades.
- Understanding the amount and location of future population and employment growth predicted for the area.
- Understanding why people travel, how people travel and where people travel both now and in the future for the area.
- Understanding how the road network surrounding the hospital precinct would operate in the future with the road upgrades being delivered by the NSW Government, and the predicted traffic growth informed by travel forecasts provided by Transport for NSW for the area.
- Identification of where potential spare capacity might be available on the surrounding road network following the RMS road upgrades to accommodate further growth and development, and what travel demands and influences could support further growth and development in the hospital precinct.
- Development of four growth scenarios in collaboration with Northern Beaches Council based on the objectives of:
  - Integrating land use and transport
  - Supporting the use of public and active transport
  - Facilitating accessible, amenable and safe environments
  - Reducing the need to travel through trip containment and co-location of uses.
- A high level assessment of how the road and transport networks surrounding the hospital precinct would respond to the growth scenarios developed, and their potential for infrastructure upgrade requirements.
- Comparison of the growth scenarios using a Multi Criteria Assessment (MCA) to identify a preferred scenario that would support the principles of land use and transport integration, accessibility, and sustainable travel behaviours.
within the future hospital precinct, to progress to Stage Two for more detailed traffic modelling.

1.5.2 Stage Two – Preferred growth scenario traffic modelling assessment

The preferred growth scenario is shown in Figure 4.

Figure 4: Preferred growth scenario

Stage Two involved the following:

- Assessment of the potential traffic distribution to understand the high level impacts caused by the new preferred growth scenario (identified in Stage 1):
  - Evidence that identified the new Road Network Enhancement Work can accommodate the traffic trip generation caused by the preferred growth scenario

- Development of a local area operational traffic model that assessed the Frenchs Forest Road West corridor:
  - Generation of likely trip patterns that represented the preferred growth scenario for the town centre
  - Quantified the traffic impacts on the road network caused by the town centre
  - Identification of road infrastructure improvements required to accommodate the town centre (centre road access)

The outcomes of the Stage 2 transport assessment are discussed in Section 3.

1.5.3 Stage Two refinement

Following adoption of the preferred growth scenario and Stage 2 traffic modelling assessment, further refinement occurred to consider two local issues associated with delivery of the structure plan and road network improvements:

- Relocation of The Forest High School to the Warringah Aquatic Centre (WAC) site on Aquatic Drive.
• Adjustment to the urban density along the southern boundary of the RMS Stage 2 Network Enhancement Works to respond to the changing road environment.

These refinements to the Stage 2 assessment are discussed in Section 3.

1.6 Summary of land use assumptions used for modelling

The following land use mix assumptions are relevant to the different stages of modelling undertaken for the NBH precinct:

1.6.1 Original Hames Sharley/ MacroPlan Dimasi/ Arup

Bureau of Transport Studies (BTS) additional floor space and employment forecasts to 2021

- 704 dwellings (2,268 people)
- 47,000 m² Commercial GFA (715 jobs)
- 4,000 m² Retail GFA (133 jobs)
- 70,000 m² Hospital (1,400 jobs)

Structure Plan - specialised precinct full potential additional floor space for 2036 (Based on Macroplan assessment in 2014)

- 3,838 dwellings (10,102 people)
- 140,000 m² Commercial GFA (2,129 jobs)
- 34,000 m² Retail GFA (1,133 jobs)
- 100,000 m² Hospital (2,000 jobs)

1.6.2 RMS modelling for the Northern Beaches Hospital Road Connectivity and Network Enhancement Project

Forecasts for population and employment within the NBH Structure Plan investigation area included in the original RMS model for 2036:

- 2,712 people
- 4,464 jobs (additional to hospital)

1.6.3 Updated Arup modelling for the detailed transport assessment for preferred growth scenario 2

Forecasts for population and employment within the NBH Structure Plan investigation area included in the Arup modelling for 2031:

- 4,400 people (2,000 dwellings assuming 2.2 people/dwelling)
- 3,700 jobs (additional to hospital)
2 Detailed Transport Assessment

2.1 Current and future context

2.1.1 Population and employment growth

In 2011, there were over 30,000 residents living within the study area. By 2031, this is forecast to grow to over 40,000 residents. Employment within the study area provided over 13,000 jobs in 2011, and this is forecast to grow to over 19,000 jobs by 2031.

Within the hospital precinct itself, it was previously envisaged in the growth scenarios discussed during the community and business workshops in October and November 2014 that by 2036 an additional 6,800 residents and 4,500 jobs could be located in the hospital precinct.

RMS modelling works undertaken as part of the Northern Beaches Hospital Road Connectivity and Network Enhancement Project provided for an additional 2,710 residents and 4,465 jobs by 2036 in the hospital precinct (on top of original forecast growth) as shown in Figure 5 and Figure 6.

Figure 5: Assumed population increase to 2036 (TfNSW, BSA, RMS)

1 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model (LU14), 2015
2 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model (LU12)
2.1.2 Forecast travel characteristics

To understand the reasons why people within the study area travel, and how they travel, analysis was undertaken of internal trips within the study area and external trips leaving the study area. This helped to differentiate between the reasons that people travel for services that are well provided within the study area and those which require people to travel outside of the study area to access them. From this, identification of any differentiators between mode choice based on internal and external trips was also undertaken.
Why people travel

Figure 7 indicates that in 2031, for internal trips, the most common reason for travel is forecast to be related to social and recreational purposes. This is followed by commuting, shopping and educational related trips. Showing that a large proportion of trips within the study area will be for discretionary purposes, meaning that people have the option of choosing the timing and/or destination of their travel.

Figure 8 indicates that for an external trip leaving the study area, almost half are forecast to be for the purpose of commuting to work. These trips are non-discretionary trips, which means they have specific locations and require travel at specific times. It can be seen that a significant proportion of external trips are also forecast to be for social and recreational purposes.

Figure 7: 2031 internal trips by purpose

Figure 8: 2031 external trips by purpose

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3 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
4 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
How people travel

Figure 9 indicates that in 2031, for internal trips, a significant proportion is forecast to be by car, with 48 per cent by car driver, and a further 21 per cent by car passenger. A significant proportion of internal trips are also forecast to be made by active transport, e.g. walking or cycling, suggesting generally shorter trip lengths that would support the use of active transport modes inside the study area.

Figure 10 indicates that for external trips leaving the study area, a far higher amount are forecast to be by car in 2031 compared to internal trips, with 61 per cent by car driver and 20 per cent by car passenger. Active transport use is forecast to be significantly lower than internal trips. However, public transport use is forecast to increase from the 3 per cent of internal trips being by bus, to 11 percent for external trips.

Figure 9: 2031 internal trips by mode

Figure 10: 2031 external trips by mode

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5 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
6 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
Where people travel

Figure 11 and Figure 12 indicate that for trips coming to and from the study area in 2031, they will remain largely concentrated around the Northern Beaches region.

For trips coming to the study area, the highest proportions originate within the study area itself, or to the north and east of the study area, with over 1,000 people travelling from the Brookvale-Dee Why centre.

For trips going from the study area, they will also see the highest proportions remaining within the study area itself, or travelling to the north and east, similar to above. However, a greater proportion are destined for the employment centres to the south of the study area, with over 3,000 going to the Sydney CBD and North Sydney, and over 1,000 going to Chatswood. Brookvale-Dee Why will still have a large proportion travelling from the study area, with over 2,000 destined for this centre.
Figure 11: Trip locations to the Study Area in 2031

7 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
Figure 12: Trip locations from the Study Area in 2031

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8 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
A significant number of through trips are experienced travelling east and west through the study area that do not start or end within the study area itself. Figure 13 indicates that in 2031, this is forecast to make up 77 per cent of trips travelling westbound through the study area in the AM peak. Figure 14 indicates that 67 per cent of trips are travelling eastbound through the study area in the AM peak.

![Figure 13: Trip origin and destinations AM westbound vehicle trips](image)

![Figure 14: Trip origin and destinations AM eastbound vehicle trips](image)

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9 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
10 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
2.1.3 Transport networks and their performance

Bus operations now and passenger volume growth to 2031

Bus travel speeds are identified to currently be slowest along Forest Way, and at the Forest Way and Warringah Road intersection, along with parts of Warringah Road running through Frenchs Forest and Forestville, Frenchs Forest Road, and Allambie Road when approaching Warringah Road in the AM peak hour (8:00-9:00) 11.

In the PM peak hour (17:00-18:00) bus travel speeds were identified as currently slowest at the intersection of Forest Way and Warringah Road, Warringah Road travelling through Frenchs Forest and Forestville, Frenchs Forest Road, and Allambie Road when approaching Warringah Road.

Figure 15 highlights bus passenger volumes are forecast to grow the most along Frenchs Forest Road within the study area to 2031 12.

Future bus planning and the NSW Government’s response to these forecast bus demands are described in Section 4.2.

Vehicle Network assignment (growth 2011 to 2031)

The land use changes (population and employment growth as a result of the NBH) is predicted to generate additional traffic above today’s levels. Figure 16 shows the modelled prediction of the location and amount of increase in morning traffic on the wider NBH road network 13.

Figure 16 highlights that the roads in the immediate vicinity of the NBH and along Warringah Road are expected to have a greater vehicle trip demands by 2031.

The large scale infrastructure upgrades being undertaken by RMS, will be delivered to accommodate this forecast traffic growth from the new Hospital development. The upgrades do not cater for additional growth anticipated by a strategic centre in this location, thus requiring a scale down of the growth scenario.

12 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
13 Transport for NSW, Bureau of Statistics and Analytics, Strategic Travel Model, 2015
Figure 15: Sydney Travel Model bus volumes 2011-2031
Figure 16: Sydney Travel Model road volumes 2011-2031
2.2 Scenario development

From the outcomes of the analysis outlined above, a number of challenges and opportunities were identified to inform the development of four growth scenarios that would support land use and transport integration, and sustainable travel behaviours for the hospital precinct into the future.

It was identified that a large proportion of travel leaving the study area that was related to work purposes was to access employment provided in the Global Economic Corridor. It is not perceived that the draft Structure Plan would be able to greatly influence this trend in the next 20 years, however, encouraging mode shift from car to public transport for these trips would help to alleviate congestion experienced on the network into the future.

A large proportion of trips leaving the study area were also identified for social and recreational purposes. Providing the opportunity to further develop the provision of these uses within the study area into the future will reduce the need to travel outside the study area and network congestion. This could also support off-peak direction travel for suburbs such as Forestville and Killarney Heights when accessing the hospital precinct for these uses.

Implementing principles of trip containment and co-location of uses within the study area into the future would help to reduce the need to travel. It was seen that for internal trips a high proportion were identified to be by active transport means. Creating a higher density mixed-use centre within the hospital precinct and co-locating higher density residential uses nearby would reduce the need to travel for a large proportion of trips, such as shopping purposes.

In addition to this, urban design measures that would support the use of active transport options such as safe and direct connections and pleasant environments should be considered during the implementation of the structure plan going forward to further support the use of these modes for local trips.

Four growth scenarios contained different locations and a mix of land uses within the hospital precinct. A multi criteria assessment (MCA) of each scenario was conducted (See Figure 17).

The MCA reviewed the ability of each scenario to support the principles of:

- Integrating land use and transport
- Encouraging public and active transport use
- Facilitating accessible, pleasant and safe environments
- Reducing the need to travel.

In addition to the MCA, a high level assessment of how the road and transport networks surrounding the hospital precinct might respond to each growth scenario was undertaken, and the potential need for infrastructure upgrades was identified. Based on this, a preferred scenario for the location and mix of land uses within the hospital precinct was identified.
2.3 Preferred growth scenario

Based on the outcomes of the MCA, scenario two was identified as the preferred growth scenario due to its ability to support the principles of land use and transport integration, accessibility, and sustainable travel behaviours within the future hospital precinct.

The draft Structure Plan based on scenario two:

- Consolidates development to the west.
- Optimises development adjacent to Grace Avenue.
- Provides appropriate interface to northern residential areas.
- Provides short to medium term development guidance, to achieve long term aspiration of a Strategic Centre.
3 Traffic Modelling Assessment

The PWG requested further traffic analysis to demonstrate that Frenchs Forest Road West had the capacity to accommodate a town centre. The modelled extents of Frenchs Forest Road West are shown in Figure 18 on the following page.

Modelling predicted the detailed traffic operations on the local road network in 2036 and was used to test if any local area road upgrades were required to further enhance traffic capacity and hence ensure the objectives were met for the town centre. The modelling tasks involved:

- Replicating the residential, commercial and retail land use of a Strategic Centre along Frenchs Forest Road West in 2036.
- Replicating the traffic trips in the AM and PM peak hours that would be generated by the Strategic Centre.
- Testing in the traffic model what effects the predicted traffic causes on the local road network. Specifically to:
  - Understand how the traffic signals would respond to accommodate the traffic
  - Understand if any turning lane re-configurations are required
  - Completing testing of the land use and associated traffic trips and patterns to gain further confidence in the traffic modelling outputs.

The modelling outcomes were:

- Results suggested Frenchs Forest Road West would accommodate the Strategic Centre’s traffic. The models’ improved signal phasing and signal coordination along the corridor can accommodate the increases in vehicle trips.
- Modelling indicated slight increases in congestion would occur along the local road corridor in both peak hours. However, this should be viewed with the equivalent offset of congestion relief on the wider NBH and Frenchs Forest precinct.
- Further investigations (land use and traffic modelling work) of the local road network is required to unlock additional capacity to ensure the Strategic Centre is effectively delivered.
Figure 18: Extent of model
3.1 Refinement to growth scenario

Following adoption of the preferred growth scenario and Stage 2 traffic modelling assessment, further refinement occurred to consider two local issues associated with delivery of the structure plan and road network improvements.

3.1.1 Relocation of The Forest High School

A traffic review has been undertaken of relocating The Forest High School to the Warringah Aquatic Centre (WAC) site on Aquatic Drive. The investigation included increasing total enrolments from the existing enrolment of 919 students to 1,500 students.

The existing student residential locations were provided by The Forest High School to assist with assessment of access from the catchment. It is evident that a significant proportion of the students are located to the east of the school with access via Warringah Road either by private vehicle drop-off or bus access. This is relevant for consideration of access routes as it results in less vehicles needing to cross Wakehurst Parkway to access the school site.

It was found that despite the intersections being largely unaffected by the potential relocation of the school to the WAC site, the southern approach to the Allambie Road/Warringah Road intersection is currently congested and if the relocation of the school site to the WAC site is pursued the RMS will have to further consider upgrades to this intersection to reduce congestion – further detailed analysis will be required.

In association with the relocation, consideration of walking and cycling access routes will be required to determine the need for improvement through provision of shared pedestrian / cyclist paths and good crossing facilities.

3.1.2 Properties along the northern side of Karingal Crescent

As part of the Stage 2 Network Enhancement works, RMS have raised concerns over the ability for the road network to support growth south of Warringah Road and east of Wakehurst Parkway. The results of the modelling and design undertaken for the Stage 2 works and advice from RMS indicate that any new large scale development that borders Warringah Road will face considerable challenges in terms of safe access and egress, and will have major consequences for the broader road network.

In particular, any upgrading of the intersection of Fizpatrick Avenue to and across Warringah Road has the potential to impact significantly on the Northern Beaches Hospital Connectivity and Network Enhancement roadworks and connecting streets. The RMS modelling shows extensive queuing and breakdown across the network are likely to result. It is for these reasons that no major growth is suitable for the area south of Warringah Road and east of Wakehurst Parkway.
Notwithstanding the above, there remains strategic justification to consider a slight adjustment to the urban density along the southern boundary of the RMS Stage 2 Network Enhancement works where properties have been directly affected by the roadworks. Minor density uplift will encourage a new built form to better respond to the changing road environment. This uplift includes 32 properties along the northern side of Karingal Crescent which back onto the widened road corridor as shown in Figure 19.

Figure 19: Properties along the northern side of Karingal Crescent

The land use assumptions utilised in the RMS modelling for this precinct included an additional 90 dwellings. The proposed uplift along one side of Karingal Crescent is therefore allowed for in the local road network modelling. Based on the low density residential traffic generation rate of 10.7 daily vehicle trips per dwelling\(^\text{14}\), the additional 32 residential dwellings would generate 342 vehicle trips per day. These additional trips on Karingal Crescent will be well within the environmental capacity of a local street.

\(^{14}\) Guide to Traffic Generating Developments - Updated traffic surveys, TDT 2013/04a

Prepared for Northern Beaches Council, Roads and Maritime Services and Transport for NSW

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4 Recommendations for the Future

4.1 Introduction
The level of development considered for the strategic centre in this road network modelling should be considered as the first stage in delivering a strategic centre in this location to its full potential. The RMS have provided road upgrades to accommodate the forecast traffic demand/increase from the hospital and this study has identified the level of development possible within the strategic centre. Further upgrades to roads, and in particular public transport, are needed to ensure the longevity and functioning of Frenchs Forest as a Strategic Centre.

4.2 Future public transport options

Sydney’s Bus Future
The Sydney’s Bus Future document was released in December 2013. It provides the framework for improving and delivering better bus services throughout the Sydney metropolitan area. Bus services will be focused into three key routes, as shown in Figure 20 below:

- Rapid routes, to use priority infrastructure, connect regionally throughout the city and have stops every 800m-1,000m
- Suburban routes, which will have stops every 400m and have mix of frequent ‘turn up and go’ and timetabled services
- Local routes which will complete the network using local streets

Figure 20: Rapid and suburban bus routes
Of particular relevance to the NBH Precinct, Sydney’s Bus Future identifies the following objectives:

- Direct connections will link the Northern Beaches to major centres such as Chatswood, St Leonards and Macquarie Park, including more than 50 new suburban services operating every weekday to connect Manly to Chatswood via Brookvale and the proposed Northern Beaches Hospital.

- More bus services to meet growing and changing demand with service frequencies will be enhanced in the evening, at night and on the weekend to meet increased customer demand outside traditional commuter peaks.

Beyond this study, there is a need for further planning work to deliver effective public transport options for residential and employment land use in the area. TfNSW will continue to develop bus planning in response to future development. This will include detailed investigations into stopping locations, service frequencies and bus priority at key intersections.

### 4.3 Future active transport options

Throughout this study, active transport was seen as a key driver to enable the success of a Strategic Centre at the NBH Precinct. Active transport was considered at a high level to relieve other transport modes and to increase the attractiveness, amenity and safety in the local area.

Beyond this study, there is a need for further planning work to deliver quality active transport options for walking and cycling to and from residential and employment land uses in the area. This will be undertaken as part of the ongoing assessment within the Structure Plan process. It will be key to ensuring the strategic objectives of establishing a Strategic Centre in Frenchs Forest are met.

### 4.4 Future road network upgrades

**Local NBH Precinct Road Network**

As outlined in Section 1.4.2, the RMS is committed to upgrading roads around the NBH Precinct. These upgrades will provide customers with a better travel experience, increase the capacity of the road network and improve access through the area, including for pedestrians and cyclists.

Effective road links are critical to enable the success of a Strategic Centre at the NBH Precinct. As described in Section 3, high level traffic modelling that was undertaken has suggested that the future Frenchs Forest Road West corridor can accommodate the traffic demands generated by the preferred growth scenario for the Strategic Centre.

Beyond this study, there is a need for further planning work to unlock more capacity on the local road network. Key strategic road linkages within the western precinct will be further investigated as part of the Structure Plan process. Road network improvements will further enable the success of the Strategic Centre.

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Greater Sydney Road Network

Infrastructure NSW released the 2014 State Infrastructure Strategy Update which included reference to a Western Harbour Tunnel. The Western Harbour Tunnel and Beaches (motorway) Link would connect Sydney's northern suburbs to an interchange at Rozelle, providing a western bypass of the Sydney CBD\textsuperscript{16}. An information sheet is shown in Figure 21.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Western_Harbour_Tunnel_info_sheet}
\caption{Western Harbour Tunnel information sheet}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Western_Harbour_Tunnel_map}
\caption{Proposed Western Harbour Tunnel and its motorway connections}
\end{figure}

The NSW Government identifies that the Western Harbour Tunnel will provide benefits to the NBH Precinct and Northern Beaches area via¹⁷:

- Environmental and health benefits due to reduced noise and emissions.
- Improved travel times, less fuel consumption and reduced congestion.
  - The link has the potential to relieve traffic congestion on both Warringah Road and The Spit.
- Public transport users can expect faster travel times as a result of traffic congestion relief on Warringah Road and The Spit.
- Greater areas will be accessible for population and employment growth and urban renewal.

The feasibility and planning of this project is currently being undertaken by the government and is subject to approval. It is not a committed project.

5 Conclusion

This report has outlined the transport assessment undertaken and justifies the preferred growth scenario.

The road upgrade works being undertaken by the RMS will enhance connectivity to the hospital and improve the broader road network capacity. These road upgrade works cater for the additional traffic generated as a result of the new hospital development. However, it does not cater for the additional growth anticipated in the draft Hospital Precinct Structure Plan as a result of Frenchs Forest being identified as a Strategic Centre.

In effect, the provision of Stage 2 RMS Road Works for the Northern Beaches Hospital development is not expected to provide excess road capacity during the AM and PM peak above accommodating the already identified additional traffic demands generated by the new Hospital and background growth factored into the model.

Modelling for the preferred growth scenario as part of this report, predicted the detailed traffic operations on the local road network in 2036 and was used to test if any local area road upgrades were required to further enhance traffic capacity and hence ensure the objectives were met for the strategic centre.

The modelling outcomes were:

- Results suggested Frenchs Forest Road West would accommodate the Strategic Centre’s traffic. The models’ improved signal phasing and signal coordination along the corridor can accommodate the increases in vehicle trips.
- Further investigations (land use and traffic modelling work) of the local road network is required to unlock additional capacity to ensure the Strategic Centre is effectively delivered.

Following adoption of the preferred growth scenario and Stage 2 traffic modelling assessment, further refinement occurred to consider two local issues associated with delivery of the structure plan and road network improvements:

- Relocation of The Forest High School to the WAC site on Aquatic Drive.
- Adjustment to the urban density along the southern boundary of the RMS Stage 2 Network Enhancement Works to respond to the changing road environment.

Traffic assessment undertaken for both of these refinements found that they could be accommodated by the RMS road upgrade projects.

This Study has identified a preferred land use scenario with consideration of traffic and transport impacts to inform the draft Hospital Precinct Structure Plan. It has also provided the opportunity to align the NSW Government road network upgrades, being implemented as part of the Northern Beaches Hospital, with development of the Northern Beaches Hospital Precinct.