10.8 Frenchs Forest Transport Studies

EXECUTIVE SUMMARY

Purpose

To advise Council on the results of the transport studies prepared by the State Government during 2011, as part of its investigations for the proposed Frenchs Forest Specialised Centre and the proposed Northern Beaches Hospital.

Summary

These transport studies, commissioned by Transport NSW, overwhelmingly conclude that the transport network around Frenchs Forest is already at capacity and needs significant investment in road infrastructure and public transport improvements, to accommodate background growth expected over next five years.

Since these reports were completed, the proposed Frenchs Forest Specialised Centre has been abandoned by the NSW State Government. The NSW State Government is however committed to the new Northern Beaches Hospital proceeding.

The results of these transport studies are still of relevance as an indication of the existing transport situation in Frenchs Forest as well as an indication of what improvements to transport infrastructure are needed in the short term and what improvements should be investigated for the medium to long term. They are also important as an indication of the public transport and road infrastructure upgrades which are likely to be required as part of the future planning and development of the Northern Beaches Hospital.

The results will also be of relevance for any future development proposals in the Frenchs Forest area which will result in an increase in traffic feeding into this Warringah Road transport corridor. For example, Council's Housing Strategy which aims to increase residential densities in Warringah, should take into account the results of these transport studies. In this regard it is noted that Council is in receipt of a letter from the Minister in relation to the status of Council's draft Housing Strategy. Staff are investigating a response and this is scheduled to be reported to Council at the 27 March meeting.

Financial Impact

Potential requirement for road infrastructure upgrades.

Policy Impact

Need for detailed strategic master planning for the Frenchs Forest area, to accommodate the development of the Northern Beaches Hospital and ancillary development.

RECOMMENDATION OF DEPUTY GENERAL MANAGER ENVIRONMENT

A. That Council note the contents of the Frenchs Forest Specialised Centre - Strategic Transport Assessment report and the Frenchs Forest Specialised Centre - Local Transport Assessment report, as seen at Attachments 1 and 2.

B. That Council note the infrastructure issues raised by these reports, and these matters, along with the Minister's recent response to Council's draft Housing Strategy be further discussed in

a workshop between staff and Councillors at a time to be scheduled forthwith.

C. That Council call on the NSW Government to ensure that the planning and delivery of the Northern Beaches Hospital be a whole of government approach that addresses the issues of health service provision, land uses, sustainability principles as well as traffic and transport.

REPORT

Background

On 17 December 2010, the Minister for Planning declared a large part of Frenchs Forest as a potential State Significant Site (SSS) under the provisions of State Environmental Planning Policy (Major Development) 2005. This proposal identified Frenchs Forest as a potential Specialised Centre for the region.

The proposal was exhibited from 17 December until 28 February 2011 for public comment. In response to concerns raised by Council and the community, the Minister in February 2011 directed NSW Transport to prepare a Transport Management and Accessibility Plan (TMAP) to assess the transport implications of this proposed specialised centre.

NSW Transport, working with Council, Planning NSW and other transport related organisations, prepared a brief for this transport work and in May 2011, consultants AECOM were commissioned to prepare two reports:

- a *Strategic Transport Assessment* for the potential Frenchs Forest Specialised Centre, (including the proposed Northern Beaches Hospital); and
- a *Local Transport Assessment* for the potential Frenchs Forest Specialised Centre (including the proposed Northern Beaches Hospital).

A working party was established, which included Council, to guide and oversee the preparation of the Strategic Transport Assessment. Council was not however involved in preparation of the Local Transport Assessment. A copy of these documents, dated 11 November 2011, can be seen at Attachments 1 and 2.

The Minister for Planning on 16 December 2011, decided not to proceed with the proposed State Significant Site for Frenchs Forest. This decision was in part, based upon the results of these transport studies. However, NSW Health is still proceeding with the planning and construction of the Northern Beaches Hospital. The Minister for Planning, in his announcement, stated that "*the local community would be consulted through the precinct planning process and be given a chance to have their say on what development is appropriate in the area of the proposed new hospital".*

The purpose of this report is to advise Council of the results of these two transport studies, and to outline the consequences to Council of possible road infrastructure upgrades and future strategic planning demands.

The Strategic Transport Assessment is more of an overview of the traffic and transport situation and identifies short and longer term actions to address issues of concern. The Local Transport Assessment, using the results of the strategic report, looks at more detail at the actual impact of the proposed Specialised Centre and hospital development on traffic and transport in the Frenchs Forest area. It also has short and longer term measures identified, so there is some duplication in their recommendations.

Key Findings - Strategic Transport Assessment

This Study aimed to establish the current strategic transport context, as well as in 2016 and 2036. In examining the existing transport situation it concluded that:-

- All major roads servicing the Warringah area (Mona Vale Road, Military Road, Pittwater Road and Warringah Road) are carrying volumes of traffic in the am peak which are above their designed capacity;
- All key intersections are also operating close to their design capacity in the am peak, especially the Warringah Road/Wakehurst Parkway intersection which operates at Level of Service F;

- Warringah Road carries a high proportion of car trips (70 – 90% private vehicle mode share), because east-west public transport connections are limited;
- Approximately 60% of vehicle trips on Warringah Road through Frenchs Forest originate from Brookvale, Dee Why and Pittwater LGA.

. In examining the transport situation in 2016 – 2036, it concluded that:-

- Traffic models indicate that demand for access to the Northern Beaches will increase;
- By 2016 the am peak demand will exceed the capacity of Mona Vale, Military and Warringah Roads;
- With no improvements to transport infrastructure, peak travel periods will increase, congestion will worsen and longer journey times will result;
- Mitigating measures need to be investigated in the short term (next 5 years) even if there is no extra development at Frenchs Forest;
- With the introduction of the proposed Specialised Centre, by 2016 most arterial links will be over capacity and all key intersections in Frenchs Forest will be at Level of Service (LoS) F. All approach roads to Frenchs Forest will also be nearing their capacity per lane and Warringah Road at the Roseville Bridge will be carrying 1.5 times its capacity;
- By 2036, with the proposed Specialised Centre, the situation would be the same, with Roseville Bridge carrying 1.6 times its capacity.

Taking these matters into account, the study made a number of suggestions and recommendations to address some of these existing and possible future transport issues. The short term measures recommended were:-

- Preparation of a Sustainable Transport Strategy
- Further investigation of enhanced east-west bus services
- Further investigation of signalising the Forest Way/Naree Road intersection.
- Further investigation of the extension of Aquatic Drive to link to Wakehurst Parkway

While Transport NSW is the agency responsible for most of the proposed infrastructure upgrades and public transport improvements, Warringah Council is identified as a partner for the last 2 of these short term measures. Each of these measures are estimated to cost between $1 and 2 million. Council would also be involved in the preparation of a Sustainable Transport Strategy.

A number of medium/long term measures were also recommended for further investigation:-

- Dedicated Bus Rapid Transit (BRT) system from Mona Vale to Chatswood via Dee Why;
- Dedicated BRT system from Mona Vale to the CBD;
- Grade separation of Wakehurst Parkway and Warringah Road intersection;
- Grade separation of Forest Way and Warringah Road intersection;
- Grade separation of Wakehurst Parkway and Frenchs Forest Road intersection;
- The provision of 4 lanes westbound on Warringah Road, from Forest Way to Woodlands Road, to be implemented as a westbound bus lane in peak periods;
- Flood protection and contingency planning for Wakehurst Parkway at Narrabeen Lagoon, to mitigate flooding risk.

Of these medium to long term works, the BRT is the subject of a separate pre-feasibility study currently being prepared by Transport NSW. Of the other measures, the only one earmarked for Council input is the works on Wakehurst Parkway to mitigate flooding risk. This measure is estimated to cost in the order of $5 –10 million.

This strategic study concluded that the existing Frenchs Forest road network is nearing capacity and will need a significant investment in infrastructure in the short term. The responsibility for most of this infrastructure investment lies with Transport NSW, however Council is earmarked to partner TNSW on some proposed upgrade measures, particularly where improvements relate to the local road network.

An analysis of predicted traffic growth for the area indicates the need for grade separation of the intersections of Warringah Road with Wakehurst Parkway and Forest Way. Indicative costs for these intersection works are in the order of $100 – 200 million for Wakehurst Parkway and $50 – 150 million for Forest Way. The report also concluded that any grade separation of intersections along Warringah Road should be undertaken simultaneously with the hospital development.

A review of existing public transport identified the need for improved east-west bus services along Warringah Road to accommodate travel demand. A Northern Beaches BRT (currently the subject of a separate pre-feasibility study by Transport NSW), may provide more detailed analysis of potential patronage along the east-west corridor.

Key Findings - Local Transport Assessment

This report was specifically prepared to look at the transport implications of a Specialised Centre at Frenchs Forest (including the hospital, ancillary health care services, redeveloped commercial properties and a commercial core including 80,000 sq m of retail floor space).

Again, the existing situation was identified with traffic volumes during both peak periods at capacity and with all major intersections operating at maximum limits of their designed capacity as at grade intersections. It also identified that east-west public transport services were limited. It also noted that existing development in the Frenchs Forest area has encouraged car usage, with large carparks provided and that there is a poor level of pedestrian/cyclist connectivity between the north and south of Warringah Road.

This assessment used RTA traffic modelling to estimate future traffic volumes, both with and without the proposed Specialised Centre development. With only background development, the study predicted that by 2016, all key intersections will be operating beyond their capacity in both peaks. By 2036, in the absence of any road improvements, this would be worse with an increase in traffic of 16% above 2011 levels.

The addition of the hospital development into the modelling accelerated the need to signalise Naree Road/Forest Way and the need to increase the capacity of the Frenchs Forest Road/Wakehurst Parkway intersection, along with the Warringah Road/Wakehurst Parkway and Warringah Road/ Forest Way intersections.

Like the Strategic Transport Assessment, this report also concluded that there will need to be significant investment in transport infrastructure just to accommodate existing travel demand and background growth (prior to the area being able to support any additional development).

The report recommended that a number of road infrastructure upgrades should be investigated as part of on-going planning for the Specialised Centre. As the Specialised Centre is not proceeding, these recommendations are still relevant for future planning of the Northern Beaches Hospital. The recommendations, some of which were also in the Strategic Transport Assessment report, are:-

- Forest Way/Naree Road intersection signalisation;
- Frenchs Forest Road (East and West) duplication;
- Warringah Road/Wakehurst Parkway intersection grade separation;

- Warringah Road/Forest Way intersection grade separation;
- Potential grade separated Warringah Road underpass;
- Re-order traffic management at intersections of Warringah Road/Allambie Road and Warringah Road/Frenchs Forest Road East in favour of bus movements and allow easier access to Frenchs Forest Road;
- Introduce a new intersection at Wakehurst Parkway/Aquatic Drive to allow direct access to Wakehurst Parkway and a potential extension of bus routes from Allambie Road to Wakehurst Parkway.

It also recommended that:-

- Any major transport infrastructure works should be undertaken simultaneously with the hospital development;
- The area would benefit from improved east-west public transport services and a review of bus stop locations;
- The BRT pre-feasibility study when completed should identify short term transport options;
- Pedestrian and cycle connectivity should be a key principle in planning of any Specialised Centre.

Discussion

These transport studies have overwhelmingly concluded that the transport network around Frenchs Forest is already at capacity and needs significant investment in road infrastructure and public transport improvements, to accommodate growth expected over next five years.

Since these reports were completed, the proposed Frenchs Forest Specialised Centre has been abandoned by the NSW State Government. The NSW State Government is however committed to the new Northern Beaches Hospital proceeding.

The results of these transport studies are still of relevance as an indication of the existing transport situation in Frenchs Forest as well as an indication of what improvements to transport infrastructure are needed in the short term and what improvements should be investigated for the medium to long term. They are also important as an indication of the public transport and road infrastructure upgrades which are likely to be required as part of the future planning and development of the Northern Beaches Hospital.

The results will also be of relevance for any future development proposals in the Frenchs Forest area which will result in an increase in traffic feeding into this Warringah Road transport corridor. For example, Council's Housing Strategy which aims to increase residential densities in Warringah, should take into account the results of these transport studies.

Policy Impact

Need for detailed strategic master planning for the Frenchs Forest area, to accommodate the development of the Northern Beaches Hospital and ancillary development.

Financial Impact

Potential requirement for road infrastructure upgrades.

Group Manager Strategic Planning

Attachment Booklets/CD Frenchs Forest Specialised Centre – Strategic Transport Assessment
Frenchs Forest Specialised Centre – Local Transport Assessment

AECOM

Transport for NSW
11 November 2011
Document No. 002

Frenchs Forest Specialised Centre

Strategic Transport Assessment

Frenchs Forest Specialised Centre

Strategic Transport Assessment

Prepared for

Transport for NSW

Prepared by

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

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Executive Summary

Frenchs Forest Specialised Centre Strategic Transport Assessment

In May 2011, Transport for NSW (TfNSW) commissioned AECOM to undertake a strategic transport assessment of the potential Frenchs Forest Specialised Centre that includes the proposed Northern Beaches Hospital. The brief identified the following key outcomes for the study:

1) To identify the existing transport network deficiencies and travel characteristics in Frenchs Forest and the wider Northern Beaches area.

2) Develop strategic responses to the existing transport deficiencies.

3) Develop strategies to accommodate the Frenchs Forest potential specialised centre development (including the proposed hospital) and test these strategies in the Sydney Strategic Transport Model (STM) and the RTA's Sydney Region Highway Assignment Model.

4) Demonstrate the benefits of these strategies in terms of wider network benefits.

5) Summarise the benefits and high-level costs associated with each strategy to enable Government bodies to make informed choices about the scale of the potential Specialised Centre; and identify the short, medium and long term transport strategies that would best serve the site.

6) Make recommendations on high level Travel Demand Management measures that could be implemented in support of the Frenchs Forest Specialised Centre to encourage sustainable travel behaviour of employees, residents and all other users.

Existing transport patterns, deficiencies and future challenges

Travel patterns

The Household Travel Survey (HTS) pooled data for 2008 indicates approximately 880,000 all purpose trips per weekday originate in the Warringah, Manly and Pittwater Local Government Areas (LGAs), which together form the North-East Subregion (referred to as the Northern Beaches). Most trips originate in Warringah LGA (60 per cent) and a high proportion (76 per cent) of all trips is made by car. The HTS also indicates a strong demand for walking, with 16 per cent of trips made on foot.

The Census (2006) noted that 85,000 journey to work trips originate in the Northern Beaches per day, of which 40 per cent were made to destinations outside the Northern Beaches. Major destinations for work trips outside the Northern Beaches are the Sydney CBD (30 per cent), North Sydney (14 per cent), Willoughby (13 per cent) and Ryde (6 per cent).

The majority of work trips that leave the Northern Beaches are made by car. The proportion of trips made by car varies by destination, and is a function of public transport provision, and the cost and availability of parking. Ryde has the highest proportion of car travel (95 per cent), reflecting the limited public transport provision and availability of parking in areas such as Macquarie Park. Trips to the Sydney CBD have a lower car mode share (32 per cent), reflecting the concentration of public transport provision and limited parking supply. Buses are the primary mode of public transport for journey to work trips, with 56 per cent of trips to the Sydney CBD made by bus, 25 per cent to North Sydney and 11 per cent to Willoughby.

Existing deficiencies

Mona Vale Road, Warringah Road, Military Road and Pittwater Road provide the majority of transport capacity to the Northern Beaches. These roads are all operating close to their capacity in the morning peak hour. Key intersections around Frenchs Forest area are operating close to their capacity in the morning peak hour, especially the intersection of Warringah Road and Wakehurst Parkway, which operates at Level of Service F.

A large proportion of vehicle trips through Frenchs Forest on Warringah Road originate in Brookvale, Dee Why and the Mona Vale area. Warringah Road carries a high proportion of car trips, because east-west public transport connections are limited between Dee Why and Pittwater LGA to employment centres of Chatswood, Macquarie Park and North Sydney.

Future challenges

Over the next 25 years, 20,000 more jobs will be created in the Northern Beaches and the population will increase by 32,000 people. The ratio of jobs per person will increase from 0.38 to 0.40 jobs per person.

The Strategic Transport Model (STM) and the RTA Sydney Region Highway Assignment Model indicate demand for access to the Northern Beaches will increase, and by 2016 the AM peak demand will exceed the capacity of Mona Vale Road, Military Road and Warringah Road. Congestion will increase, with longer journey times and peak periods will become longer as people try to avoid delays by starting their journeys earlier or later.

The Frenchs Forest Specialised Centre State Significant Site (SSS) Study (NSW Department of Planning & Infrastructure, December 2010) outlines a proposal for a new Northern Beaches hospital, ancillary healthcare services, redeveloped commercial properties and a commercial core that could support somewhere in the order of 50,000 to 100,000 sqm of retail floor space. The SSS study also outlines addition of up to 1,300 new dwellings and 7,000 to 12,000 new jobs plus 5,000 health jobs at Frenchs Forest in the future. While the land use and development controls could theoretically provide capacity for 12,000 to 17,000 additional jobs, this strategic assessment assumes 7,000 additional jobs will be provided in Frenchs Forest by 2036.

Travel demand forecasts suggest that the Specialised Centre goes some way towards achieving government targets for sub-regional trip containment, yet the specialised nature of healthcare employment also attracts additional visitors to the Northern Beaches.

Strategic responses

Short Term

A consistent approach to travel demand management and travel behaviour change should be implemented across the Northern Beaches through a Sustainable Transport Strategy. This strategy should provide for the implementation of workplace travel plans and a travel demand management strategy for the potential Specialised Centre including the new Northern Beaches Hospital. The demand management program in the sustainable transport strategy should be linked to the provision of sustainable infrastructure (i.e. walking and cycling networks) and to a parking management strategy that sets pricing and supply controls to discourage travel by private vehicle. Demand management programs can achieve a 5 – 9 per cent reduction[1] in private car use, which would equate to approximately 28,000 less peak hour car trips across the Northern Beaches sub-region in 2036.

Public transport service improvements that improve the east-west connectivity and provide new routes to North Sydney would achieve a minor mode shift away from private vehicle use. Two new bus routes are proposed, together with service frequency responses on four existing routes. These changes would increase east-west public transport capacity through the Northern Beaches and increase capacity for journeys to key employment destinations. Together, these changes could accommodate approximately 3,000 peak hour public transport trips.

The net increase in traffic generated by the full Specialised Centre would be approximately 2,000 vehicle trips in the morning peak in 2036 in addition to the background growth . This level of traffic cannot be accommodated by the surrounding road network and infrastructure upgrades would be required to provide increase intersection and road capacity. The following short term measures are recommended for further detailed investigation:

- *RN4* – signalise Forest Way / Naree Road intersection
- *RN7* – extend Aquatic Drive to link to Wakehurst Parkway

Access to the hospital site from the west is assumed to be via the intersection of Forest Way with Naree Road/Frenchs Forest Road. This intersection is currently unsignalised and does not provide controlled access to Frenchs Forest Road. Signalising this intersection would provide controlled access to the hospital site, Forest High School and residential streets to the north of Frenchs Forest Road.

An extension of Aquatic Drive may also benefit the area by allowing direct access onto Wakehurst Parkway, a potential bus priority measure and a new pedestrian link from Fitzpatrick Avenue to Aquatic Drive, providing direct pedestrian access to the employment area and the leisure facilities on Aquatic Drive.

[1] The Effects of Smarter Choice Programmes in the Sustainable Travel Towns, February 2010

Medium to Long Term

Medium to long-term improvements could include a mass transit solution, potentially Bus Rapid Transit (BRT). The Strategic Transport Model results highlight two preliminary BRT options which could reduce private vehicle traffic in the Northern Beaches:

- *PT7* - dedicated Bus Rapid Transit system from Mona Vale to Chatswood via Dee-Why in line with the current investigation by the Northern Beaches BRT pre-feasibility study being undertaken by TfNSW
- *PT8* - dedicated Bus Rapid Transit system from Mona Vale to the CBD in line with the current investigation by the Northern Beaches BRT pre-feasibility study being undertaken by TfNSW

TfNSW is currently investigating potential BRT links to the Northern Beaches as part of the Northern Beaches BRT pre-feasibility study, including the detailed needs and feasibility of BRT routes in the sub-region. This is a separate study to the Frenchs Forest Strategic Transport Assessment. The outcomes of that study may benefit the development of the Frenchs Forest Specialised Centre.

As well as improving public transport connections, there is a need for improved road network capacity through Frenchs Forest and along Warringah Road. The following road network measures are recommended for further detailed investigation:

- *RN11* – grade separation of Wakehurst Parkway and Warringah Road intersection
- *RN12* – grade separation of Forest Way and Warringah Road intersection
- *RN13* – grade separation of Wakehurst Parkway and Frenchs Forest Road
- *RN14* – provision of four lanes westbound on Warringah Road from Forest Way to Woodlands Road, Implement as a westbound bus lane in peak periods between Forest Way and Woodlands Road.
- *RN15* – investigate contingency planning for Wakehurst Parkway at Narrabeen Lagoon to mitigate flooding risk.

Wakehurst Parkway experiences closures due to flooding. Opportunities to improve the reliability of access along Wakehurst Parkway to the Specialised Centre should be investigated.

Summary of costs and benefits

The following table provides a list of possible measures and an indication of probable costs for infrastructure upgrades, their potential benefit and the lead agency responsible for their implementation.

Measure	Indication of probable cost ($000's)	Benefit to Frenchs Forest	Benefit to sub-region	Lead delivery agency	Timing
Bus Network Improvements PT1-PT6	$4-5,000	Improved public transport access	Reduction of approx. 5,000 Vehicle Kilometres Travelled per day	TfNSW	Short Term
PT7 - East-West route BRT	$100-150,000▲	Estimated 20 per cent reduction in peak hour traffic on Warringah Road in 2036	Reduction of approx. 48,000 Vehicle Kilometres Travelled per day	TfNSW	Medium to LongTerm
PT8 - North-South route BRT	$100-150,000▲	Slight reduction in through traffic	Reduction of approx. 66,000 Vehicle Kilometres Travelled per day	TfNSW	Medium to LongTerm
RN4 – Naree Road	$1-2,000	Controlled access to Frenchs Forest Road	Hospital access	TfNSW/ Warringah Council	Short Term
RN7 – Aquatic	$1-2,000	Business Park	Business Park	TfNSW/	Short

Measure	Indication of probable cost ($000's)	Benefit to Frenchs Forest	Benefit to sub-region	Lead delivery agency	Timing
Drive		access	access	Warringah Council	Term
RN11 – Wakehurst Parkway / Warringah Road	$100-200,000	Increased intersection capacity	Improved travel times	TfNSW	Medium to LongTerm
RN12 – Forest Way / Warringah Road	$50-150,000	Increased intersection capacity	Improved travel times	TfNSW	Medium to LongTerm
RN13 - *Wakehurst Parkway/ Frenchs Forest Road*	$50-150,000	Increased intersection capacity	Improved travel times	TfNSW	Medium to LongTerm
RN14 – Warringah Road widening	$5-10,000	Reduced congestion	Improved travel times	TfNSW	Medium to Long Term
RN15 – Wakehurst Parkway Flooding	$5-10,000*	Improved access	Improved access	TfNSW/Warringah Council	Medium to Long Term
TDM1- Northern Beaches Sustainable Transport Strategy	$500	More efficient use of infrastructure capacity	More efficient use of infrastructure capacity	TfNSW / SHOROC regional councils	Short Term

▲*Probable cost based on a per km cost of $5m – more detailed costs to be obtained as part of the Northern Beaches BRT pre-feasibility study*

**probable cost taken from "Narrabeen Lagoon Flood Risk Management Plan" SMEC 2003*

Conclusion

This study sought to identify a range of transport measures that could support the growth in employment and population in the Northern Beaches, and the potential Specialised Centre at Frenchs Forest. The analysis documented in this report clearly demonstrates that the road network is nearing capacity today and will need a significant investment in infrastructure in the short term. Analysis of the predicted traffic growth indicates the need for grade separation of the intersections of Warringah Road with Wakehurst Parkway and Forest Way, and that the introduction of the Specialised Centre would accelerate the need for this infrastructure investment.

Any grade separation of the intersections along Warringah Road should be undertaken simultaneously with any hospital development.

A review of public transport across the subregion identified the need for improved east-west bus services along Warringah Road to accommodate the demand for travel between the coastal suburbs and external employment centres, such as Chatswood and North Sydney. The Northern Beaches BRT pre-feasibility study, currently being undertaken by TfNSW as a separate investigation, may provide more detailed analysis of potential patronage along the east-west corridor and guide future planning for the Specialised Centre, around Transit Oriented Development principles.

1.0 Introduction

1.1 Background

In December 2010, the Department of Planning and Infrastructure (DP&I) publicly exhibited a State Significant Site (SSS) proposal for a new Specialised Centre at Frenchs Forest in Warringah. The concept plan included 12-17,000 new jobs (including health related jobs associated with the new hospital) and an activity centre supported by a range of 50,000 to 100,000 sqm of 'retail town centre' floor space.

Following public exhibition of this proposal, it was determined that further investigation into the transport impacts of the centre and the existing transport infrastructure in the Northern Beaches was required.

In May 2011, Transport for NSW (TfNSW) commissioned AECOM to undertake a strategic transport assessment of the potential Specialised Centre and the transport network across the Northern Beaches Subregion. The purpose of this study was to provide TfNSW and the other key stakeholders involved in the study, such as the DP&I, Ministry of Health, Roads and Traffic Authority and local Councils in the Northern Beaches with an overview of the condition of the transport network in the Northern Beaches subregion and identify measures that could be introduced in order to manage the impact of the Hospital and the full Specialised Centre and improve the transport network as a whole.

The brief identified the following key outcomes for the study:

1) To identify the existing transport network deficiencies and travel characteristics in Frenchs Forest and the wider Northern Beaches area.

2) Develop strategic responses to the existing transport deficiencies.

3) Develop strategies to accommodate the Frenchs Forest Specialised Centre (including the hospital) development and test these strategies in the Sydney Strategic Transport Model (STM) and the RTA's Sydney Region Highway Assignment Model.

4) Demonstrate the benefits of these strategies in terms of wider network benefits.

5) Summarise the benefits and high-level costs associated with each strategy to enable Government bodies to make informed choices about the scale of the Specialised Centre and what would be the short, medium and long term transport strategies that would best serve the site.

6) Make recommendations on high level Travel Demand Management measures that could be implemented in support of the Frenchs Forest Specialised Centre to encourage sustainable travel behaviour of employees, residents and all other users.

7) Deliver a detailed assessment of the local study area transport network that considers all of the strategies developed, in a format that can be used as a basis for the development of a local traffic assessment that will support the Part 3A application for the Northern Beaches Hospital (delivered as a separate document to this report titled "Frenchs Forest Specialised Centre Local Transport Assessment").

1.2 Site location

Frenchs Forest is located in the Warringah Local Government Area (LGA), approximately 18km north of the Sydney CBD and 9km north-east of Chatswood.

Frenchs Forest sits on the convergence of three of the key roads in the Northern Beaches:

- Warringah Road
- Wakehurst Parkway, and
- Forest Way.

Frenchs Forest and the major arterial roads in the Northern Beaches are shown in Figure 1.

Figure 1 Frenchs Forest Location and major arterial roads

Source, AECOM

2.0 Planning and policy context

2.1 State and regional strategic planning policies and proposals

2.1.1 NSW 2021, NSW Government, 2011

NSW 2021 is a long term plan to deliver the best possible services to the people of NSW. The NSW State Plan sets out how it will achieve the following:

- Restore economic growth;
- Return quality health, transport, education, police, justice and community services, putting customer service at the heart of service design; and
- Build infrastructure that drives our economy and improves people's lives.

The plan sets out a target of facilitating the delivery of 25,000 new dwellings per year in Sydney, and increasing the percentage of the population living within 30 minutes by public transport of a major centre.

The State Plan intends to ensure that; the economy grows stronger through supporting jobs and attracting business investment and the health system provides the highest quality care accessible to all.
The plan also highlights a key target to improve the efficiency of the road network during peak times on Sydney's road corridors.

2.1.2 Frenchs Forest Specialised Centre – State Significant Site Study, Cox on behalf of DP&I and Ministry of Health, December 2010

The purpose of the State Significant Site Study for DP&I and the Ministry of Health was to identify the overall nature and form of the proposed centre as a precursor to State Significant Site listing and rezoning.

The study sets out the structure plan and framework which supports the vision for a specialised centre that would accommodate a proposed Northern Beaches Hospital, 7-12,000 additional jobs and a retail town centre of approximately 50-100,000sqm.

2.2 Previous studies and recommendations

2.2.1 Shaping Our Future, directions for transport, health, housing and jobs for a vibrant sustainable Shore Regional Organisation of Councils (SHOROC) region, SHOROC, 2010

The strategy sets out major directions for the region including:
- Frenchs Forest as a new specialised centre for housing, jobs and health;
- Immediate construction of the level 5 Northern Beaches Hospital at Frenchs Forest and associated road infrastructure works; and appropriate upgrades required to enable the long term complementary role for Mona Vale Hospital;
- Strengthening public transport and road linkages with particular focus on: the East/West corridor between the major centres of Dee Why/Brookvale and Frenchs Forest and from Frenchs Forest and Mona Vale to Chatswood, Macquarie/Ryde and beyond; and improvements to the crucial North/ South corridor; and
- Improving sustainability of the region by reducing reliance on private vehicles as the major transport mode, accounting for example for 72 per cent of commuter journeys.

The strategy sets out the following directions:
- Housing and jobs – Frenchs Forest as a new specialised centre for housing, jobs and health with additional dwellings and job capacity, focussing employment clusters around the new hospital and health services.
- Health – immediate construction of the level 5 Northern Beaches Hospital and ancillary and private services at Frenchs Forest as well as the major road infrastructure required;
    - Grade separation at the intersections of Wakehurst Parkway and Warringah Road to avoid gridlock around the hospital; and
    - Upgrades to Wakehurst Parkway to provide flood free access.

2.2.2 Improving transport on the Warringah peninsula – Bureau of Transport and Regional Economics 2003

The BTRE report of 2003 provides a summary of the transport issues facing the region. This report, produced almost ten years ago, made several recommendations on how to improve the accessibility to the Warringah Peninsula.

The findings of this report highlight a large percentage of trips leaving the region to places of employment elsewhere.

The conclusion of this report was that localised intersection upgrades and improvements were only beneficial when implemented alongside major capacity increases that will ensure that traffic remains relatively free flowing.

It also stated that any major capacity increase must be managed to ensure that it doesn't cause additional congestion elsewhere on the Sydney road network.

The report goes on to discuss the need to manage demand through road pricing but to offset this pricing and provide a viable alternative there needs to be a commensurate increase in public transport services.

It states that public transport is typically an attractive transport option in more densely settled residential areas to central city work locations where employment densities are high, as can be seen with the trend in journeys to work (JTW) to Sydney CBD. The opposite is true in lower density areas of residence and employment, such as travel between Warringah and Chatswood or Ryde, where parking is also relatively cheap compared to the CBD or North Sydney.

The report made three recommendations:

- A new road tunnel from Spit Road to the Warringah Expressway

- Improved public transport, especially east-west links

- Public transport in a dedicated right of way, both between Manly to Sydney CBD

2.2.3 Frenchs Forest Specialised Centre Transport Report – ARUP 2010

The report prepared by Arup as part of the State Significant Site Study (December 2010) made recommendations for a number of local traffic management measures that could create an accessible centre that isn't dominated by traffic by removing traffic from the area via a tunnel underpass. These were:

- Grade separating Warringah Road (tunnel)
- Grade separating Wakehurst Parkway (tunnel)
- Creating a ring-road around Frenchs Forest

These measures are considered in this study and discussed in the later chapters of this report.

This may alleviate congestion in the area and allow the development of a centre to progress, but it is likely that this would only shift the congestion from this area to other points in the network. The zone of influence of this project would be wider reaching than just the local area and as recommended by Arup, should be addressed through the development of a detailed TMAP.

The report also recommended the development of a major public transport interchange at the heart of the development, served by a high capacity public transport system.

This report also acknowledged the previous studies and proposed projects such as the Warringah Freeway extension and rail projects, and how they have not been implemented because of local objections, funding and constructability constraints and changes in political direction.

2.2.4 Warringah Road Corridor Study - RTA 2009

This RTA study was part of the RTA pinch point program, which sought to identify the key pinch points on strategic corridors across Sydney and propose specific traffic management measures which may alleviate congestion or improve traffic flow along these corridors in the short term.

The Warringah Road study identified several improvements to traffic management on Boundary Street, which are being further investigated by the RTA at the moment.

The recommendations local to Frenchs Forest are:

- Warringah Road/Wakehurst Parkway – lengthen eastbound right turn bay on Warringah Road
- Warringah Road/Allambie Road – reduce the number of eastbound right turn lanes on Warringah Road

The study also comments on the likely need for the intersection of Wakehurst Parkway and Warringah Road to be grade separated.

3.0 Existing transport conditions in the Northern Beaches

3.1 Existing journey to work travel patterns

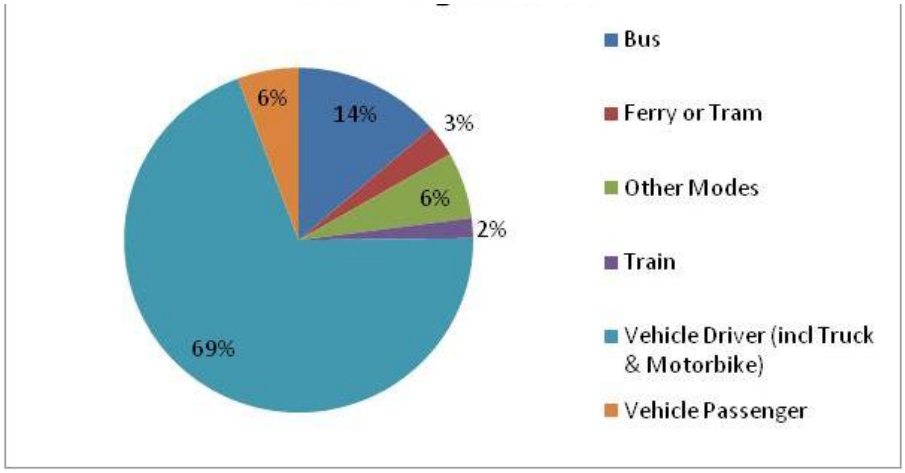
Travel characteristics for NSW residents travelling to work are gathered from the Journey-To-Work (JTW) data extracted from Australian Bureau of Statistics (ABS) 2006 Census. The JTW data set includes details of the origin and destination zones of trips, as well as characteristics of the journey such as mode of travel.

JTW data reports on the primary mode of travel. Rail trips reported in the Northern Beaches would all require a secondary mode of travel, most likely to be car or bus.

The North-East Subregion includes Warringah, Pittwater, and Manly Local Government Areas (LGAs). Frenchs Forest is located in Warringah LGA. The North-East Subregion is also known as the Northern Beaches, and that term has been used in this report.

Analysis of JTW data and existing travel behaviour in the Northern Beaches, and in particular Frenchs Forest, indicates that there were approximately 85,000 trips per day from Warringah, Pittwater, and Manly LGA's. **Figure 2** shows the majority of trips (69 per cent) made from the Northern Beaches were by car (vehicle driver), with 19 per cent made by public transport (bus, train, ferry etc). The JTW analysis on the following pages interrogates the JTW data further to determine any trends in the travel behaviour according to their origins and destinations.

Figure 2: Northern Beaches JTW mode share

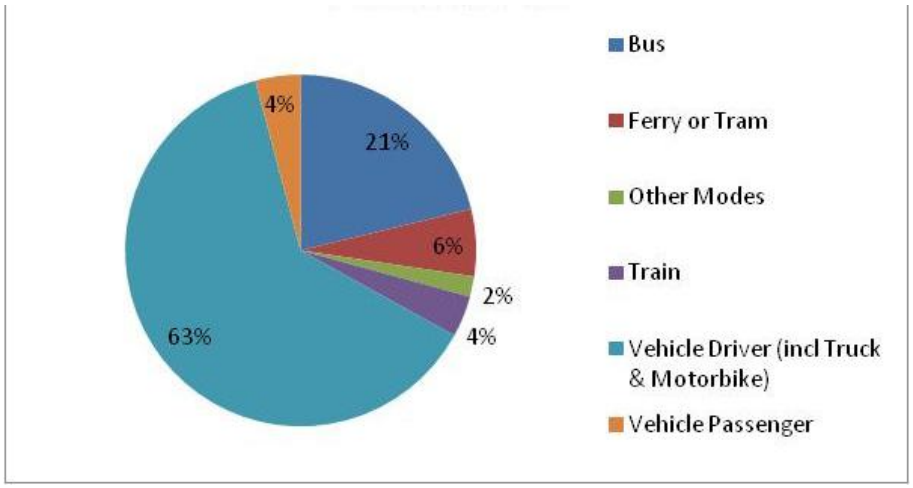


Source, ABS, 2006

3.1.1 Trips leaving the subregion

Of the 85,000 work trips, approximately 40,000 leave the Northern Beaches to areas of employment. **Figure 3** shows the modal split for the trips leaving the subregion and the data indicates that again, the majority of trips (63 per cent) are made by car (driver), with 31 per cent made by public transport.

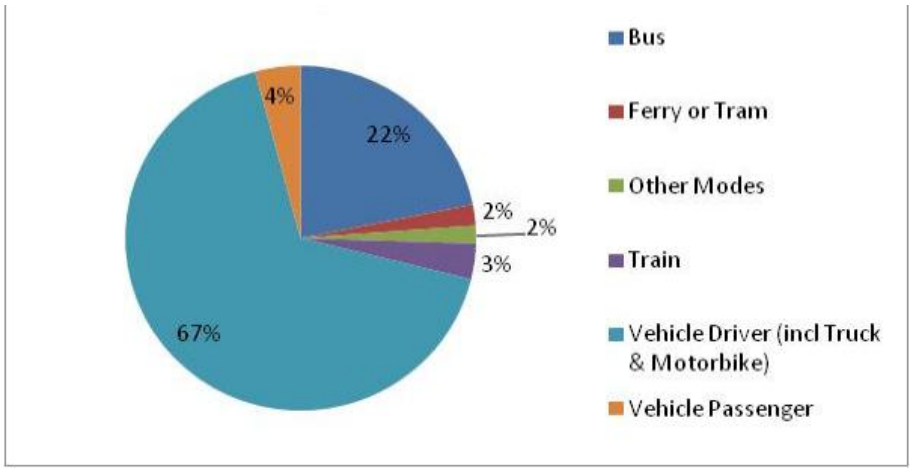
Figure 3: Northern Beaches to external JTW mode share



Source, ABS, 2006

Analysis focusing on the Warringah and Pittwater LGA's, which are more likely to be using the Warringah Road corridor, which crosses Frenchs Forest, indicates that approximately 35,000 journeys to work leave from the Warringah and Pittwater LGAs to destinations outside of the Northern Beaches, with the mode split of these trips shown in **Figure 4**.

Figure 4: Warringah and Pittwater JTW mode share



Source, ABS, 2006

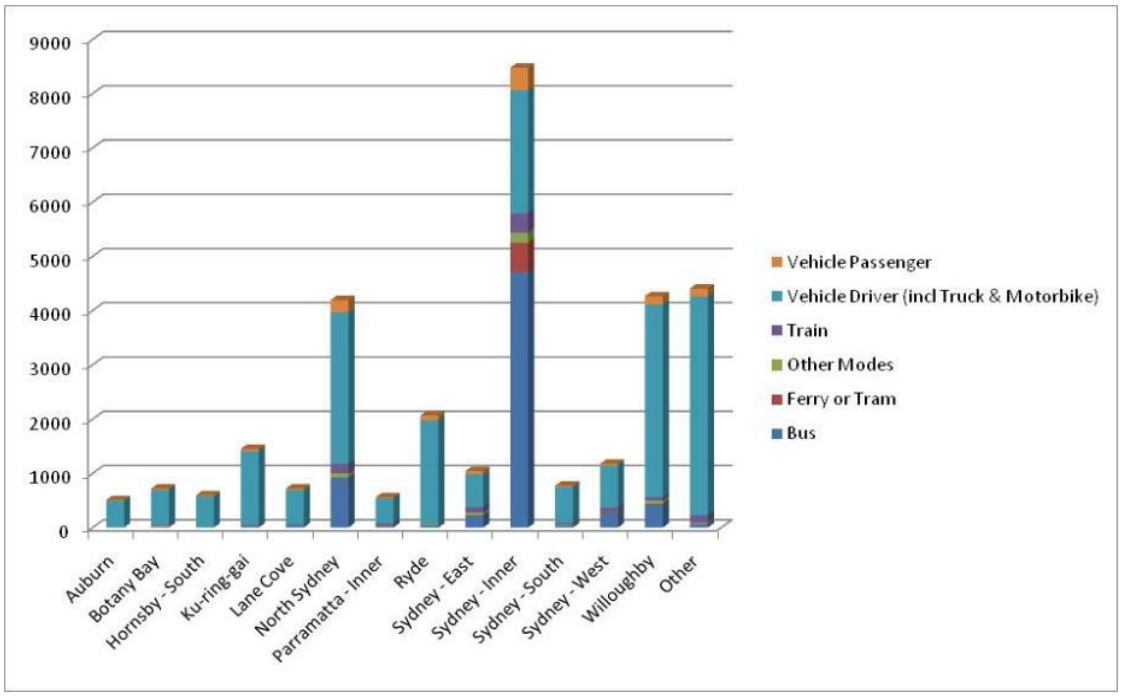
Further analysis indicates approximately 20,000 car trips (57 per cent) leaving the Warringah and Pittwater LGA each day for work purposes via Warringah Road, Military Road/Spit Road, Pittwater Road or Mona Vale Road, with the majority likely to be using Warringah Road and Military Road.

In addition JTW data for the Warringah and Pittwater LGAs identifies the main work destinations, namely:

- Sydney CBD (26 per cent)
- North Sydney (13 per cent)

- Willoughby (13 per cent)
- Ryde (6 per cent)

Figure 5: Breakdown of external JTW by destination and mode



Source, ABS, 2006

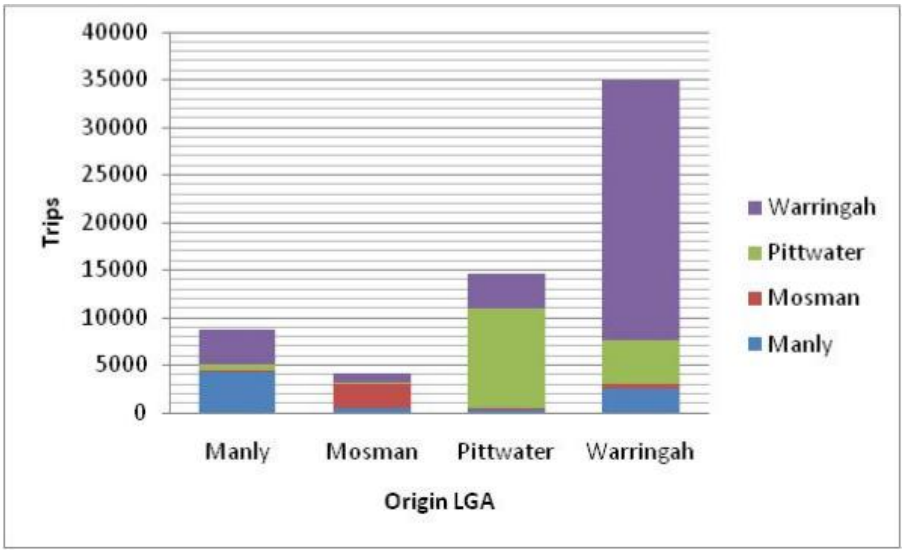
The analysis indicates a large amount of car trips are made to North Sydney, Willoughby and Ryde with the majority of this traffic travelling along Warringah Road, through the heart of Frenchs Forest. This analysis suggests a need for active encouragement of travel behavioural change and mode-shift to non-car for work trips to these destinations.

The analysis demonstrates the travel behaviour of inter-regional trips originating in the Northern Beaches. It shows that apart from trips to the CBD, the percentage of trips to work by private vehicle ranges from approximately 70 to 90 per cent, which suggests that there is little incentive for commuters to destinations outside of the CBD to use anything other than their cars as their mode of transport.

3.1.2 Trips within the subregion

Across the subregion the JTW data reveals that approximately 62,000 trips are internal, with over half of those trips originating in Warringah LGA. Warringah LGA has a higher level of trip containment, with 77 per cent of trips from Warringah staying within Warringah, as shown in Figure 6.

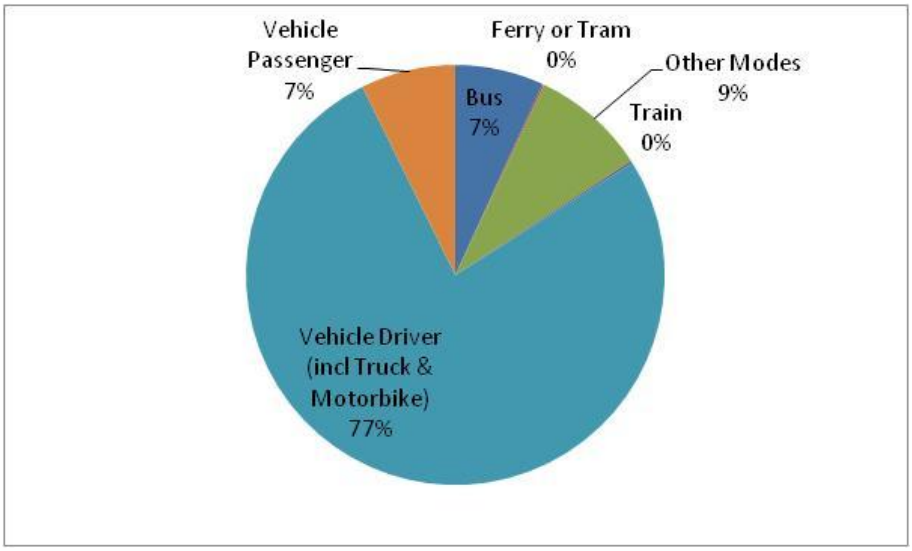
Figure 6 JTW within the sub-region



Source, ABS, 2006

Figure 7 below shows private vehicles are the dominant mode of travel within the Northern Beaches (Warringah, Pittwater, and Manly LGAs). However, there is a high proportion of trips via bus and other modes (walking, cycling).

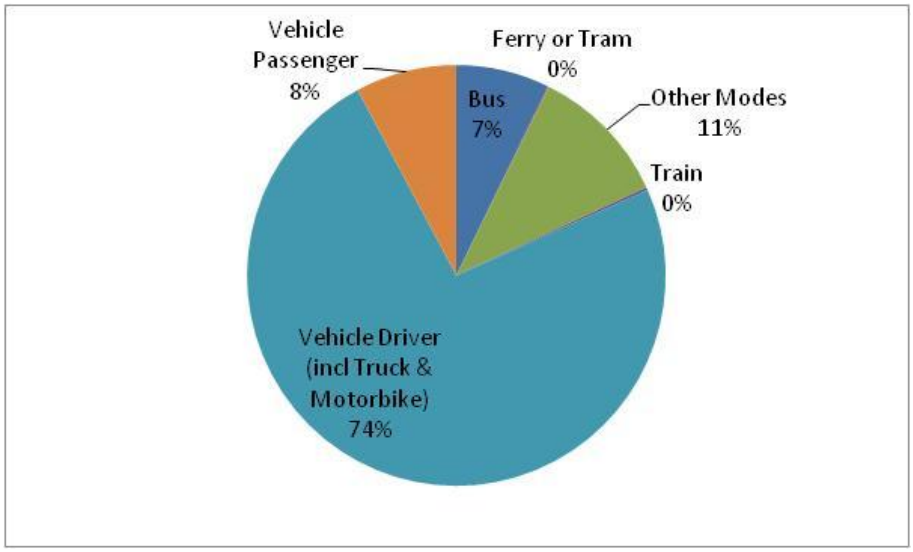
Figure 7 Internal JTW mode split for the Northern Beaches LGAs



Source, ABS, 2006

Further analysis of Warringah LGA in isolation shows a similar trend in mode-splits. With Warringah being the most populous LGA in the region, it is expected that this LGA would influence the overall mode split for the region.

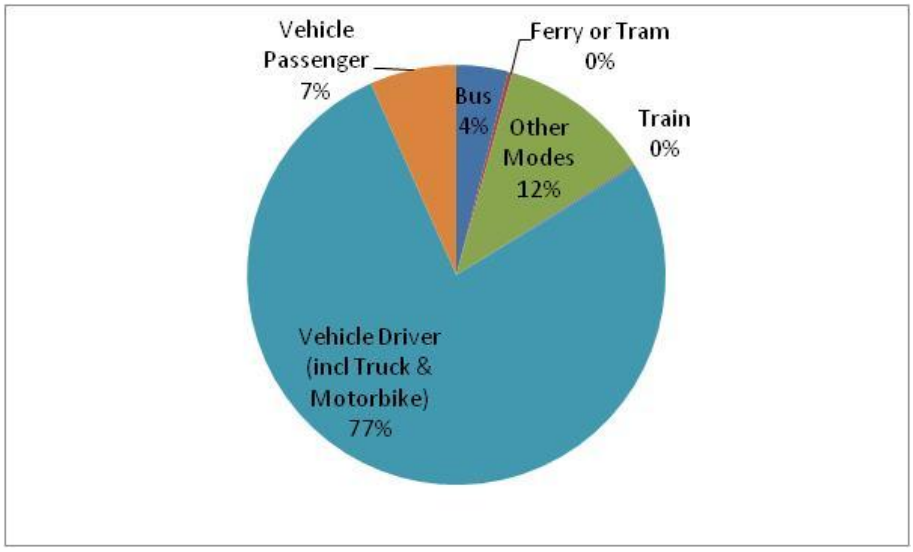
Figure 8 Internal JTW mode-split for Warringah LGA



Source, ABS, 2006

Analysis of Pittwater LGA shows a higher reliance on private vehicles for commuting to work, although the number of trips is much lower, with only 7,000 internal work trips.

Figure 9 Internal JTW mode-split for Pittwater LGA



Source, ABS, 2006

The internal JTW analysis suggests that a lot of the peak period traffic congestion in the subregion might be caused by internal movements; however the concentration of population and employment is on the coast and as such would not be directly impacting on Frenchs Forest.

The congestion seen in Frenchs Forest during the peak periods is caused by people travelling through Frenchs Forest to destinations outside the Northern Beaches and the fact that 86 per cent of all journeys to work to Frenchs Forest are by car.

3.2 Existing all purpose travel patterns

The Household Travel Survey is an annual sample survey that records the travel behaviour across Sydney for trips of all purposes, grouped into the following categories:

- Work
- Business
- Education (Primary, Secondary, Tertiary)
- Shopping
- Other

Analysis of Household Travel Survey (HTS) pooled data for 2008 indicates approximately 880,000 trips of all purposes originate in the Northern Beaches during an average weekday, as shown in the table below:

Table 1 Mode of all purpose trips originating in the Northern Beaches

Mode	Manly	Pittwater	Warringah	Total	Split
Vehicle driver	63,896	120,928	300,892	485,716	55%
Vehicle passenger	28,845	46,917	108,368	184,130	21%
Train	527	672	3,395	4,594	1%
Bus	8,155	6,066	25,990	40,211	5%
Ferry	4,384	2,214	1,185	7,783	1%
Walk only	31,817	43,231	62,925	137,973	16%
Other	4,172	3,117	10,107	17,396	2%
Total	141,796	223,145	512,862	877,803	100%

Source, TfNSW, 2006

As Table 1 shows, the mode split of trips is similar to that seen in the JTW analysis, with 76 per cent of all trips being made by private vehicle.

Journeys to Work (JTW) account for approximately 12% of all daily trips, with the majority of JTWs occurring in the morning peak.

3.3 Existing public transport provision

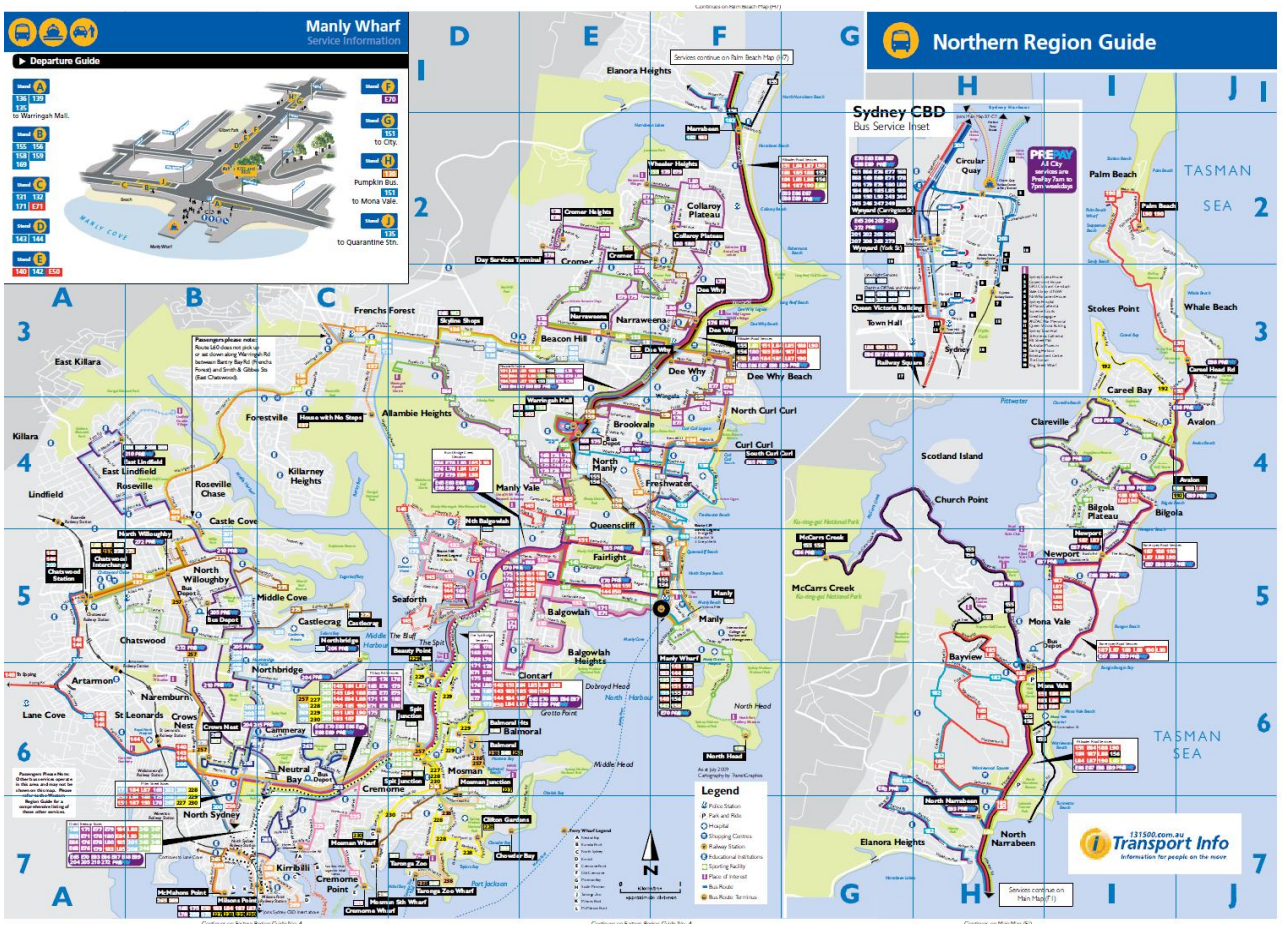
The HTS data also included information on average weekday and morning peak period bus trips originating and terminating in the Northern Beaches. Of approximately 40,000 bus trips on an average weekday, 65 per cent originate in Warringah. Almost half of those daily bus trips originate in the morning peak period.

North-south bus network coverage in the Northern Beaches is fairly extensive. However, there is limited east-west coverage. This is a legacy of the old bus contract regions, which were small and the administration of these regions did not foster the development of cross-regional routes that weren't destined for the CBD. Since the rationalisation of the bus contract regions the network has developed, but it is apparent that there is still scope to improve the links across the Northern Beaches region in an east-west direction.

Anecdotal evidence suggests that buses are often full during the peak periods, and services can only pick up passengers within their contract regions.

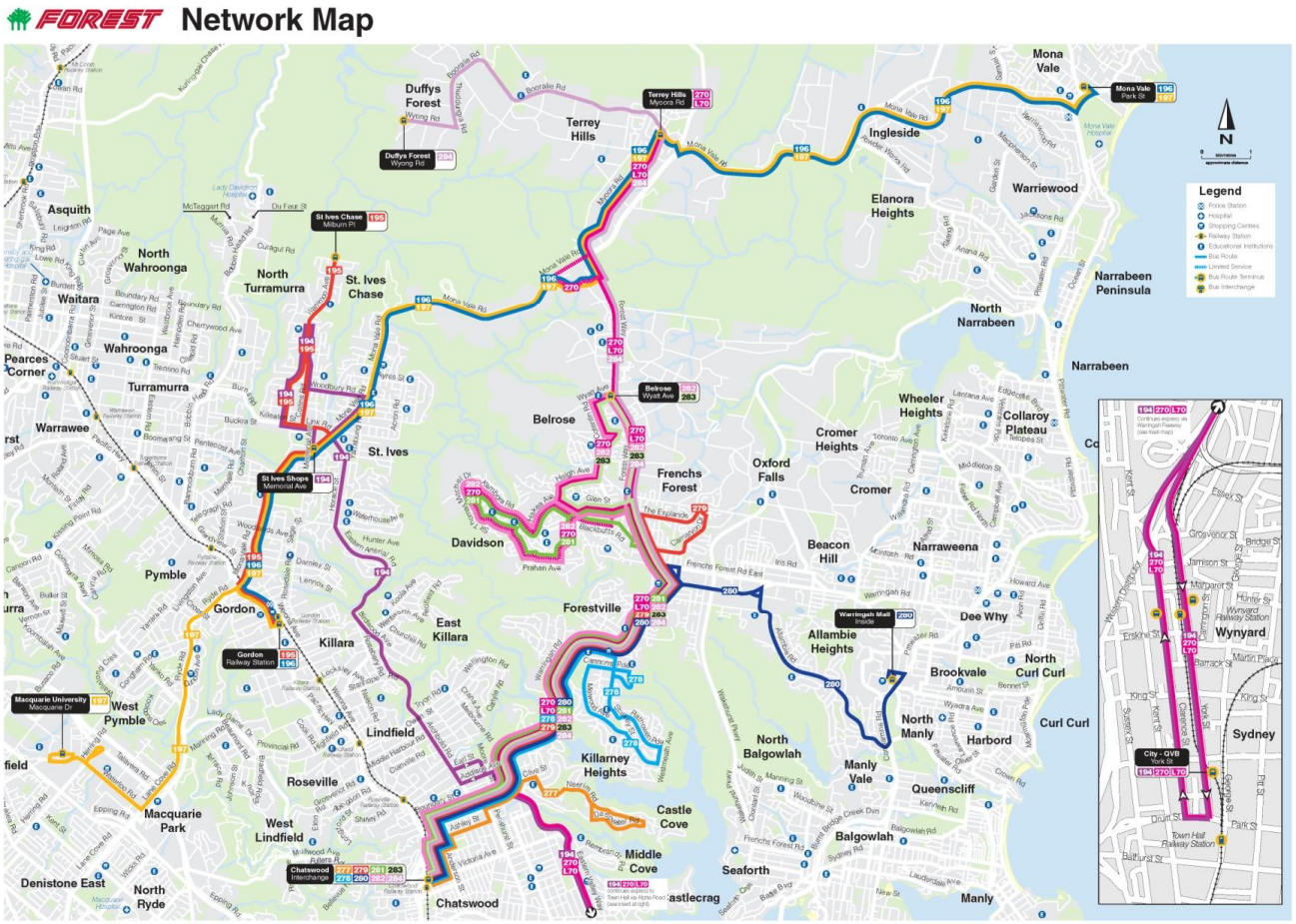
Sydney Buses and Forest Coaches operate buses along Warringah Road and Forest Way in the vicinity of Frenchs Forest as shown in Figure 10 and Figure 11.

Figure 10: Sydney Buses network map



Source: Sydney Buses, 2011

Figure 11: Forest network map



Source: Forest Coachlines, 2011

Bus routes and frequencies for the morning peak period (7-9am) are shown in **Table 2**. There are 112 bus services that service Frenchs Forest in the morning peak period, 83 travel south-west and 29 travel north-east. All routes travel along Warringah Road in the vicinity of Frenchs Forest, and most routes also travel along Forest Way.

The table below shows the frequencies on buses in 2011.

Table 2: Bus route frequencies

Route	Between	Route	Frequency (7-9am)	
			S-W Bound	N-E Bound
270	Belrose-City	Warringah Road / Forest Way	25	7
279-284	Duffys Forest - Chatswood	Warringah Road / Forest Way	17	10
280	Warringah Mall-Chatswood	Warringah Road / Forest Way	4	6
L60	Mona Vale-Chatswood	Warringah Road	3	0
136	Manly- Chatswood	Warringah Road / Forest Way / Frenchs Forest Road East	9	5
137	Chatswood to Bantry Bay	Warringah Road	0	1
169	Manly-City	Warringah Road / Forest Way / Frenchs Forest Road East / Wakehurst Parkway	4	1
E69	Manly-City	Warringah Road / Forest Way / Frenchs Forest Road East / Wakehurst Parkway	17	0
173	Narraweena to Milsons Point	Warringah Road / Forest Way / Frenchs Forest Road East / Wakehurst Parkway	3	0

Source: www.131500.com.au

There are no railway stations in the vicinity of Frenchs Forest. The nearest railway stations are at Chatswood (9kms) or Roseville (7.5kms). Rail trips would therefore require a secondary mode of transport to reach the rail station.

3.4 Existing road network

3.4.1 Road hierarchy

As shown in Figure 12, the three main access roads into and out of the Northern Beaches region are:

- Warringah Road;
- Spit Bridge/Military Road; and
- Mona Vale Road.

The major strategic roads within the Northern Beaches include:

- Pittwater Road;
- Wakehurst Parkway;
- Forest Way;

Other roads of importance in the vicinity of the Northern Beaches include:

- Eastern Valley Way; and
- Boundary Street.

Figure 12: Northern Beaches and arterial roads

Source: AECOM 2011

Warringah Road is the main access road into and out of the peninsula via Frenchs Forest. An investigation into the origins of trips on Warringah Road was undertaken via use of the Sydney Strategic Transport Model (STM). The STM is a four-step strategic model managed by TfNSW and covers the whole of Sydney. Select link analysis of the 2011 STM described the proportion of all car trips leaving the peninsula via Warringah Road at Roseville Bridge. These results can be seen in **Table 3**.

Table 3: Trips leaving the peninsula via Warringah Road

From	Leaving the Peninsula Proportion (%)
Origin Area	2011
Frenchs Forest	11%
Warringah South West	16%
Warringah South East	7%
Warringah Central	20%
Warringah North East	8%
Warringah North	13%
Pittwater North East	8%
Pittwater	12%
Manly East	3%
Manly West	2%
Total	100%

Source, TfNSW, 2011

The table shows that the majority (20 per cent) of trips leaving the peninsula via Warringah Road and the Roseville Bridge come from the Central Warringah area, including the suburbs of Dee Why and Brookvale. A large proportion also comes from the Warringah North area (13 per cent), which includes the suburb of Terry Hills. 20 per cent of trips also come from the Pittwater LGA which includes the suburbs of Mona Vale, Warriewood and the northern most beaches.

When comparing these trip origins with public transport services from these areas, it is apparent that the perceived attractiveness of public transport in these areas may be attributable to the limited service provision for east-west routes in this area.

3.4.2 Road network description

Warringah Road

Warringah Road is a major arterial road that connects Boundary Street / the Pacific Highway at Roseville in the west with Pittwater Road at Brookvale in the east, travelling through the northern suburbs of Sydney including Frenchs Forest. Warringah Road currently has three lanes in each direction for its entire length (including the Roseville Bridge). It has a posted speed limit of 80 km/hr for sections of its length, however the speed limit is 70km/hr through Frenchs Forest.

The average travel speed in the westbound direction drops to below 20km/h during the morning peak[2].

RTA Average Annual Daily Traffic (AADT) recorded in 2010 on Warringah Road at the Roseville Bridge was 67,500 vehicles per day in both directions.

Site visit observations showed that during the morning peak hours, Warringah Road becomes congested through Frenchs Forest (Figure 13).

The capacity of Warringah Road to the west of Frenchs Forest is limited by Roseville Bridge and then further limited as traffic flows into Roseville and onto either Eastern Valley Way or Boundary Street and the Pacific Highway.

[2] Warringah Road Corridor Study, RTA, 2009

Figure 13: Congestion on Warringah Road

Source: AECOM, 2011

Military Road / Spit Road

Military Road is a major arterial road that connects Sydney's lower north shore suburbs to the Spit Bridge and the Northern Beaches. It has three lanes in each direction and a posted speed limit of 60km/hr for the majority of its length. The southern section of the Spit Bridge also has three lanes in each direction, narrowing to two lanes in each direction at its northern end before widening again as it becomes Manly Road passing through the suburb of Seaforth.

Drivers experience congestion along Military Road as they travel through Mosman, Cremorne and Neutral Bay.

AADT recorded in 2009 on the Spit Bridge was 67,100 vehicles per day in both directions. There are bus lanes along some sections of Military Road and peak period clearway restrictions.

Mona Vale Road

Mona Vale Road is an arterial road that connects the Pacific Highway in the suburb of Pymble to the west with Pittwater Road at Mona Vale to the east. West of Forest Way it is primarily 6 lanes. East of Forest Way it is generally a four lane, divided carriageway for the majority of its length. The posted speed limit ranges between 60km/hr and 90km/hr.

AADT recorded in 2010 on Mona Vale Road at a location near the Forest Way intersection was 48,000 vehicles per day in both directions.

Pittwater Road/ Condamine Street/ Barrenjoey Road

Pittwater Road and its connections with Condamine Street and Barrenjoey Road is an arterial road that travels north-south along the coast connecting Manly in the south with Mona Vale in the north. The majority of the road has 3 lanes in each direction. Pittwater Road has a posted speed limit of 60 km/hr.

AADT recorded in 2010 on Pittwater Road at a location near Lismore Avenue was 44,500 vehicles per day in both directions.

There has been considerable investment in bus priority measures along this corridor, with the majority of the road now accommodating a peak period bus lane in both directions.

Wakehurst Parkway

Wakehurst Parkway is an arterial road that provides an inland north-south route through Garigal National Park between Seaforth to the south and Narrabeen in the north via Frenchs Forest. Wakehurst Parkway has one lane in each direction for the majority of its length, however it widens to two lanes when approaching the intersection of Warringah Road at Frenchs Forest. The section of road between Frenchs Forest Road East and Warringah Road has a dedicated bus lane in the southbound direction. Wakehurst Parkway has a posted speed limit of 70 km/hr in the vicinity of Frenchs Forest.

The section of this road that borders Narrabeen Lagoon is prone to flooding several times a year due to its lack of elevation above the flood level. When this flooding occurs the only alternative routes between the two areas are via Pittwater Road and Beacon Hill or via Mona Vale Road and Forest Way.

AADT recorded in 2010 on Wakehurst Parkway at a location near Frenchs Forest Road was 20,000 vehicles per day in both directions.

Forest Way

Forest Way travels north-south and connects Mona Vale Road to the north with Warringah Road at Frenchs Forest to the south. It has three lanes in each direction in the vicinity of Frenchs Forest and the built up urban area, narrowing to two lanes in each direction as it travels northwards towards Mona Vale Road. Forest Way has a posted speed limit between 70km/hr and 80km/hr.

AADT recorded in 2010 on Forest Way in Belrose was 38,000 vehicles per day in both directions.

On the approach to the intersection with Warringah Road there is a bus lane and bus priority at the signals.

Frenchs Forest Road/ Naree Road

Frenchs Forest Road travels east-west through Frenchs Forest, providing a parallel route to Warringah Road. It connects to Forest Way in the west by way of Naree Road and Warringah Road in the east. It is a local road, travelling through the residential area and has one lane in each direction. It provides access to the business parks located in Frenchs Forest on its southern side as well as residential access streets on its northern side.

Frenchs Forest Road forms part of Strategic Bus Corridors 15 and 17.

The Forest High School is accessed from Frenchs Forest Road, and in turn via the intersection of Wakehurst Parkway and Frenchs Forest Road. Anecdotal evidence suggests that this school traffic has a significant impact on general traffic flow.

Frenchs Forest Road has a posted speed limit of 50 km/hr.

Eastern Valley Way

Eastern Valley Way is a sub-arterial route linking Northbridge and Frenchs Forest via the Roseville Bridge crossing on Warringah Road. It has two lanes in each direction and runs northwards from Sailors Bay Road. The road has regular driveway access as it runs predominantly through a residential area. The road operates with clearways during peak hours and has a speed limit of 60km/hr. Bus routes operate along its entire length.

Its capacity and function as a traffic arterial is limited, but it is the most direct route to the Warringah Expressway/North Sydney from Frenchs Forest, bypassing Chatswood.

Boundary Street

Boundary Street runs east-west and connects the Pacific Highway with Warringah Road. It is a four lane, undivided road with two lanes in each direction between the Pacific Highway and Archibold Street, before it widens to three lanes in each direction east of Archibold Street. The road travels through a residential area and has a posted speed limit of 60km/hr.

The intersection of Boundary Street and the Pacific Highway is currently the subject of a design exercise to increase capacity. As part of this project Railcorp is also intending to rebuild the rail bridge that crosses Boundary Street. This will improve the overall intersection capacity in the area, but is still subject to the influence of congestion on the Pacific Highway.

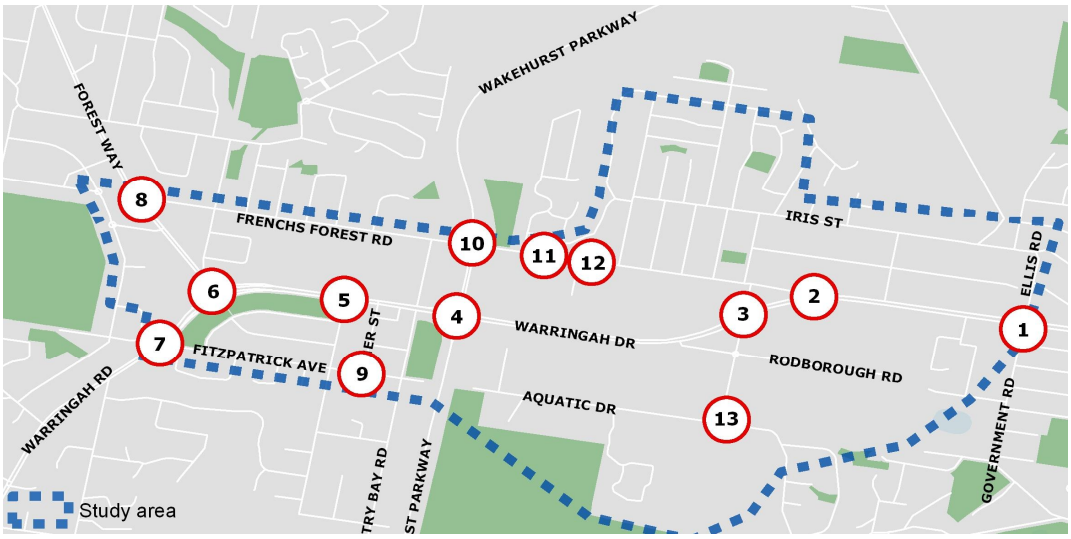
3.5 Existing road network capacity

3.5.1 The Frenchs Forest local road network

Manual traffic counts were undertaken by Austraffic traffic surveyors on Thursday 12 May 2011 between 7am and 9am, and between 4pm and 6pm at the following locations (shown on **Figure 14**):

1) Warringah Road and Ellis Road
2) Warringah Road and Frenchs Forest Road (East)
3) Warringah Road and Allambie Road
4) Warringah Road and Wakehurst Parkway
5) Warringah Road and Hilmer Street
6) Warringah Road and Forest way
7) Warringah Road and Fitzpatrick Avenue
8) Forest Way and Naree Road
9) Hilmer Street and Fitzpatrick Avenue
10) Wakehurst Parkway and Frenchs Forest Road
11) Frenchs Forest Road and Skyline Place
12) Frenchs Forest Road and Parkview Hotel Entrance
13) Allambie Road and Aquatic Drive

Figure 14: Traffic count survey locations



Source: AECOM 2011

3.5.2 Mid-block analysis

Average peak hour midblock flows and capacity on the key roads in the study area are shown in Table 4.

Table 4: AM Peak hour mid-block flows

Road	Location	Number of lanes (per direction)	2011 AM Peak hour Flow WB/SB	2011 AM Peak hour Flow EB/NB	Volume / Capacity*for peak direction
Warringah Road	Between Hilmer Street and Wakehurst Parkway	3	3028	3028	1.00
Warringah Road	West of Forest Way	3	3502	2564	1.16
Wakehurst Parkway	Between Warringah Road and Frenchs Forest Road	2	1224	673	0.61
Forest Way	Between Warringah Road and Naree Road	3	1972	1267	0.65
Frenchs Forest Road (East)	Between Wakehurst Parkway and Allambie Road	1	727	881	0.88

*based on a capacity of 1,000 vehicles per lane / hour Source: Austraffic2011

The Volume/Capacity ratio is a measure of how much of the roads capacity is being used during a peak period. A value exceeding 0.9 (90 per cent of capacity used) is an indication that users are likely to experience congestion and reduced travel speeds.

The table shows that in the AM peak hour Warringah Road is carrying volumes of traffic approximately equal to its theoretical capacity per lane, as demonstrated by the volume over capacity ratio exceeding 1. West of Wakehurst Parkway and west of Forest Way, the volume on Warringah Road exceeds the theoretical capacity.

Table 4 also indicates that the Frenchs Forest Road mid-block east of Wakehurst Parkway carries volumes close to capacity in the AM peak hour.

3.5.3 Intersection analysis

The existing operation and performance of key intersections within the study site has been assessed using *Sidra Intersection 5.1*, a computer based modelling package designed for calculating isolated intersection performance.

The main performance indicators for SIDRA 5.1include:

- Degree of Saturation (DoS) – a measure of the ratio between traffic volumes and capacity of the intersection is used to measure the performance of isolated intersections. As DoS approaches 1.0, both queue length and delays increase. Satisfactory operations usually occur with a DoS range between 0.7-0.8 or below;
- Average Delay – duration, in seconds, of the average vehicle waiting at an intersection; and
- Level of Service (LoS) – a measure of the overall performance of the intersection (this is explained further in **Table 5**).

Table 5: Level of Service and average delay performance criteria for intersections

Level of Service	Average Delay (secs/veh)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	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, RTA, 2002

The following five key intersections have been assessed:

- Warringah Road and Allambie Road (location 3 on Figure 14)
- Warringah Road and Wakehurst Parkway (location 4 on Figure 14)
- Warringah Road and Forest Way (location 6 on Figure 14)
- Forest Way and Naree Road (location 8 on Figure 14)
- Wakehurst Parkway and Frenchs Forest Road (location 10 on Figure 14)

Table 6 summarises the intersection performance based on the 2011 traffic flows for the AM peak hour.

Table 6: Existing AM peak hour intersection performance

Intersection	Demand Flow (veh / hr)	LoS	DoS	Ave Delay (sec)	95% Back of queue (m)
Warringah Road / Allambie Road	4,730	D	0.90	48	43
Warringah Road / Wakehurst Parkway	6,496	F	0.97	73	56
Warringah Road / Forest Way	7,670	D	0.95	50	70
Forest Way / Naree Road	3,255	F	1.42	31	37
Wakehurst Parkway / Frenchs Forest Road	3,081	D	0.94	50	34

Source: AECOM 2011

The table indicates that in the AM peak hour all key intersections within the Frenchs Forest study area operate with less than 10 per cent spare capacity.

The intersection of Forest Way / Naree Road operates over capacity, with a DoS greater than 1 and high traffic demands on Forest Way restrict traffic entering from Naree Road.

The intersection of Warringah Road / Wakehurst Parkway operates at a LoS F and with long average delays. This reinforces the SHOROC report, which identifies the need to grade separate this intersection.

3.5.4 Strategic road network

A summary of Annual Average Daily Traffic (AADT) volumes from RTA permanent count station data records from 2009 and 2010 is shown in **Table 7**.

Table 7: RTA permanent counts (2009 and 2010)

Count location and date	AADT (both directions)
Mona Vale Road (Forest Way) 2010	47,900
Pittwater Road (Lismore Avenue) 2010	44,530
Warringah Road (Roseville Bridge) 2010	67,440
Wakehurst Parkway (Frenchs Forest Road) 2010	20,010
Forest Way (Belrose) 2010	38,330
Spit Bridge 2009	67,170

Source: RTA, 2009, 2010

Peak hour traffic flows for the roads on the strategic road network have been obtained from the RTA Sydney Strategic Model for the 2011 model year.

Table 8 shows two-way midblock AM peak period flows (1 hour) and related capacity on the strategic roads within the study area.

Table 8: AM peak hour mid block traffic flows across the Peninsula

Road	Location	Number of lanes (per direction)	2011 AM Peak hour Flow WB/SB	2011 AM Peak hour Flow EB/NB	Worst Volume / Capacity*
Warringah Road	Roseville Bridge	3	4422	2139	**1.47**
Manly Road	Spit Bridge	3	3167	1672	**1.06**
Condamine Street	South of Kentwell Road	3	1829	1632	0.61
Mona Vale Road	East of Forest Way	2	2037	1381	**1.02**

*based on a capacity of 1,000 vehicles per lane / hour Source: RTA 2011

Table 9 shows the two-way midblock morning peak period flows (1 hour) around the Frenchs Forest area.

Table 9 AM peak hour mid block traffic flows in Frenchs Forest

Road	Location	Number of lanes (per direction)	2011 AM Peak hour Flow WB/SB	2011 AM Peak hour Flow EB/NB	Worst Volume / Capacity*
Warringah Road	East of Ellis Road	3	1996	1476	0.67
Wakehurst Parkway	South of Warringah Road	1	832	878	0.88
Forest Way	Belrose	3	1424	1028	0.48
Frenchs Forest Road	Forest High School	1	344	591	0.59

*based on a capacity of 1,000 vehicles per lane / hour Source: RTA 2011

The tables above suggest that Warringah Road, Mona Vale Road and Manly Road are all operating at or above their physical traffic capacity in the morning peak period. This correlates with the reality that road users commuting from the Northern Beaches regularly experience traffic congestion. With this level of traffic congestion the journey time reliability of these roads is understood to be poor.

3.5.5 Summary of existing conditions

The preceding information outlines the travel behaviour of people in the Northern Beaches and the existing condition of the transport network in the area. This can be summarised into the following points:

- Private vehicle mode share of 70 to 90 per cent seen in the region, depending on trip purpose and destinations such as Willoughby, North Sydney and Ryde LGA's.
- Access to peninsula via Mona Vale Road, Warringah Road, Military Road, all of which carry volumes of traffic above their designed capacity in the AM peak.
- Approximately 60 per cent of vehicle trips through Frenchs Forest on Warringah Road originate in the suburbs of Brookvale and Dee Why, and Pittwater LGA
- Limited public transport connections from Dee Why and Pittwater LGA to employment centres of Chatswood, Macquarie Park and North Sydney.
- The congestion on Warringah Road, Forest Way and Wakehurst Parkway limits the flow of traffic in Frenchs Forest
- The key intersections around Frenchs Forest are all operating close to their design capacity in the morning peak, especially the intersection of Warringah Road and Wakehurst Parkway, which operates at capacity and LoS F.

4.0 Future land use and transport context

4.1 Introduction

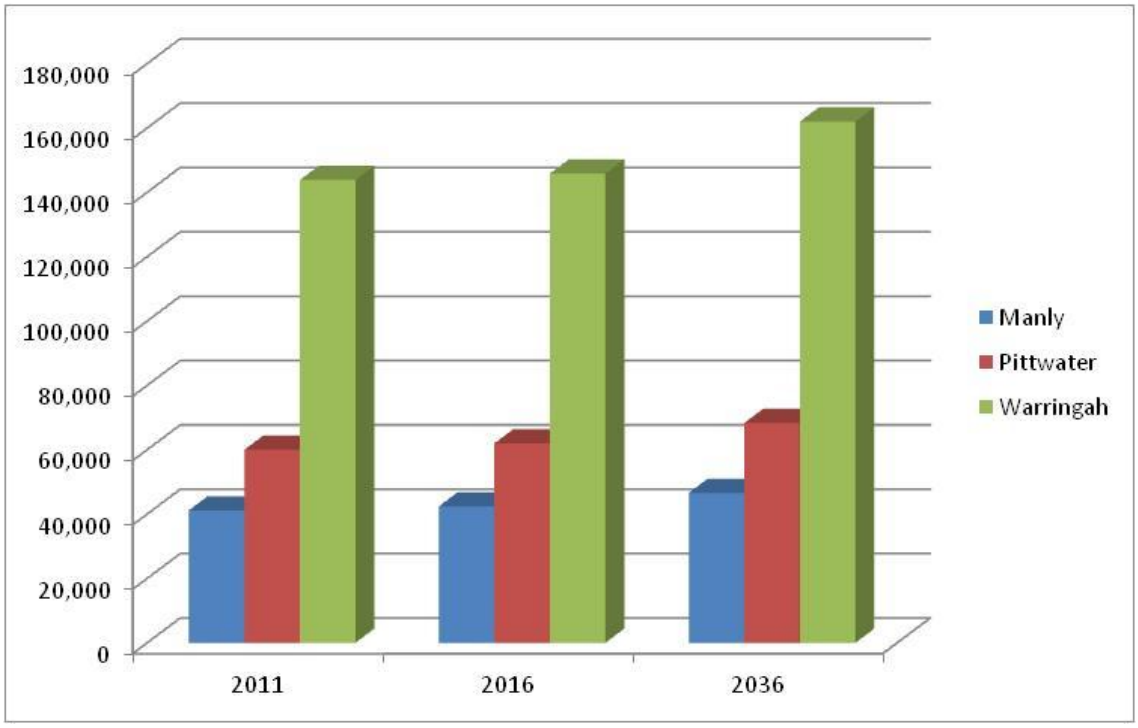
This section summarises the future land use and transport network in the study area including the future population and employment growth of the North East Subregion, the potential increase in traffic and public transport demand, as well as the planned provision of transport services and infrastructure upgrades to cater for future development.

4.2 Population and employment growth

4.2.1 Population

The population and employment growth has been taken from the BTS forecasts release of October 2009. This data was analysed to determine the growth in Manly, Warringah and Pittwater SLAs.

Figure 15 Population growth in Manly, Warringah and Pittwater



Source: TfNSW 2011

Table 10 Population growth by SLA

SLA	Population					
	2011	2016	2011 to 2016	2036	2016 to 2036	2011 to 2036
Manly	41,166	42,412	3.0%	46,622	9.9%	13.3%
Pittwater	60,006	61,980	3.3%	68,348	10.3%	13.9%
Warringah	143,862	145,862	1.4%	162,032	11.1%	12.6%
Total	245,034	250,254	2.1%	277,002	10.7%	13.0%

Source: BTS Population Forecasts by Year October 2009 release. Accessed August 2011

According to data from the Bureau of Transport Statistics and based on DP&I estimates, the combined population of the three SLA's is expected to reach 277,002 by 2036. Breaking down this figure, it can be seen that most of the expected population growth will be accommodated by the SLA of Warringah, which has a higher population than the other two SLA's combined. In Warringah, population is expected increase by 18,170 from 2011 to 2036, accounting for 57 per cent of the total expected growth in this period across the three SLA's. However, from 2011 to 2036, population increase is similar across each of the three SLA's with population increasing by 13.3 per cent in Manly, 13.9 per cent in Pittwater and 12.6 per cent in Warringah.

4.2.2 Employment

The amount of employment across the three SLA's is forecast to reach approximately 112,000 by 2036, which is a 21.5 per cent increase over today's employment numbers.

Table 11 Employment growth in the Northern Beaches

SLA	Employment				
	2011 Base	2016 Base	2011-2016	2036 Base	2011-2036
			3.4%		17.3%
Pittwater	21,261	22,318	5.0%	26,188	23.2%
Warringah	57,231	59,992	4.8%	69,783	21.9%
Total	92,115	96,389	4.6%	111,958	21.5%

Source: BTS Employment Forecasts by Year October 2009 release. Accessed August 2011

When comparing the employment forecast against the population there is a ratio of around 2.5 residents per job in 2036. This is a comparative increase in the availability of employment in 2011, where there is a ratio of 2.66 residents per job.

This increase in local employment would support the objective of trying to reduce commuting distances by creating more employment opportunities in the Northern Beaches area, and reduce the need to travel further afield for work.

4.3 Future road network and public transport upgrades

The focus in this area is maximising the use of existing infrastructure by improvements to bus priority along the Strategic Bus Corridors and some highway improvement schemes that will alleviate traffic congestion in certain areas as identified in such studies as the RTA's Warringah Road Corridor Study of April 2009.

4.4 Future business as usual traffic demand

4.4.1 Sydney Strategic Transport Modelling (STM) summary

Future base traffic demand for the Frenchs Forest study area and wider strategic area has been determined through the STM model. Data outputs from the models have been obtained for the following years:

- 2016 Business as usual transport and land use
- 2036 Business as usual transport and land use

The Business as usual models are the default STM models that TfNSW maintains, based on the population and employment forecasts set by the Department of Planning in October 2009. Similarly, the transport network for the forecast model years of 2016 and 2036 contains assumptions on network upgrades in the next 25 years, such as the introduction of:

- The North West Rail Link
- Widening of Mona Vale Road at key locations
- Widening of Sydney Road

Analysis of the model outputs shows insight to the distribution of traffic on key routes and the change in travel patterns between 2011, 2016 and 2036.

The STM model, based on EMME/2 strategic modelling software, is a multi-modal four-step strategic transport model. The model covers the whole of the Sydney Greater Metropolitan Area and is generally used to estimate relative changes in travel patterns between different forecast scenarios.

For the purposes of this study the STM model was used to predict the relative changes in travel patterns between the forecast years and the different land use and transport options.

To improve the validity of the model results this study also took advantage of the RTA's Sydney Region Model, which is a highway traffic assignment model. The 2011 model was calibrated against the traffic survey data and existing permanent count data and used as the base network for applying relative growth to for the different land use and transport network scenarios.

Volume plots for the base models can be found in **Appendix A**.

Select link analysis of the STM base model shows the expected proportion of all car trips leaving the peninsula via Warringah Road and the Roseville Bridge in 2016 and 2036 compared to 2011. These results can be seen in Table 12.

Table 12: Select link analysis Roseville Bridge

From	Leaving the Peninsula Proportion (%)		
Origin Area	2011	2016	2036
Frenchs Forest	11%	11%	12%
Warringah SW	16%	16%	15%
Warringah SE	7%	6%	6%
Warringah C	20%	21%	21%
Warringah NE	8%	8%	10%
Warringah N	13%	13%	13%
Pittwater NE	8%	8%	7%
Pittwater	12%	12%	12%
Manly E	3%	3%	2%
Manly W	2%	2%	2%
Total	100%	100%	100%

Source, TfNSW, 2011

The table indicates that the general trend in the proportion of trips leaving the peninsula via Warringah Road remains fairly constant into the future, with slight increases in Frenchs Forest and central and north-east Warringah.

This clearly demonstrates that around 62 per cent of all car trips travelling south on Warringah Road are coming from either Pittwater LGA or within the eastern suburbs of Warringah.

4.5 2016 future traffic demand

With the increase in population and employment it is expected that there will be a corresponding increase in trips being made.

The tables below (Table 13) summarise the traffic volumes at mid-block locations on the key arterial and sub-arterial roads across the Peninsula provided through the strategic RTA highway model outputs for 2016.

Table 13 2016 AM peak traffic volumes across the Peninsula

Road	Location	Number of lanes (per direction)	Estimated 2016 AM Peak hour Flow WB/SB	Estimated 2016 AM Peak hour Flow EB/NB	Worst Volume / Capacity*
Warringah Road	Roseville Bridge	3	4650	2350	1.55
Manly Road	Spit Bridge	3	3310	1810	1.10
Condamine Street	South of Kentwell Road	3	1870	1790	0.62
Mona Vale Road	East of Forest Way	2	2170	1440	1.08
Warringah Road	East of Ellis Road	3	2100	1570	0.70
Wakehurst Parkway	North of Warringah Road	1	1200	430	1.2
Forest Way	Belrose	3	1470	1090	0.49
Frenchs Forest Road	Forest High School	1	390	610	0.61

*based on a capacity of 1,000 vehicles per lane / hour Source: TfNSW 2011

The trend in traffic growth across the region is continued at a local level around Frenchs Forest.

The traffic on these roads increases by an average of approximately 5 per cent between 2011 and 2016. This is in line with a similar level of employment growth across the region. During the AM peak the main trip purpose is commuting, therefore this correlation between the percentage increase in trips and employment growth suggests that the STM model is accurately predicting traffic growth.

4.6 2036 future traffic demand

4.6.1 The Warringah peninsula

By 2036 the estimated level of traffic growth across the peninsula results in the mid-block volumes on nearly all of the arterial roads in the subregion exceeding the lane capacity during the AM peak period, as can be seen in Table 14.

Table 14 2036 AM peak traffic volumes across the Peninsula

Road	Location	Number of lanes (per direction)	Estimated 2036 AM Peak hour Flow WB/SB	Estimated 2036 AM Peak hour Flow EB/NB	Worst Volume / Capacity*
Warringah Road	Roseville Bridge	3	4790	2500	1.60
Manly Road	Spit Bridge	3	3520	2030	1.17
Condamine Street	South of Kentwell Road	3	2050	2190	0.73
Mona Vale Road	East of Forest Way	2	2380	1640	1.19
Warringah Road	East of Ellis Road	3	2500	1680	0.76
Wakehurst Parkway	North of Warringah Road	1	1190	470	1.19
Forest Way	Belrose	3	1760	1240	0.59
Frenchs Forest Road	Forest High School	1	450	780	0.78

*based on a capacity of 1,000 vehicles per lane / hour Source: TfNSW 2011

The assumed capacity of 1,000 vehicles per lane results in a Volume/Capacity ratio of close to 1.6. Roseville Bridge is an un-interrupted stretch of divided urban road and therefore could be assumed to have a slightly higher capacity. If the lane capacity of 1,400 vehicles per lane is assumed, the westbound lanes at Roseville Bridge are still estimated to be carrying approximately 15 per cent more traffic than their capacity.

The estimated level of growth between 2011 and 2036 is approximately 17 per cent, which demonstrates a linear growth in traffic against employment and population growth.

4.7 Summary of future land use and transport context

Based on the existing land use and transport forecasts contained within the STM model and based on the DP&I forecasts, it is possible to draw the following conclusions:

- The ratio of population against employment decreases from 2.66 to 2.5 between 2011 and 2036 indicating more local employment.
- By 2016 Warringah Road, Manly Road and Mona Vale Road are carrying even more traffic with no substantial capacity increases. The volume/capacity ratios on these links are even higher and suggest that mitigating measures need to be investigated in the short term.
- The origins of trips on Warringah Road do not change greatly over time and it is likely that the congestion experienced today will only worsen without any transport improvements.
- The level of traffic growth and high volume/capacity ratios suggest that the traditional morning peak period of 7-9am could not accommodate the travel demand. With no improvements to transport infrastructure this may mean that the peak periods may spread.

5.0 The Frenchs Forest Specialised Centre

5.1 Northern Beaches Hospital proposal

The Northern Beaches Hospital proposal involves the construction of a hospital at Frenchs Forest. Currently, the Northern Beaches region is serviced by hospitals at Mona Vale and Manly. However, the existing location of the hospitals means that approximately half of their radial catchment area lies off the coast. The Royal North Shore hospital is currently the nominated hospital, which serves the North East Subregion, but sits outside the boundaries of the North East subregion and is a considerable distance from the coastal suburbs on the Northern Beaches.

The proposed Northern Beaches Hospital site at Frenchs Forest is located at the junction of Warringah Road and Wakehurst Parkway. The hospital's position in the centre of the sub-region means the hospital catchment covers most of the sub-region.

The hospital development will increase employment in the Frenchs Forest centre by 5,000 jobs, comprising 2,000 direct hospital jobs, and 3,000 ancillary jobs.

5.1.1 Location and access

Access to the proposed hospital site is assumed to be from Frenchs Forest Road, as shown in **Figure 16** below.

Figure 16: Location of proposed Northern Beaches Hospital

Source: AECOM 2011

5.1.2 Relocated healthcare employment

This study assumes the majority of healthcare employment at Mona Vale and Manly hospitals would relocate to Frenchs Forest, with these two hospital sites being downgraded to local medical centres.

5.2 The State Significant Site

Frenchs Forest is proposed as a potential Specialised Centre in the State Significant Site Study exhibited by DP&I and the Ministry of Health in December 2010. It is to be developed around the Northern Beaches hospital and was conceived with the objective to concentrate employment and create an activity centre that will provide better amenity to the western and central areas of the Northern Beaches and balance the bias of services on the coastal strip.

The extent of the State Significant Site (SSS) as proposed by DP&I is approximately shown as the blue dashed line in Figure 16.

The SSS Study for the Frenchs Forest Specialised Centre (December 2010) indicated the potential to provide an increase of 1,000 to 1,300 new dwellings from the 1,200 existing, and an increase in employment from the existing 8,000 jobs to anywhere between 12,000 to 17,000 jobs (including health related jobs).

One of the key objectives for the Frenchs Forest Specialised Centre is to increase local employment opportunities thereby containing local vehicle trips and maximising the use of public transport as an alternative. While the land use and development controls could theoretically provide capacity for 12,000 to 17,000 additional jobs, this strategic assessment assumes 7,000 additional jobs will be provided in Frenchs Forest by 2036.

The 7,000 additional jobs is in line with employment and population growth estimates for the subregion. The study assumes these additional jobs would be drawn from other areas within the North East subregion with the exception of 1,000 direct health employment jobs, which have been drawn from outside the subregion.

Table 15: Frenchs Forest employment changes

Scenario	Additional Health Employment jobs	New Health Associated jobs	Other new jobs	Total new jobs
2016 + Hospital	2,000	3,000	0	5,000
2036 Full Development	2,000	3,000	2,000	7,000

5.2.1 Retail centre

In addition to a new hospital and increased employment in the business parks, the SSS also proposed a new retail precinct at the eastern end of the study area between Warringah Road and Frenchs Forest Road East. The indicative scale of this precinct was set at a range between 50,000 to 100,000sqm of Commercial Core floor space to serve the Frenchs Forest area and to reduce the need for local residents and employees to travel to Warringah Mall or Chatswood.

STM predicts shopping trips according to a level of retail employment and the relative attractiveness of these employment numbers compared to other retail employment zones. For the purposes of this study, it has been assumed that there will be approximately 1,000 retail jobs within the Specialised Centre. Beyond the scope of this study, further analysis is required outside the STM model to understand the potential traffic generation of a retail centre in the late afternoon/ early evening or at the weekend. This is addressed as part of a separate report called the Frenchs Forest Specialised Centre Local Transport Assessment (AECOM, 2011).

6.0 Future transport network conditions

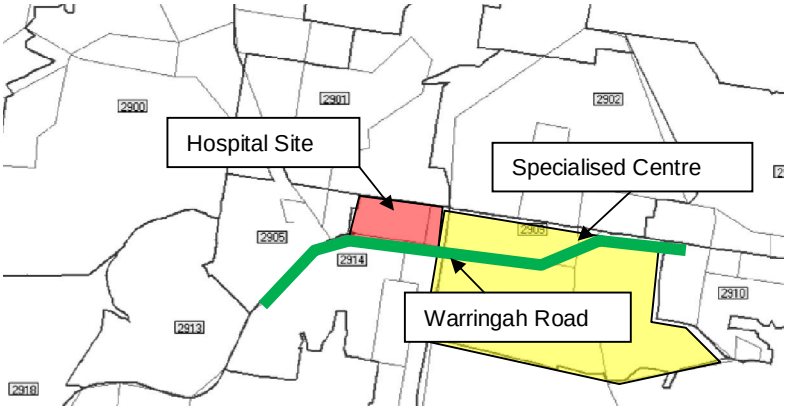
6.1 Introduction

This section assesses the likely traffic impacts of the potential Frenchs Forest Specialised Centre on the local and strategic road network. The transport network in these scenarios has not been modified from the base assumptions in STM. Assessment of the development has been undertaken for the following scenarios:

- 2016 Business as usual Transport Network + Hospital Development & Ancillary
- 2036 Business as usual Transport Network + Full Specialised Centre Development (including hospital)

The changes in employment were added to the strategic model in the two main travel zones in Frenchs Forest, namely 2909 and 2914

Figure 17 Frenchs Forest travel zones



Source: AECOM 2011

6.2 RTA highway model analysis

Relative changes in trip volumes generated by the development site between 2011, 2016, 2036 and the different development scenarios were analysed using the RTA strategic highway model. Two hourly trip volumes for the AM peak period originating and destined for the Frenchs Forest area (travel zones of 2909 and 2914) under the different development scenarios are shown in **Table 16**.

Table 16: Changes in total trip generation at Frenchs Forest across travel zones

Scenario	Total Trips (7-9am)	Difference with development
2011	10,518	
2016 Base	11,258	
2016 + Hospital	12,571	1,313 increase over 2016 base
2036 Base	13,658	
2036 Full Development	15,576	1,917 increase over 2036 base

Source: TfNSW 2011

The RTA strategic highway model predicts that there will be an 11 per cent net increase in morning peak car trips with the introduction of the hospital and associated development in 2016 compared with the 2016 base.

In 2036 the model predicts that there will be a 14 per cent net increase in morning peak private vehicle trips at Frenchs Forest compared with the 2036 base.

This analysis takes into account the relative change in the number of trips being attracted to the area and the change in the number of trips being produced within the area.

This scenario assumes the hospital is generating a sizeable proportion of its trips during the morning peak period. In reality it is likely that the impact of the traffic generated by the hospital will not be so significant during the peak periods, as hospital staff tend to follow shift patterns.

6.3 2016 hospital road network performance

The outputs from the RTA highway assignment model were analysed to determine the change in traffic volumes and volume/capacity ratios. The development scenarios were compared against the corresponding base models for that forecast year.

Table 17 2016 hospital AM peak hour link volumes

Road	Location	Number of lanes (per direction)	Estimated 2016 AM Peak hour Flow WB/SB (% change over 2016 base))	Estimated 2016 AM Peak hour Flow EB/NB (% change over 2016 base)	Worst Volume / Capacity*
Warringah Road	Roseville Bridge	3	4550 (-2%)	2420 (2.6%)	1.52
Manly Road	Spit Bridge	3	3370 (2%)	1800 (0%)	1.12
Condamine Street	South of Kentwell Road	3	1890 (1%)	1810 (1.3%)	0.63
Mona Vale Road	East of Forest Way	2	2160 (-0.5%)	1420 (1.8%)	1.08
Warringah Road	East of Ellis Road	3	2250 (6.6%)	1550 (-1.4%)	0.75
Wakehurst Parkway	North of Warringah Road	1	1200 (-0.6%)	395 (-10%)	0.97
Forest Way	Belrose	3	1580 (7%)	1050 (-3.5%)	0.53
Frenchs Forest Road	Forest High School	1	380 (1.5%)	730 (17%)	0.73

*based on a capacity of 1,000 vehicles per lane / hour Source: TfNSW 2011

As can be seen in **Table 17**, the change in traffic patterns across the region is marginal, with a 2 per cent reduction in trips travelling out of the region on Warringah Road, with a corresponding 2 per cent increase in trips coming into Frenchs Forest, most likely because of the new employment opportunities.

The table above outlines the changes in traffic volumes on the key roads in Frenchs Forest. As can be seen, there is an increase in traffic entering the Frenchs Forest area from all directions, which is to be expected with the increase in employment. There is also a decrease in trips leaving the area in some instances, demonstrating an increase in trip containment in the area.

Table 18 shows the performance of the key intersections in Frenchs Forest with the hospital development in place. The intersection performance was calculated in SIDRA, with the forecast years and development profiles using RTA highway assignment turning movement plots as the inputs for intersection volumes.

Table 18 2016 hospital AM peak hour intersection performance

Intersection	Level of Service	Deg of Satn (v/c)	Ave Delay (sec)	95% Back of queue (m)
Warringah Road / Allambie Road	F	1.013	71.3	77.3
Warringah Road / Wakehurst Parkway	F	1.001	90.4	72.2
Warringah Road / Forest Way	F	1.148	127	114.2
Forest Way / Naree Road	F	1.667	51.1	56.5
Wakehurst Parkway / Frenchs Forest Road	F	1.026	88	59.5

Source: AECOM 2011

In 2016, the LoS at all of the intersections is at F, with high degrees of saturation and lengthy delays. Clearly these intersections need upgrading before the hospital can be developed. The proposed intersection improvements are discussed in Section 8, and the Local Transport Assessment that accompanies this report.

6.4 2036 full development road network performance

The change in traffic conditions in the estimated 2036 full development scenario is outlined in the following tables.

Table 19 2036 full development AM Peak hour strategic road volumes

Road	Location	Number of lanes (per direction)	2036 AM Peak hour Flow WB/SB (% change over 2036 Base)	2036 AM Peak hour Flow EB/NB (% change over 2036 Base)	Worst Volume / Capacity*
Warringah Road	Roseville Bridge	3	4750 (-1%)	2620 (5%)	1.58
Manly Road	Spit Bridge	3	3525 (0%)	2020 (0.3%)	1.18
Condamine Street	South of Kentwell Road	3	2000 (2%)	2220 (1.5%)	0.74
Mona Vale Road	East of Forest Way	2	2440 (2%)	1580 (-4%)	1.22
Warringah Road	East of Ellis Road	3	2530 (1.2%)	1610 (-4.4%)	0.85
Wakehurst Parkway	North of Warringah Road	1	1250 (5.4%)	420 (-11%)	1.25
Forest Way	Belrose	3	1820 (3.3%)	1200 (-3%)	0.61
Frenchs Forest Road	Forest High School	1	410 (-9.3%)	900 (9%)	0.86

*based on a capacity of 1,000 vehicles per lane / hour Source :TfNSW 2011

The AM peak generally has a westbound and southbound travel direction, as evidenced in the table above. The volume over capacity ratio is calculated from the peak travel direction. The relative change in traffic between the 2036 base and the full development scenario across the Northern Beaches region is generally low on key arterial roads, although a five per cent increase in northbound traffic on Roseville Bridge is forecast.

On a local level, it can be seen that the additional development is drawing five per cent more trips from the north and nine per cent more trips from the west.

The key intersections are all predicted to operate at a LoS of F in 2036 in their current configurations. The extent of intersection improvements is discussed further in Section 8.

Table 20 2036 full development AM peak hour local intersection performance

Intersection	Level of Service	Deg of Satn (v/c)	Ave Delay (sec)	95% Back of queue (m)
Warringah Road / Allambie Road	F	1.087	119	106.1
Warringah Road / Wakehurst Parkway	F	1.079	161.4	120.9
Warringah Road / Forest Way	F	1.177	207.1	176.4
Forest Way / Naree Road	F	2.033	76.2	82.3
Wakehurst Parkway / Frenchs Forest Road	F	1.482	316.8	219.2

Source: AECOM 2011

6.5 Summary of future transport issues and constraints

Modelling analysis clearly shows that the volumes of traffic in the Northern Beaches will increase considerably over time and by 2036 the level of traffic on the key arterial roads and intersections would suggest worsening driving conditions without any improvements to the road network or public transport.

The 2016 results with hospital development in the absence of any transport or road improvements can be summarised as:

- By 2016 most arterial links the Northern Beaches will be over capacity.
- Warringah Road at Roseville Bridge will be carrying approximately 1.5 times its capacity.
- The intersections of Warringah Road / Allambie Road, Warringah Road / Wakehurst Parkway, Warringah Road / Forest Way, Forest Way / Naree Road, Wakehurst Parkway / Frenchs Forest Road in the Frenchs Forest area will be operating at LoS F in 2016.
- All approach roads to Frenchs Forest will be nearing their capacity per lane.

The 2036 results with the development of the full specialised centre, including the hospital can be summarised as:

- By 2036 most arterial links in the Northern Beaches will be over capacity.
- Warringah Road at Roseville Bridge will be carrying approximately 1.6 times its capacity.
- All five key intersections in the Frenchs Forest area will be operating at LoS F in 2036.
- All approach roads to Frenchs Forest will be nearing their capacity per lane.

6.5.1 Limitations of transport modelling

- Analysis of the trip generation for the hospital in STM and the RTA highway model does not take into account the shift work patterns for employees, which would result in a larger proportion of staff trips occurring outside of normal peak periods.
- The STM model is primarily used for analysing the weekday AM peak period and its public transport assignment model only provides estimates for the AM peak period. Consequently, the study has only considered the AM peak period (7-9am). Trips associated with the retail component of the development are not picked up in this analysis, as the majority of retail trips occur in the afternoon/evening period. The impact of afternoon peak trips is discussed in more detail in the Local Transport Assessment (AECOM, 2011)
- STM is only intended as a tool to guide and inform the strategic planning decision process.

7.0 Strategic transport measures

7.1 Introduction

This section provides a summary of the measures that could improve the transport network in the Northern Beaches and thereby could support the delivery of the proposed development at Frenchs Forest.

A list of measures has been developed for the short, medium and long term and include public transport, road network and Travel Demand Management (TDM) measures.

The key issues and constraints identified in the previous sections of this report are:

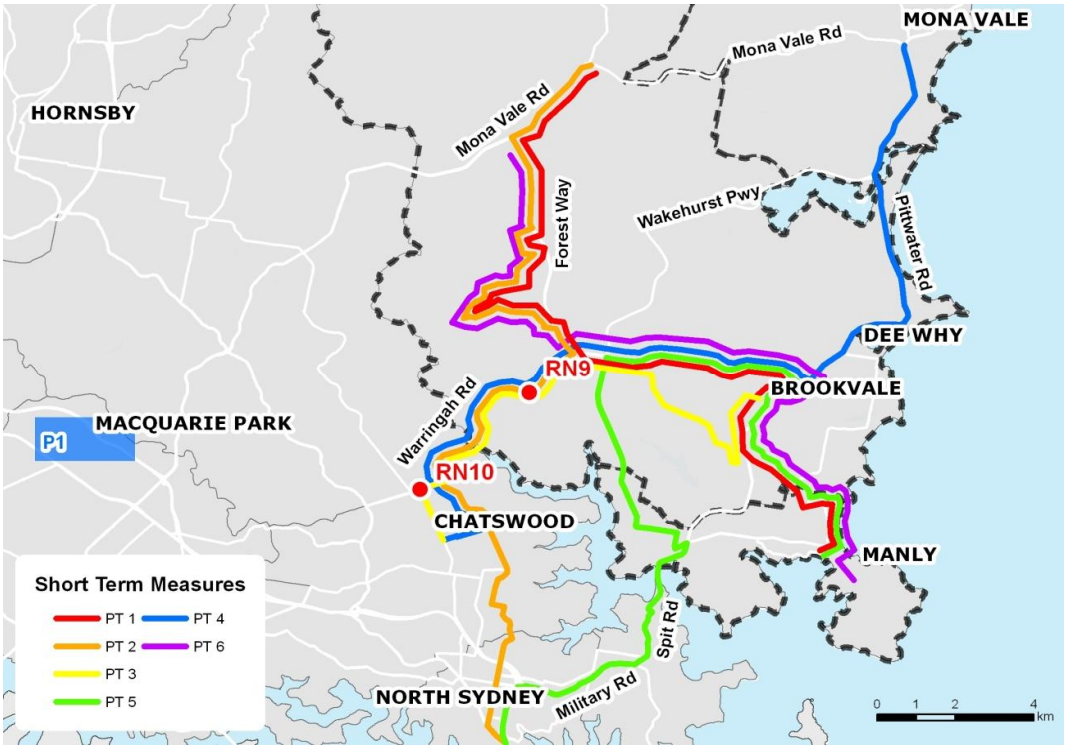
- Reducing private vehicle use across the region.
- Increasing public transport usage.
- Creating new public transport services that address the lack of east-west network coverage.
- Improving the existing road network to maximise its capacity.
- Improving access to Frenchs Forest and reducing intersection delays.
- Identifying the access requirements for the hospital site in the short term.

The potential measures have not been subjected to a thorough investigation into their feasibility. With the road/intersection modifications in particular, there are environmental and ecological concerns that may preclude the proposed measure from further consideration.

7.2 Short term

Short term measures mainly address the existing road network issues and constraints and suggest public transport measures that could be introduced. For the purpose of this study 'short term' has been defined as 0-5 years.

Figure 18 Short term strategic measures



Source: AECOM 2011

7.2.1 Public transport

A range of public transport measures are identified in the short term to improve public transport patronage and reduce the need to travel by private car through the Northern Beaches and in particular the Frenchs Forest area.

JTW data analysis focused on the origin and destinations of trips likely to be using Warringah Road. The JTW data suggests that there is a strong demand for better public transport links to Chatswood, Ryde and North Sydney. The HTS data supports the conclusions drawn from the JTW data, with similar trends in mode-splits.

Select link analysis of the STM model indicated that a large number of these trips originate in either the Brookvale/Dee-Why area or Pittwater LGA. When comparing this analysis against existing bus services, it was apparent that there is the potential to increase the headways on some services to improve coverage.

Very few services stop in North Sydney, with most Northern Beaches services bypassing North Sydney as they join the Warringah Expressway. The potential to improve links to North Sydney resulted in a new route being proposed.

It was also identified that there is a need for better counter peak services along the Warringah Road corridor.

The short term bus network enhancements and the addition of new routes will provide better east-west connections and also better links to North Sydney, potentially alleviating some of the congestion on Warringah Road.

The following measures are considered in this assessment:

PT1 – New route (Terry Hills to Manly) – 15 minute headways in peak period and direction – this provides a better counter peak service through Frenchs Forest, improving access to the hospital.

PT2 – New route (Terry Hills to Milsons Point) – 15 minute headways in peak period and direction – this provides a needed link to North Sydney, which currently has limited bus connections from the Northern Beaches

PT3 – Increase frequency on route from Chatswood to Warringah Mall in the counter peak to 10 minutes – this will provide better connectivity from Chatswood across to Frenchs Forest and Warringah Mall, connecting all three centres with a regular service.

PT4 – Enhance frequency of services on corridor from Mona Vale to Chatswood to five minute services in the peak direction during the peak period – this will provide an enhanced service for residents in Mona Vale and Dee-Why, where a large proportion of trips on Warringah Road originate.

PT5 – Enhance frequency of services on services from Manly to the City via Frenchs Forest to five minute services in the peak direction during the peak period – this will improve the service provided to residents of Beacon Hill and Frenchs Forest wishing to travel to the city.

PT6 – Provide a route from the Austlink centre at Terry Hills to Manly Wharf – this will provide a north-west to south-east service that travels through Frenchs Forest and Allambie Heights to Manly Wharf.

The service modifications and additions listed above could potentially be introduced in the next 5 years. These would need to be investigated further by TfNSW to ascertain the feasibility of these modifications.

7.2.2 Parking

JTW analysis shows that the modal split of trips to areas such as Willoughby and Ryde is approximately 90 per cent of work trips by private vehicle. This is potentially due to a combination of poor public transport links and relatively cheap parking which together result in little incentive not to drive.

P1 – Consider introducing a category 2 Parking Space Levy (PSL) at the employment centre of Macquarie Park.

The parking space levy currently imposed in the CBD, Chatswood, Bondi Junction and other areas requires the owners of private parking spaces to pay a levy per year per space. It is proposed that a similar scheme could be introduced at Macquarie Park to discourage commuting to work by private vehicle. The tier 2 parking levy is $740 per annum.

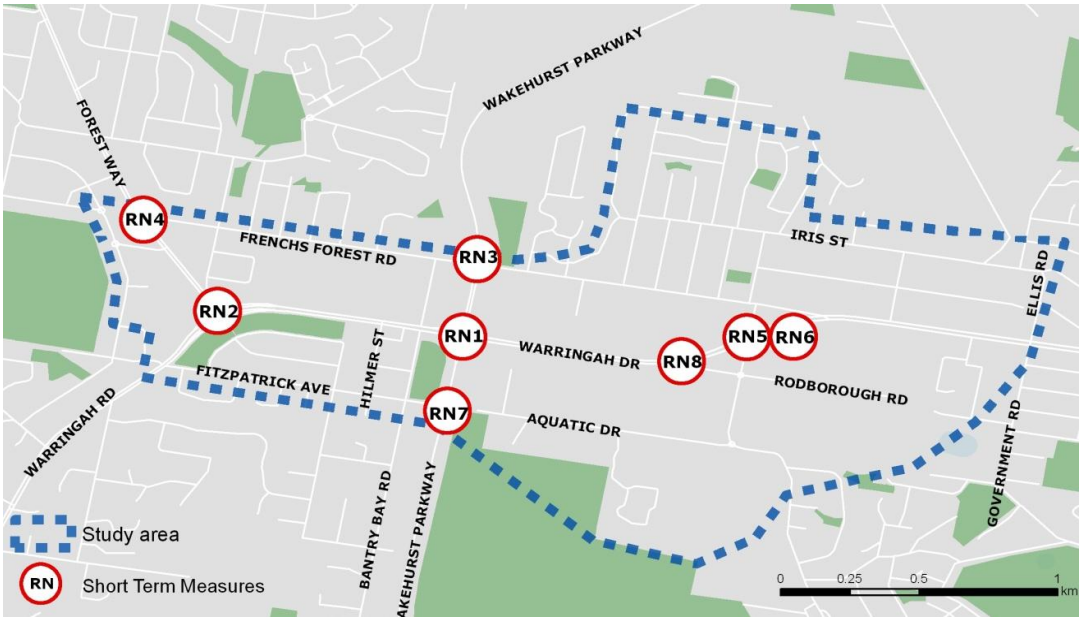
Whilst not within this study area or under the jurisdiction of any stakeholders in this study, it is proposed that this measure could help in achieving modal shift, but only if complemented by a substantial increase in public transport services to the area from the Northern Beaches. The wider impact of this proposal is not known and should be considered if this measure were to be investigated further.

This has been modelled in STM by applying the same parking cost penalty to Macquarie Park, as is applied to Chatswood.

7.2.3 Road network

Analysis of the existing road network in 2011 and in the future (2016, 2036) with and without the proposed development at Frenchs Forest has identified the need for road network and intersection improvements to increase capacity and improve the operation of the road network.

Figure 19 Short term local measures



Source: AECOM 2011

The following short term measures have been identified and considered:

RN1 – Operational/capacity review of the Warringah Road / Wakehurst Parkway intersection - reviewing the signal control method, any improvements to alignments and the SCATS control.

RN2 – Operational/capacity review of the Warringah Road / Forest Way intersection - reviewing the signal control method, any improvements to alignments and the SCATS control.

RN3 – Operational/capacity review of the Wakehurst Parkway / Frenchs Forest Road intersection - reviewing the signal control method, any improvements to alignments and the SCATS control.

Measures RN1-RN3 are suggested as short term solutions to capacity issues and would be superseded by any longer term infrastructure upgrades that are proposed for these intersections.

RN4 – Signalise the Forest Way / Naree Road intersection – this will provide controlled access to Naree Road and the proposed hospital site. Further investigation on the feasibility of this intersection is needed, especially the relationship between this intersection, Russell Avenue and the pedestrian crossing on Forest Way.

RN5 – Reduce right turn lanes from 2 to 1 from Warringah Road to Allambie Road – this is a measure identified in the RTA Warringah Road Corridor Study to improve afternoon peak capacity on Warringah Road.

RN6 – Ban right turn from Allambie Road to Warringah Road, allow right turn from Allambie Road to Frenchs Forest Road East – this will remove an intersection conflict and allow for better signal control of the intersection, thus reducing delay.

RN7 – Extend Aquatic Drive to link to Wakehurst Parkway and to operate as left in left out into Aquatic Drive, with potential for right turn for buses only from Aquatic Drive – this would allow traffic from the business parks on Aquatic Drive to exit directly onto Wakehurst Parkway, rather than rejoining Warringah Road and adding to the congestion. This has previously been investigated by the RTA, but may warrant further investigation if the land use either side of this intersection changes.

RN8 – Signalise Warringah Road / Rodborough Road and allow right turns from Rodborough Road onto Warringah Road – this would control the egress from Rodborough Road, allowing safer access onto Warringah Road and controlled egress from the business parks.

RN9 – Investigate the linking to Starkey Street intersection control group and whether this can be changed to benefit Frenchs Forest – it is understood from the RTA that all of the traffic signals in Frenchs Forest have their cycle times limited by their connection to the Starkey Street intersection.

RN10 – Add additional eastbound lane on Boundary Street from Pacific Highway under rail bridge – whilst this will not directly benefit the Frenchs Forest area, this measure near the intersection of Boundary Street with the Pacific Highway may improve traffic flow and ease some of the congestion experienced by traffic in the Chatswood area, as identified in the RTA Warringah Road Corridor Study. It is understood that this measure is currently being planned and as such was not included in any further costing or discussion in the report.

7.2.4 Travel Demand Management (TDM) measures

Travel Demand Management (TDM) strategies involve the application of policies, objectives, measures and targets to influence travel behaviour, to encourage uptake of sustainable forms of transport, i.e. non-car modes, wherever possible and to reduce the need to travel and hence reduce overall transport and travel demand and the impacts of new development.

TDM1 - A Sustainable Travel Strategy (STS) for the SHOROC Region in conjunction with Warringah, Pittwater, Manly and Mosman Councils. This would be an overarching policy and strategy designed to encourage people to choose to travel via sustainable modes as opposed to the car, where appropriate to needs and lifestyle. Where alternatives to the car are not viable, options to encourage car sharing can be promoted to minimise the need for single occupancy vehicle travel.

The STS would involve various individual elements of travel planning for different land uses, travel demand management, public transport, walking and cycle infrastructure improvements, parking restraint, and travel awareness marketing, branding awareness campaigns and promotion. The managed implementation of all these elements together under a single comprehensive STS could deliver significant step change in a location such the SHOROC Region. The strategy would need to be applied across schools, workplaces, universities, precincts and communities. Whilst an individual travel plan for a site would encompass a range of actions that form a strategy for that site, to effectively address travel behaviour change, an overarching strategy is concerned with active travel behaviour changes across region and evidence has shown that this can create the necessary behavioural changes that infrastructure provision alone or other management measures in isolation can struggle to achieve.

The SHOROC Region would benefit from implementing the following travel plans as part of the strategy:

- Workplace travel plans for large companies/organisations;
- Residential / community travel plans;
- School travel plans; and
- A hospital travel plan for the proposed Northern Beaches hospital at Frenchs Forest.

The implementation of travel plans needs to be supported through the planning process, therefore it is strongly advised that relevant local planning policies such as Development Control Plans (DCP) for new developments be reviewed to include compulsory travel plans to be undertaken for all new employment generating developments such as the new development in the potential specialised centre.

As well as travel plans, the STS program should include a car sharing scheme and a marketing and awareness campaign which promotes sustainable transport in the region. Other measures involved include encouragement of active travel choices (walking and cycling) and encouragement of public transport use. Encouragement of travel behaviour change through promotion, marketing and awareness campaigns and branding will be as important as the introduction of infrastructure in enacting modal shift in the SHOROC region.

The following measures are therefore assessed as part of the STS:

TDM1 – Implementation of a SHOROC Region Sustainable Travel Strategy (including travel planning)

TDM1a – Include requirements for Travel Plans (workplace, new developments) in relevant Council DCPs

TDM1b – Marketing and Awareness campaign for SHOROC Region Sustainable Travel Strategy

TDM1c – Region Car Sharing Scheme

TDM1d – Active travel choices strategy (promotion of walking/cycling and improvements to infrastructure)

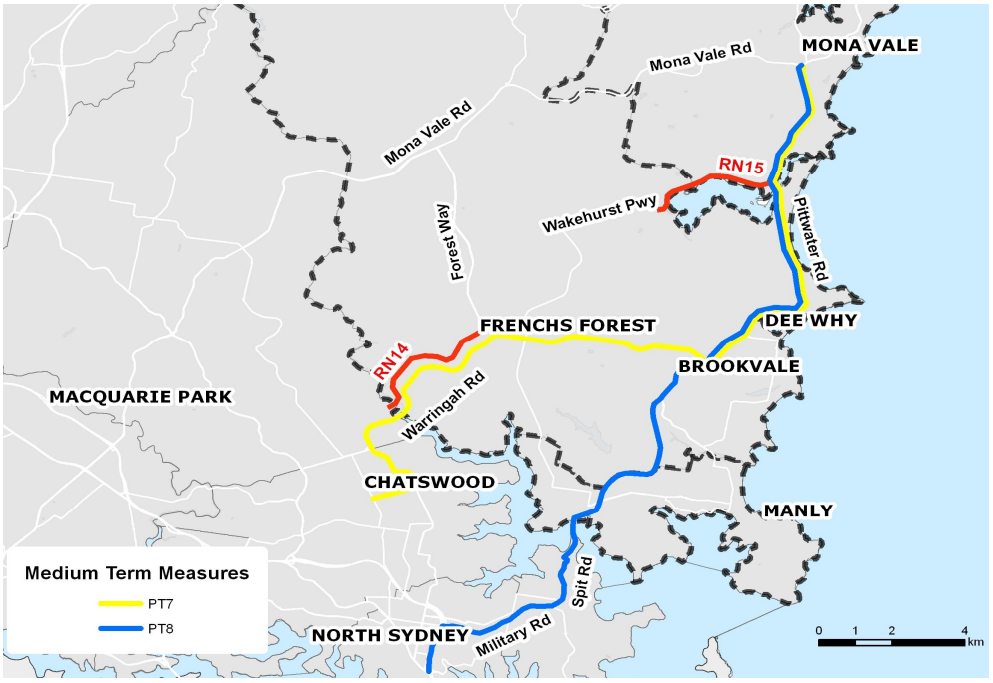
TDM1e – Public transport promotion

Appendix B includes some reference material on Sustainable Transport Strategy case studies and their effectiveness at encouraging travel behaviour change.

7.3 Medium to long term

Medium to long term measures are listed to address existing road network constraints and to accommodate future road network demand follow. For the purpose of this study medium to long term has been defined as 5 -25 years.

Figure 20 Medium to long term strategic measures



Source: AECOM 2011

7.3.1 Public transport

TfNSW is currently undertaking the Northern Beaches BRT pre-feasibility study, which is a separate study to the Frenchs Forest Strategic Transport Assessment. This study is considering a range of BRT options. The two corridors identified in the SHOROC report, from Mona Vale to the City, and from Dee-Why to Chatswood have both been used in the Frenchs Forest Transport Assessment to test the potential for mode-shift in the STM model.

A prominent BRT system in the Northern Beaches could provide broader social and economic benefits such as productivity gains, pollution reduction, improved mobility, job creation as well as the primary objective of increasing network capacity. The pre-feasibility study being undertaken by TfNSW will consider in more detail the infrastructure requirements and cost of such a scheme.

Building on the short term measures and improved connectivity that these would provide, it was also determined that the two routes recommended by SHOROC have the potential to attract patronage from the Northern Beaches.

For the purposes of this study, the team identified routes that follow similar alignments to those proposed by SHOROC. These routes were then modified in the STM model to simulate a BRT like system.

PT7 – Provide a high frequency dedicated BRT system from Mona Vale to Dee Why to Chatswood – the BRT service has been modelled to run at an average speed of up to 40km/h. The exact location of stops has not been calculated in this study

PT8 – Provide a high frequency dedicated BRT system from Mona Vale to the City – the BRT service has been modelled to run at an average speed up to 40km/h. The exact location of stops has not been calculated in this study

To simulate a BRT system it was necessary to remove a traffic lane in each direction.

7.3.2 Road network

Analysis of the background traffic growth alone suggests that over the next 5 years the traffic congestion through Frenchs Forest would reach a point where major infrastructure upgrades are required to maintain traffic flow even with no hospital development. The road upgrades should be designed and built to accommodate growth for at least the next 25 years.

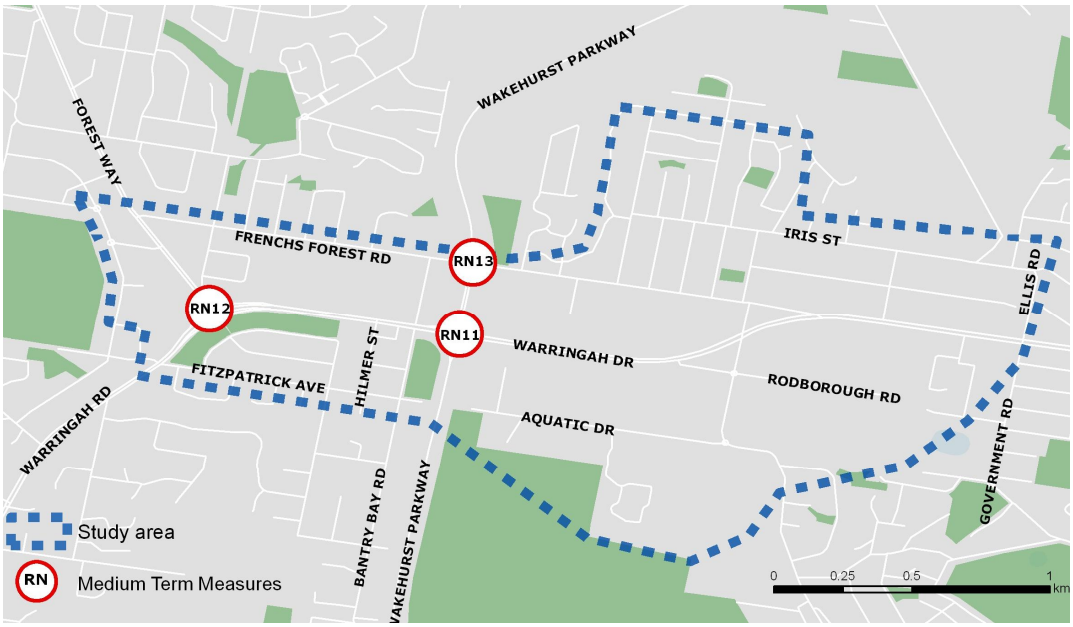
With the introduction of a hospital and additional employment at Frenchs Forest, the need to provide better road access to the site is even greater. Additional site access points, improved public transport services and a requirement to improve the pedestrian and cyclist environment introduce conflicting performance objectives for the Frenchs Forest road network.

Existing intersections in Frenchs Forest cannot be expanded and the only solution to accommodating existing and higher traffic volumes is to grade separate the key intersections of Warringah Road with Wakehurst Parkway and Forest Way. This could be designed and delivered in such a way that the surface level environment and street profile may be reduced and potentially encourage more pedestrian and cyclist activity. Grade separation of traffic movements would have the added benefit of potentially improving bus journey times by reducing intersection delays. These intersections could be grade separated in isolation, or if delivered as one scheme they could effectively create a Frenchs Forest bypass tunnel similar to the scheme proposed in the 2010 State Significant Study.

The intersection of Warringah Road and Wakehurst Parkway will play a key role in providing access to the proposed Northern Beaches hospital. Vehicles on Warringah Road will access Frenchs Forest Road via this intersection. Any grade separation of this intersection will have to allow for easy distribution of traffic to and from the hospital.

In the medium to long term the following measures have been considered for the road network in the region:

Figure 21 Medium term local measures



RN10– Implement Park and Ride schemes based around BRT origins i.e. Dee-Why parking station and Mona Vale parking station. There is also an existing Park and Ride station at Warriewood. The effectiveness of this service should be reviewed, as well as the potential for new locations across the Northern Beaches.

RN11– Grade separation of Wakehurst Parkway and Warringah Road intersection – This has been identified as a priority in several studies and should be considered as one of the first infrastructure upgrades in the Northern Beaches. It has the potential to improve journey time reliability through the area and also improve bus journey times by reducing the intersection delay experienced by buses that currently travel on Frenchs Forest Road East and join Warringah Road or continue over Wakehurst Parkway. The major volume at this intersection is the east-west movement on Warringah Road. An underpass would remove this through movement, freeing up surface road space.

RN12 – Grade separation of Forest Way and Warringah Road intersection – this intersection is also approaching its functional capacity in peak periods and has limited scope to improve its capacity. The only way to improve its capacity is to grade separate. As with Warringah Road and Wakehurst Parkway, the most logical movement to separate would be the east-west through movement on Warringah Road, which could be accommodated in a tunnel under the intersection.

RN13 – Grade separation of Wakehurst Parkway and Frenchs Forest Road – with the need to improve access to Frenchs Forest Road West and the hospital site, it is suggested that this intersection could be considered as a candidate for grade separation. The topography of the intersection would lend itself to an east-west bridge on Frenchs Forest Road that bridges over Wakehurst Parkway. This could potentially be a bus and emergency vehicle route only.

RN14 – Widen Warringah Road from Forest Way to Woodlands Road – the median along Warringah Road between Forest Way and Woodlands Road is wide enough that an additional westbound lane could be introduced in places. This could serve as a peak period bus lane, further improving the attractiveness of bus services by increasing bus speeds. It is possible that this proposal would also require some additional land to accommodate intersections. The cost of land acquisitions has not been explored.

RN15 – The flooding risk on Wakehurst Parkway has been identified as a risk to vehicle access to Frenchs Forest from the Mona Vale area. Mitigating this flooding risk and contingency planning should be considered as part of the improvement to capacity across the Northern Beaches.

7.3.3 Travel Demand Management measures

The Sustainable Travel Strategy for the SHOROC Region would continue to be implemented with extensive monitoring to continue successful delivery of the strategy and to identify areas of improvement as time goes on.

7.4 Long term

Long term measures are to address future road network demand, future growth and future changes within the region. For the purpose of this study ‘long term’ has been defined as beyond 25 years.

7.4.1 Public transport

In the long term, beyond 25 years, the following measure may need to be considered:

PT9 – investigation into the feasibility of a Northern Beaches rail corridor from Chatswood to Mona Vale via Manly and Warringah Mall – whilst not considered in any great detail in this study, this should be acknowledged as a long term aspiration for some form of rail system to serve this area, which will be one of the only major areas of Sydney that is not connected to any rail network.

7.4.2 Road network

RN 16 - Investigate the feasibility of a tunnel from Cammeray/Miller Street at the Warringah Freeway under Middle Harbour to Seaforth, linking into the Burnt Bridge Creek Deviation. A link could also be provided to Warringah Freeway.

By removing through traffic from Warringah Road and Military Road these corridors would experience an improvement in environmental quality, and provide capacity for BRT services into the city.

7.5 Summary list of potential measures

This section summarises the measures proposed for each time frame and also highlights which of these measures have been modelled in STM or the RTA's highway assignment model.

Some of the measures were too localised or small scale to show any significant change in a strategic model and as such were not modelled. It was also not possible to model more complex measures such as park and ride and the sustainable transport strategy in the current version of STM.

7.5.1 Short term 0-5 years

Table 21 Proposed short term measures

Measure ID	Description	Objective	Package	Modelling Scenario
PT1 – new route (Terry Hills to Manly)	Counter peak bus service from Terry Hills to Manly	Improve PT access to Frenchs Forest and cross region links	**B1**	**1-4**
PT2 – new route (Terry Hills to Milsons Point)	New service via Frenchs Forest to North Sydney	Improve PT access to major employment centre from Northern Beaches		
PT3 – increased frequency on route, counter peak to 10 minutes between Chatswood and Warringah Mall	Enhanced service between Chatswood and Warringah Mall	Improve PT access to Frenchs Forest and cross region links		
PT4 – enhance frequency on route from Mona Vale to Chatswood	Enhanced service from Mona Vale to Chatswood via Dee-Why and Frenchs Forest	Improve PT access to Frenchs Forest and cross region links	**B2**	**1-2**
PT5 – enhance frequency on route from Manly to the City	Enhanced service from Manly to the City via Frenchs Forest	Improve PT access to Frenchs Forest and cross region links		
PT6 – Extend route from Manly Wharf to Austlink centre at Terry Hills	Provide route from Manly Wharf to Austlink via Frenchs Forest	Improve north-west to south-east PT coverage		**Not Modelled**
P1 – introduce a category 2 Parking Space Levy (PSL)	Introduce a parking levy on owners of car parks in Macquarie Park	Encourage mode shift and reduce unnecessary car trips	**P1**	**2-4**
RN1 – Warringah Road / Wakehurst Parkway intersection improvements	Investigate potential for any capacity increase at intersection	Reduce intersection delays		**Not Modelled**
RN2 – Warringah Road / Forest Way intersection improvements	Investigate potential for any capacity increase at intersection	Reduce intersection delays		**Not Modelled**
RN3 – Wakehurst Parkway / Frenchs Forest Road intersection improvements	Investigate potential for any capacity increase at intersection	Reduce intersection delays		**Not Modelled**

Measure ID	Description	Objective	Package	Modelling Scenario
RN4 – signalise Forest Way / Naree Road intersection	Signalise intersection to allow controlled access	Improve access to Frenchs Forest Road and hospital site	**R1**	**1-4**
RN5 – reduce right turn lanes from Warringah Road to Allambie Road	Reduce lanes to allow for additional ahead capacity	Reduce delay experienced in the PM peak		
RN6 – ban right turn from Allambie Road to Warringah Road	Remove right turn facility and force traffic to turn right at Skyline shops	Reduce intersection delay		
RN7 – extend Aquatic Drive to link to Wakehurst Parkway	Create a new link to Wakehurst Parkway from Aquatic Drive business park	Reduce unnecessary trips through Warringah Road/Wakehurst Parkway intersection		
RN8 – signalise Warringah Road / Rodborough Road	Signalise intersection of Rodborough Road	Reduce delays and improve safety, reduce demand at Allambie Road		
RN9 – investigate linking to Starkey Street intersection control group	Modify signal control grouping to remove Starkey Street influence	Allow greater flexibility in SCATS control in Frenchs Forest		**Not Modelled**
TDM1 – Implementation of a SHOROC Region Sustainable Travel Strategy	Investigate the potential to implement a subregional strategy for sustainable travel in the Northern Beaches	Educate all road users on alternatives to private vehicle travel. Request that major trip generators encourage employees/visitors to use alternative modes.		**Not Modelled**

7.5.2 Medium to long term 5-25 years

Table 22 Proposed medium to long term measures

Measure ID	Description	Objective	Package	Modelling Scenario
PT7 – BRT like system from Dee Why to Chatswood	Investigate new segregated bus route from Mona Vale/Dee-Why to Chatswood	Improve public transport access from Pittwater and Warringah to Chatswood and its rail connections	**B3**	**3**
PT8 – BRT like system from Mona Vale to the City	Investigate new segregated bus route from Mona Vale/Dee-Why to CBD	Improve public transport access from Pittwater and Warringah to the CBD	**B4**	**4**
RN10 – implement park and ride schemes based around BRT origins	Investigate the potential to construct park and ride stations around BRT system	Increase potential patronage by allowing direct transfer from car to BRT		**Not Modelled**
RN11 – grade separation of Wakehurst Parkway and Warringah Road intersection	Underpass for through movements on Warringah Road	Improve journey times and reduce intersection delay – improve bus journey times	**R3**	**3-4**
RN12 – grade separation of Forest Way and Warringah Road intersection	Underpass for through movements on Warringah Road	Improve journey times and reduce intersection delay – improve bus journey times		
RN13 – grade separation of Wakehurst Parkway and Frenchs Forest Road	Investigate potential for bridge over Wakehurst Parkway	Improve journey times and reduce intersection delay – improve bus journey times		
RN14 – provision of four lanes westbound on Warringah Road from Forest Way to Woodlands Road. Implement as bus lane in peak periods.	Investigate use of median as additional traffic lane – peak period bus lane	Improve journey times, reduce congestion and improve bus journey times in peak periods		**Not Modelled**
RN15 – Flood protection and contingency planning for Wakehurst Parkway at Narrabeen Lagoon to address flooding risk	Investigate the potential of flood protection for Wakehurst Parkway to reduce the flooding occurrences	Ensure reliable access to the specialised centre from Pittwater		**Not Modelled**

7.5.3 Long term beyond 25 years

Table 23 Proposed long term measures

Measure ID	Description	Objective	Package	Modelling Scenario
PT 9 – Investigate future potential for rail link to Northern Beaches	Consider the long term transport needs of the Northern Beaches and need for rail infrastructure	Improve PT accessibility and connect region to Sydney rail network		**Not Modelled**
RN 16 – Investigate future potential for Warringah Freeway Extension	Provide freeway connection to Burnt Bridge Creek Deviation, bypassing Mosman	Improve travel times and reduce traffic congestion in Mosman area		**Not Modelled**

8.0 Strategic modelling results

Following the development of the strategic and local measures it was then necessary to group these measures into strategies for testing purposes in the STM and the RTA's highway assignment model by grouping these measures into likely stages in network development in order to estimate the benefit of these measures.

It was not possible to test all measures in STM, because of limitations on the STM model and the fact that some of the measures, such as TDM1 – Sustainable Transport Strategy, are not quantifiable in a strategic model. It was also not possible to simulate the impact of local traffic management measures. The local impact assessment is detailed in the separate report to be read in conjunction with this report called "Frenchs Forest Specialised Centre Local Transport Assessment".

It was decided that the two BRT routes would be tested in isolation to identify the benefit each may provide. The combined benefit of the two routes together was not tested.

8.1 Transport strategy testing

The measures were packaged together into short; and medium to long term options as follows:

Table 24 Grouping of short term measures

Transport Scenario	PT Measures Tested	Parking & Road Measures Tested	Demand Scenario
Scenario 1	B1, B2	R1	2016 Hospital
Scenario 2	B1, B2	R1, P1	2016 Hospital

Table 25 Grouping of medium to long term measures

Transport Scenario	PT Measures Tested	Parking & Road Measures Tested	Demand Scenario
Scenario 3	B1, B3	R1, R3	2036 Full Development
Scenario 4	B1, B4	R1, R3	2036 Full Development

8.2 Modal analysis

The STM model outputs summarised the change in trips by mode and by purpose over a 24 hour period. These results were grouped according to trips originating in the Northern Beaches area and trips destined for the Northern Beaches area, including Warringah, Pittwater and Manly SLA's.

It is worth noting when interpreting these results, that the STM model estimates interchanges between public transport modes but only reports the primary mode of travel. What this means is that if a bus is taken to reach a ferry or rail terminal, the trip will be reported as rail or ferry rather than bus.

The validity of the STM model outputs and the model results themselves have not been interrogated in any detail. It is assumed that the outputs provided from the STM are fit for purpose. In addition, the STM model, being strategic in nature, does not impose any constraint on public transport capacity, and as such may over predict the shift to these modes. However, what it does show is whether or not these modes are seen as a more attractive mode to driving, demonstrating the potential for these measures to attract patronage.

8.2.1 Short term results

The results below show the percentage change in trips for the two short term scenarios.

Table 26 Summary of modal shift in STM by short term option

Scenario	Car	Public Transport	Cycle/Walk	Taxi
2016 Hospital	292,000	31,000	48,000	1,000
2016 Scenario 1	-0.2%	2%	-0.2%	-0.4%
2016 Scenario 2	-0.2%	2%	-0.2%	-0.3%

Source: TfNSW 2011

As can be seen in **Table 26** above, the two short term scenarios do achieve some increase in public transport trips, with an increase of almost 2% in both cases.

8.2.2 Medium to long term results

The results below show the percentage change in trips for the four medium to long term scenarios.

Table 27 Summary of modal shift in STM by medium to long term option

Scenario	Car	Public Transport	Cycle/Walk	Taxi
2036 Full Development	326,000	34,000	52,000	2,000
2036 Scenario 3	-0.2%	9%	0.2%	-2%
2036 Scenario 4	-0.2%	21%	-0.1%	-4 %

Source: TfNSW 2011

As can be seen in **Table 27** above, the medium to long term options appear to achieve significant increases in public transport patronage. Scenario 3 introduces the east-west BRT connection from the Northern Beaches to Chatswood. This scenario achieves an overall increase in public transport patronage of 9%.

Scenario 4 includes the BRT route and sees the largest increase in public transport trips throughout the day, with an increase of 21 per cent.

These results give a high level assessment of the mode shift potential and may overestimate the mode shift; however the Northern Beaches BRT pre-feasibility study currently being prepared as a separate document by TfNSW will go into greater detail on mode shift analysis of the BRT corridors.

8.3 Analysis of RTA highway assignment model

The STM model was used to estimate relative changes in travel behaviour across all modes. Following this test in STM, BTS then provided the RTA with vehicle trip change matrices, which are origin and destination matrices that show the percentage change in vehicle trips to all destinations compared to the base 2011 model.

The RTA then applied these matrices to their validated strategic highway assignment model and provided AECOM with network plots that show the two hour morning peak traffic volumes across the network for each model run.

Analysis of these results focuses on the reduction in traffic volumes in the AM peak around Frenchs Forest, and which of the proposed measures may stand out as achieving the most traffic reduction.

RTA network volume plots for each scenario can be found at **Appendix C**.

8.3.1 Warringah Road at Roseville Bridge

The key arterial road that has the biggest influence on traffic conditions in Frenchs Forest is Warringah Road. The traffic volumes on Warringah Road at Roseville Bridge were compared and the results (for base case and development scenarios with no improvements) are highlighted in the tables below.

Table 28 Warringah Road (Roseville Bridge) 2 hour AM Peak traffic volumes

Model Run	Traffic volumes (7-9am)			
	Northbound	Difference over previous scenario	Southbound	Difference over previous scenario
2011 Base	4280		8850	
2016 Base	4710	10%	9310	5%
2016 Hospital only	4840	3%	9090	2%
2036 Base	5010		9590	
2036 Full Development	5250	5%	9500	1%

Source: TfNSW 2011

As seen in **Table 28**, the traffic growth between the 2011 and 2016 models is around 5 per cent in the southbound direction, which is the peak flow direction in the morning peak.

In 2016, the hospital development reduces this volume by approximately 200 vehicles, suggesting that some trip containment occurs. There is also a similar increase in northbound trips, which is expected as the hospital draws more employment from outside the subregion.

The 2036 model runs show that the volume of traffic on Roseville Bridge increases (from 13130 to 14600) by 12 per cent between 2011 and the 2036 base model. The northbound traffic increases by 17 per cent and southbound by 8 per cent.

With the specialised centre in place the northbound traffic increases (from 5010 to 5250) by around 5 per cent, with southbound traffic reducing by (from 9590 to 9500) only 1 per cent.

As can be seen in **Table 29**, with the introduction of the short term measures one can see that the change in traffic volumes on Roseville Bridge does not alter by a substantial amount in the morning peak period.

Table 29 Impact of short term measures on Warringah Road (Roseville Bridge) 2 hour AM Peak traffic volumes

Model Run	Traffic volumes (7-9am)			
	Northbound	Difference	Southbound	Difference
2016 Hospital	4840		9090	
2016 Scenario 1	4920	80	9060	-30
2016 Scenario 2	4900	60	9020	-70

Source: TfNSW 2011

As can be seen in **Table 30**Table 29, the introduction of scenarios 3 and 4 in the medium to long term has a significant impact on traffic volumes on Roseville Bridge. As would be expected, the greatest reduction in traffic volumes at this point comes from the introduction of the east-west BRT service (scenario 3), which reduces southbound traffic volumes to levels lower than the 2011 model run at that location.

Table 30 Impact of medium to long term measures on Warringah Road (Roseville Bridge) 2 hour AM Peak traffic volumes

Model Run	Traffic volumes (7-9am)			
	Northbound	Difference	Southbound	Difference
2036 Full Development	5245		9500	
2036 Scenario 3	4410	-835	7625	-1875
2036 Scenario 4	5450	210	9300	-200

Source: TfNSW 2011

8.3.2 Warringah Road (East of Ellis Road)

Whereas Roseville Bridge is to the west of Frenchs Forest and shows the change in trips on the boundary of the subregion, this point to the east of Ellis Road shows the change in traffic volumes that are entering or leaving the Frenchs Forest area from the rest of the subregion.

Table 31 Impact of short term measures on Warringah Road (East of Ellis Road) 2 hour AM Peak traffic volumes

Model Run	Traffic volumes (7-9am)			
	Eastbound	Difference	Westbound	Difference
2016 Hospital	3095		4495	
2016 Scenario 1	2875	-220	4355	-140
2016 Scenario 2	2935	-160	4360	-135

Source: TfNSW 2011

Table 31 above shows the change in traffic volumes for scenarios 1 and 2. As can be seen, there is a slight reduction in traffic volumes over the base 2016 hospital model run, with a 3 per cent reduction in westbound trips and an 8 per cent reduction in eastbound trips in scenario 1 and a similar level in scenario 2. This would suggest that the improved bus services are attracting new trips, and that the parking levy doesn't significantly alter traffic volumes at this point.

In the medium to long term scenarios, one can see that the east-west BRT (scenario 3) achieves an 11 per cent reduction in westbound trips.

Table 32 Impact of medium term measures on Warringah Road (East of Ellis Road) 2 hour AM Peak traffic volumes

Model Run	Traffic volumes (7-9am)			
	Eastbound	Difference	Westbound	Difference
2036 Full Development	3210		5070	
2036 Scenario 3	3050	-160	4500	-570
2036 Scenario 4	3250	40	4670	-400

Source: TfNSW 2011

Interestingly, the reduction in trips resulting from scenario 4 is also considerable, and could potentially be as a result of private vehicle trips using Warringah Road to bypass Pittwater Road in the base scenario now using the north-south BRT service in this scenario.

8.4 Recommended Measures

From the analysis in this chapter, it is clear that there are certain measures which will benefit travellers in the North East subregion.

To support the recommended road upgrades and improvements to public transport services, it is recommended that the subregion develops a Sustainable Transport Strategy. This strategy will help to encourage mode shift away from private vehicle use and will set out the overarching principles for managing travel demand in the subregion, as well as setting out procedures for monitoring travel behaviour across the subregion and developing educational material.

Table 33 Recommended TDM measures

Measure	Agency Responsible
TDM1 – Sustainable Transport Strategy	Warringah/Pittwater/ Manly Council

This study has highlighted the lack of east-west bus connections and identified corridors along which more frequent services could potentially attract patronage.

While PT1-PT6 do not attract a particularly high volume of passengers, the improved connectivity provided by these new routes could be key to the ongoing development of Frenchs Forest.

PT7 and PT8 have both demonstrated the potential patronage of a BRT like system in the Northern Beaches. The modelling of PT8 predicted to attract the most passengers overall, but PT7 links into Frenchs Forest and has the potential to reduce traffic on Warringah Road considerably.

The Northern Beaches BRT pre-feasibility study being undertaken by TfNSW will go into a greater level of detail on mode choice analysis, route patronage estimates and costs and as such the results contained within this report should be considered as preliminary indications only.

Table 34 Recommended Public Transport Measures

Measure	Agency Responsible
PT1-6 – Further investigation of the enhanced east-west bus services	TfNSW
PT7 – Further investigation of a dedicated BRT system from Mona Vale to Chatswood via Dee-Why in line with the current Northern Beaches pre-feasibility study being undertaken by TfNSW	TfNSW
PT8 – Further investigation of a dedicated BRT system from Mona Vale to the CBD in line with the current Northern Beaches pre-feasibility study being undertaken by TfNSW	TfNSW

The recommended road based measures are mostly targeted at improving access to Frenchs Forest reducing congestion on Warringah Road.

Table 35 Recommended Road based measures

Measure	Agency Responsible
RN4 – Further investigation of signalising Forest Way and Naree Road intersection	TfNSW/Warringah LGA
RN7 – Further investigation of extension of Aquatic Drive to link to Wakehurst Parkway	TfNSW/Warringah LGA
RN11 – Further investigation of grade separation of Wakehurst Parkway and Warringah Road intersection	TfNSW/Warringah LGA
RN12 – Further investigation of grade separation of Forest Way and Warringah Road intersection	TfNSW/Warringah LGA

Measure	Agency Responsible
RN13 – Further investigation of grade separation of Wakehurst Parkway and Frenchs Forest Road	TfNSW/Warringah LGA
RN14 – Further investigation of provision of four lanes westbound on Warringah Road from Forest Way to Woodlands Road. Implement as bus lane in peak periods.	TfNSW/Warringah LGA
RN15 – Investigate contingency planning for Wakehurst Parkway at Narrabeen Lagoon to mitigate flooding risk	TfNSW/Warringah LGA

9.0 Quantifying the benefit

The previous section summarises the relative change in mode share and the reduction in traffic volumes on key roads around Frenchs Forest. This section seeks to qualify the benefit that these options provide against the probable cost of introducing new infrastructure or bus services.

9.1 Cost of interventions

The probable cost of introducing new bus routes has been established with the assistance of TfNSW's bus network planning team. Strategic estimates for the likely additional costs associated with introducing new or revised bus services were provided, as detailed in the table below. The modification to route PT5 was identified as being relatively minor and as such was not costed.

At this stage the source of any funding for the proposed measures has not been discussed or explored in any detail. Any apportionment of contributions would require extensive analysis beyond the scope of this study.

Table 36 Probable operational cost of additional bus routes

Measure ID	Route	Modified/New	Annual variable costs ($000's)	Bus costs ($000's)
PT1	Terry Hills to Manly	New	$2-3,000	$1,000
PT2	Terry Hills to Milsons Point	New	$2-3,000	$1,000
PT3	Chatswood to Warringah Mall	Modified	$500	$500
PT4	Mona Vale to Chatswood	Modified	$5,000	$2-3,000
PT6	Manly Wharf to Austlink	Modified	$300-500	$100-200
PT7	BRT east west system	New	$10-20,000	$1-2,000
PT8	BRT north south system	New	$10-20,000	$1-2,000

Source: TfNSW 2011

These operational cost estimates for bus routes have been based on assumptions around peak and off peak operations, headways and the routes covered and are meant to serve as an indication of likely costs to guide decision making and any further investigations into detailed bus network planning.

The operational costs for the BRT proposals are in addition to the likely infrastructure costs associated with introducing a BRT route.

The probable cost of introducing new physical infrastructure has been quantified by AECOM's cost consultants. The costs shown are purely indicative and have been estimated against a range of assumptions on the scale of works involved in delivering each of the infrastructure options. The costs do not include any allowance for property acquisition.

Table 37 summarises the strategic costs for the suggested physical infrastructure works.

Table 37 Probable cost of infrastructure measures

Measure ID	Description	Range of probable capital cost ($000's)
RN4 – signalise Forest Way / Naree Road intersection	Signalise intersection to allow controlled access	$1-2,000
RN7 – extend Aquatic Drive to link to Wakehurst Parkway	Create a new link to Wakehurst Parkway from Aquatic Drive business park	$1-2,000
RN8 – signalise Warringah Road / Rodborough Road	Signalise intersection of Rodborough Road	$1,000-2,000
PT7 – BRT east west system	Road and infrastructure costs associated with BRT system	$100-150,000▲
PT8 - BRT north south system	Road and infrastructure costs associated with BRT system	$100-150,000▲
RN10– implement park and ride schemes based around BRT origins	Investigate the potential to construct park and ride stations around BRT system	$20-30,000
RN11 – grade separation of Wakehurst Parkway and Warringah Road intersection	Recommend introducing underpass for through movements on Warringah Road	$100-200,000
RN12 – grade separation of Forest Way and Warringah Road intersection	Recommend introducing underpass for through movements on Warringah Road	$50-150,000
RN13 – grade separation of Wakehurst Parkway and Frenchs Forest Road	Investigate potential for bridge over Wakehurst Parkway	$50-150,000
RN14 – provision of four lanes westbound on Warringah Road from Forest Way to Woodlands Road. Implement as bus lane in peak periods.	Investigate use of median as additional traffic lane – peak period bus lane	$5-10,000
RN15 – Flood mitigation and contingency planning on Wakehurst Parkway	Flood mitigation on Wakehurst Parkway	$5-10,000*

▲*Probable cost based on a per km cost of $5m – more detailed costs to be obtained as part of the Northern Beaches BRT pre-feasibility study*

**probable cost taken from "Narrabeen Lagoon Flood Risk Management Plan" SMEC 2003*

9.2 Network performance improvements

As well as predicting relative changes in travel behaviour and the potential reduction in traffic volumes that each of the proposed options and model runs has estimated, it is also possible to predict area wide performance metrics for each model run. These performance metrics are:

PKT – Passenger Kilometres Travelled per day for trips originating in the Northern Beaches

PHT – Passenger Hours Travelled per day for trips originating in the Northern Beaches

VKT – Vehicle Kilometres Travelled in the morning peak period across the Sydney Greater Metropolitan Area

VHT – Vehicle Hours Travelled in the morning peak period across the Sydney Greater Metropolitan Area

9.2.1 Public transport performance

Table 38 PKT and PHT comparison for short-term options for PT trips originating in the Northern Beaches

PKT			PHT	
Scenario	Total	Difference from base	Total	Difference from base
2016 Base	**242,311**		**13,168**	
2016 Hospital	**242,872**	560	**13,195**	27
2016 Scenario 1	**248,852**	5,981 (over hospital)	**13,331**	136 (over hospital)
2016 Scenario 2	**249,104**	6,233 (over hospital)	**13,343**	148 (over hospital)

Source: TfNSW 2011

As can be seen in **Table 38**, the two short term scenarios do increase the volume of PKT's travelled, but only by a small percentage.

Table 39 PKT and PHT comparison for medium to long term options for PT trips originating in the Northern Beaches

PKT			PHT	
Scenario	Total	Difference from base	Total	Difference from base
2036 Base	**278,743**		**14,956**	
2036 Full Dev	**280,273**	1,531	**15,030**	74
2036 Scenario 3	**325,526**	45,253 (over full development)	**16,130**	1,100 (over full development)
2036 Scenario 4	**394,381**	114,107 (over full development)	**15,066**	36 (over full development)

Source: TfNSW 2011

The medium to long term scenarios demonstrate a much higher potential for increasing PKT's than the short term scenarios, with the north-south BRT route offering the biggest increase in PKT's. When considering the PHT value, we see that scenario 4 only has an increase of 36 passenger hours travelled, yet it increases the passenger kilometres travelled by 114,000. This would suggest that the north-south BRT route (PT8) improves the journey time of passengers by a considerable amount.

9.2.2 Road network performance

The road network performance measures were extracted from the RTA's highway assignment model as the VKT and VHT values for a morning two hour peak period.

The following tables summarise the results for the short, and medium to long term scenarios.

Table 40 VKT and VHT comparison for short term options for vehicle trips

VKT			VHT	
Scenario	Total	Difference from base	Total	Difference from base
2016 Base	13,071,311		408,317	
2016 Hospital	13,068,951	-2,360	408,206	-110
2016 Scenario 1	13,064,306	-4,645 (over hospital)	408,063	-143 (over hospital)
2016 Scenario 2	13,066,306	-2,645 (over hospital)	408,742	536 (over hospital)

Source: TfNSW 2011

As **Table 40** shows, the two short term scenarios do reduce the volume of VKT's travelled, with scenario 1 reducing the VKT value by the most. However, the VHT does not change significantly, and in the case of scenario 2, the VHT actually increases, suggesting journey times increase.

Table 41 VKT and VHT comparison for medium to long term options for vehicle trips

VKT			VHT	
Scenario	Total	Difference from base	Total	Difference from base
2036 Base	16,699,588		559,348	
2036 Ful Dev	16,699,629	41	560,209	861
2036 Scn 3	16,651,291	-48,338 (over full development)	557,069	-3,140 (over full development)
2036 Scn 4	16,633,218	-66,411 (over full development)	555,809	-4,400 (over full development)

Source: TfNSW 2011

Table 41 shows the change in VKT and VHT for the medium to long term scenarios. As can be seen, the model runs for scenarios 3 and 4 both demonstrate a considerable reduction in VKT's and VHT's.

Scenario 3, with the east-west BRT route (PT7) is likely to give considerable benefit to Frenchs Forest by reducing traffic on the Warringah Road corridor. However, for the subregion as a whole it is clear that scenario 4 delivers more benefit by reducing the VKT's travelled by a greater amount.

10.0 Conclusion and recommendations

10.1 Summary of study findings

Through the course of this study, AECOM has sought to establish the strategic transport context in the Northern Beaches subregion currently, in 2016 and in 2036.

By understanding the trends in travel behaviour, population and employment growth and the changes in travel patterns over time, it has been possible to identify what may be some of the limiting factors on realising state and local transport objectives such as increased public transport mode share and reducing the need for private vehicle trips.

Through the use of TfNSW's STM strategic transport model and the RTA's Sydney Region highway assignment model, it has been possible to predict the impact of the development over time and develop a range of transport measures that could:

- Reduce private vehicle use across the region.
- Increase public transport usage.
- Create new public transport services that address the lack of east-west network coverage.
- Improve the existing road network to maximise its capacity.
- Improve access to Frenchs Forest and reducing intersection delays.
- Identify the access requirements for the hospital site in the short term.

10.1.1 2011 conditions

The current transport network and travel behaviour can be summarised by the following key points:

- Private vehicle mode share of 70 to 90 per cent seen in the region, depending on trip purpose and destinations such as Willoughby, North Sydney and Ryde LGA's.
- Access to peninsula is only possible via Mona Vale Road, Warringah Road, and Military Road, all of which carry volumes of traffic above their designed capacity in the AM peak.
- Approximately 60% of vehicle trips through Frenchs Forest on Warringah Road originate in Brookvale, Dee Why and Pittwater LGA
- Limited public transport connections from Dee Why and Pittwater to employment centres of Chatswood, Macquarie Park, North Sydney
- The congestion on Warringah Road, Forest Way and Wakehurst Parkway limits the flow of traffic in Frenchs Forest
- The key intersections around Frenchs Forest are all operating close to their design capacity in the morning peak, especially the intersection of Warringah Road and Wakehurst Parkway, which operates at capacity at LoS F.

10.1.2 2016-2036 conditions

The impact of background growth in land use and the changes in travel patterns between 2016 and 2036 can be summarised as:

- The ratio of population against employment decreases from 2.66 to 2.5 between 2011 and 2036 – meaning more local employment
- By 2016 the three access roads to the peninsula are carrying even more traffic with no substantial capacity increases. The volume/capacity ratios on these links are even higher and suggest that mitigating measures need to be investigated in the short term (next 5 years) even without any development at Frenchs Forest.
- The origins of trips on Warringah Road do not change greatly over time and it is likely that the congestion experienced today will only worsen.

- The level of traffic growth and high volume/capacity ratios suggest that the traditional morning peak period of 7-9am could not accommodate the travel demand. With no improvements to transport infrastructure this may mean that the peak periods mayspread.

10.1.3 Likely impact of development proposal

With the introduction of the development, it is predicted that there would be little change in travel patterns on a sub-regional level and at a local level the development only exacerbates the already congested conditions.

The 2016 results can be summarised as:

- By 2016 most arterial links in the Northern Beaches will be over capacity (as in the base case)
- Warringah Road at Roseville Bridge will be carrying approximately 1.5 times its capacity
- All five key intersections in the Frenchs Forest area will be at LoS F in 2016
- All approach roads to Frenchs Forest will be nearing their capacity per lane

The 2036 results can be summarised as:

- By 2036 most arterial links in the Northern Beaches will be over capacity (as in the base case)
- Warringah Road at Roseville Bridge will be at approx 1.6 times its capacity
- All five key intersections in the Frenchs Forest area will be at LoS F in 2016
- All approach roads to Frenchs Forest will be nearing their capacity per lane

10.2 Recommendations

The predicted changes in travel patterns over time and the growth in traffic informed the development of strategic and local transport measures that could improve the performance of the transport network in the sub-region.

Table 42 Recommended short term measures

Measure	Agency Responsible
TDM1 – Sustainable Transport Strategy	Warringah/Pittwater/ Manly LGA
PT1-6 – Further investigation of the enhanced east-west bus services	TfNSW
RN4 – Further investigation of signalising Forest Way and Naree Road intersection	TfNSW/Warringah LGA
RN7 – Further investigation of extension of Aquatic Drive to link to Wakehurst Parkway	TfNSW/Warringah LGA

The North East sub-region is well served by north-south bus routes that connect the east coast with the CBD. However, there is a distinct lack of east-west connectivity. The relatively high car mode share of trips from Warringah and Pittwater to Willoughby and Ryde suggest that this lack of east-west connectivity is a contributing factor to the traffic congestion seen on Warringah Road.

In the short term, it is recommended that TfNSW investigate the potential for introducing new and/or modified bus routes that improve the coverage through Frenchs Forest and potentially attract some private vehicle trips to public transport.

In the medium to long term, analysis of the results documented in this report indicates that there are two public transport measures which stand out as recommendations for reducing private vehicle traffic in the Northern Beaches:

PT8 achieves a better increase in public transport patronage, but PT7 would have more impact on the road conditions around Frenchs Forest by reducing car trips along the Warringah Road corridor, but conversely would also require at least one of the traffic lanes.

As well as reducing trips, the study proposed highway and intersection upgrades which could better manage the flow of traffic through Frenchs Forest and the sub-region.

Table 43 Recommended medium to long term measures

Measure	Agency Responsible
PT7 – Further investigation of a dedicated BRT system from Mona Vale to Chatswood via Dee-Why in line with the current Northern Beaches BRT pre-feasibility study being undertaken by TfNSW	TfNSW
PT8 – Further investigation of a dedicated BRT system from Mona Vale to the CBD in line with the current Northern Beaches pre-feasibility study being undertaken by TfNSW	TfNSW
RN11 – Further investigation of grade separation of Wakehurst Parkway and Warringah Road intersection	TfNSW/Warringah LGA
RN12 – Further investigation of grade separation of Forest Way and Warringah Road intersection	TfNSW/Warringah LGA
RN13 – Further investigation of grade separation of Wakehurst Parkway and Frenchs Forest Road	TfNSW/Warringah LGA
RN14 – Further investigation of provision of four lanes westbound on Warringah Road from Forest Way to Woodlands Road. Implement as bus lane in peak periods.	TfNSW/Warringah LGA
RN15 – Investigate flood protection and contingency planning of Wakehurst Parkway at Narrabeen Lagoon to mitigate flooding risk	TfNSW/Warringah LGA

The measures have been proposed as medium to long term because of the likely timeframes involved in delivering infrastructure projects of this scale.

10.3 Conclusion

It is clear from this study that the transport network in the Northern Beaches lacks the capacity to accommodate the existing peak period travel demands and the forecast demands that it will carry in the future.

This study has identified a range of public transport measures that would provide better connectivity across the sub-region, thus providing the services that could encourage a shift away from private vehicle usage. The study also recommended several road based infrastructure measures that would improve road network capacity.

The feasibility of developing a Specialised Centre including the hospital at Frenchs Forest will be dependent on an increase in network capacity in the sub-region, especially along the Warringah Road corridor. The potential Specialised Centre would accelerate the need for the implementation of the proposed measures and its staged development would need to be closely tied to increases in transport capacity.

The grade separation of Warringah Road and Wakehurst Parkway should be addressed as a priority in any further planning for the Frenchs Forest Specialised Centre and should be undertaken simultaneously with any hospital development.

The increase in transport capacity should focus on improving public transport links between the population and employment centres along the coast and the employment and population centres adjacent to the sub-region in Willoughby, Ryde, North Sydney and the CBD. The Specialised Centre should evolve around the public transport corridor and follow the broad principles of Transit Oriented Development to encourage and foster mode shift away from private car use.

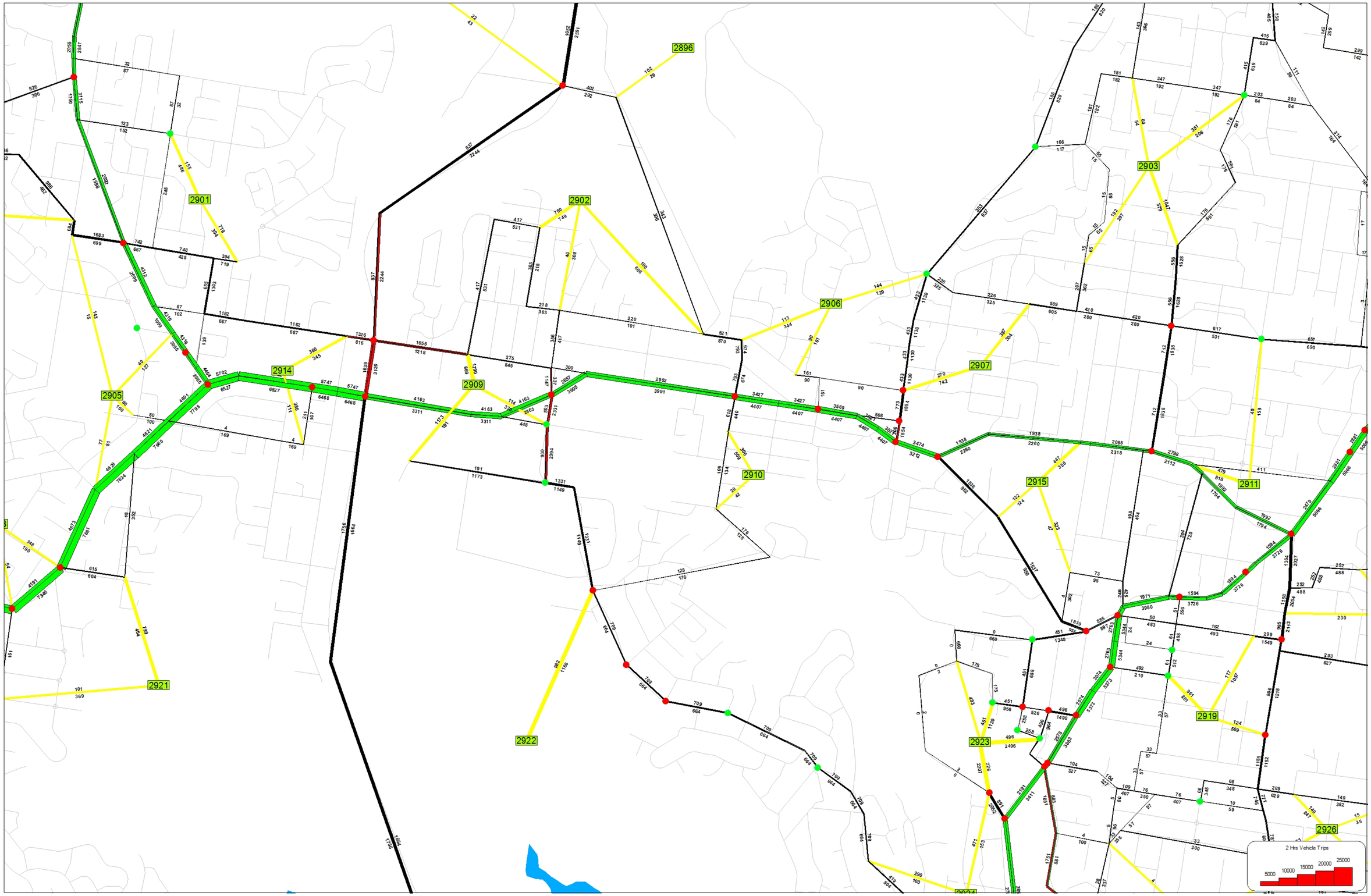
The outcome of the Northern Beaches BRT pre-feasibility study currently being undertaken by TfNSW, is likely to have a positive impact on the form and scale of the specialised centre; equally, the Frenchs Forest Specialised Centre should be regarded as a major driver for bringing forward the planning and delivery of an east-west corridor.

An early initiation of a sustainable transport strategy for the subregion to change travel behaviour may help support this development, with evidence from the UK suggesting that a comprehensive sustainable transport strategy could deliver in the range of a 6 per cent mode shift away from private vehicle use over a 3-5 year period.

Appendix A

RTA Base Model Volume Plots

TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 11: 2011 7-9am SYDRDNETWORK(mf11): 2011 FrenchsForest BASE
2011-08-09 09:38

LANE (1WAY):
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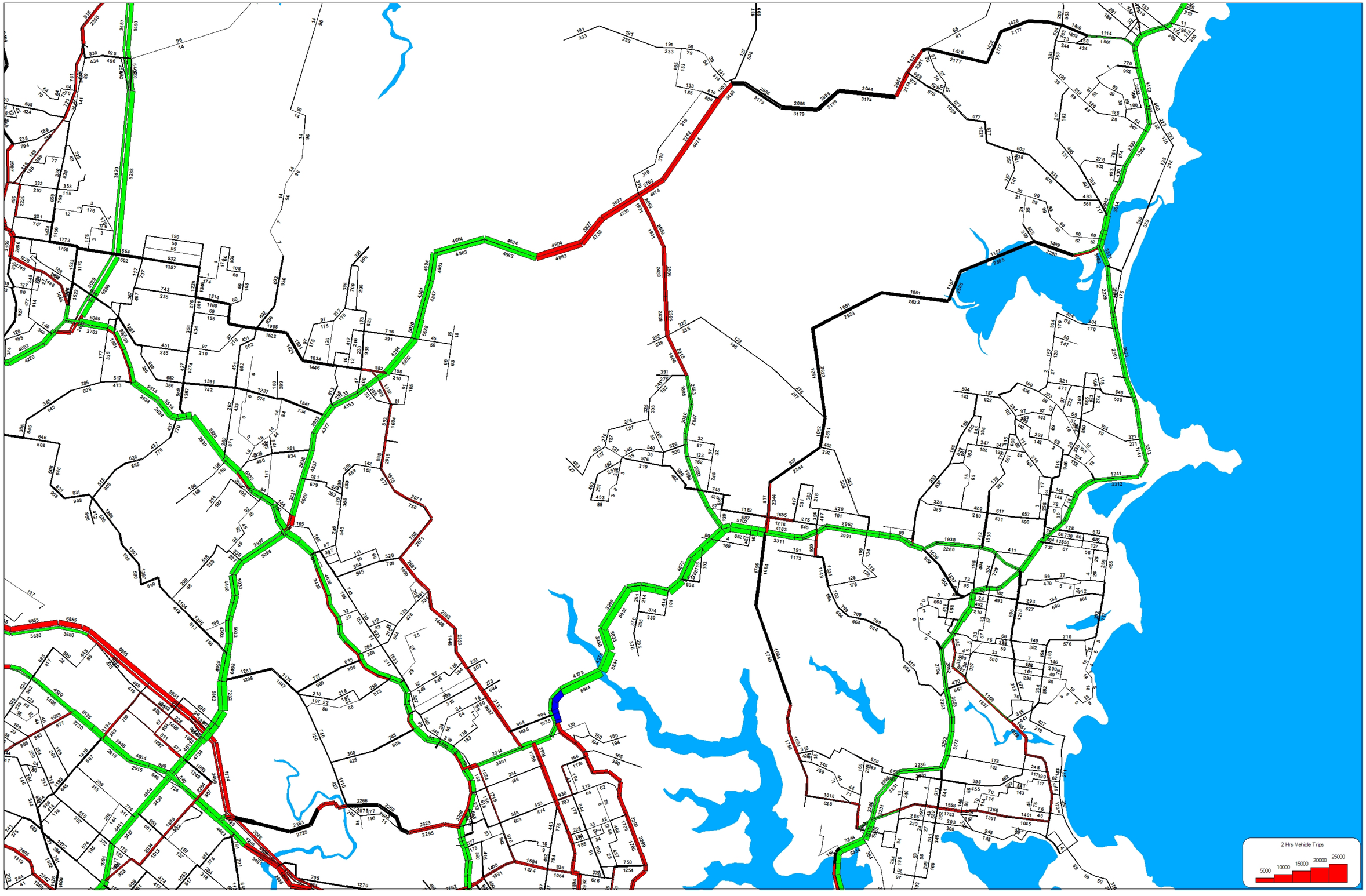
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 11: 2011 7-9am SYDRDNETWORK(mf11): 2011 FrenchsForest BASE
2011-08-09 09:49

LANE (1WAY):

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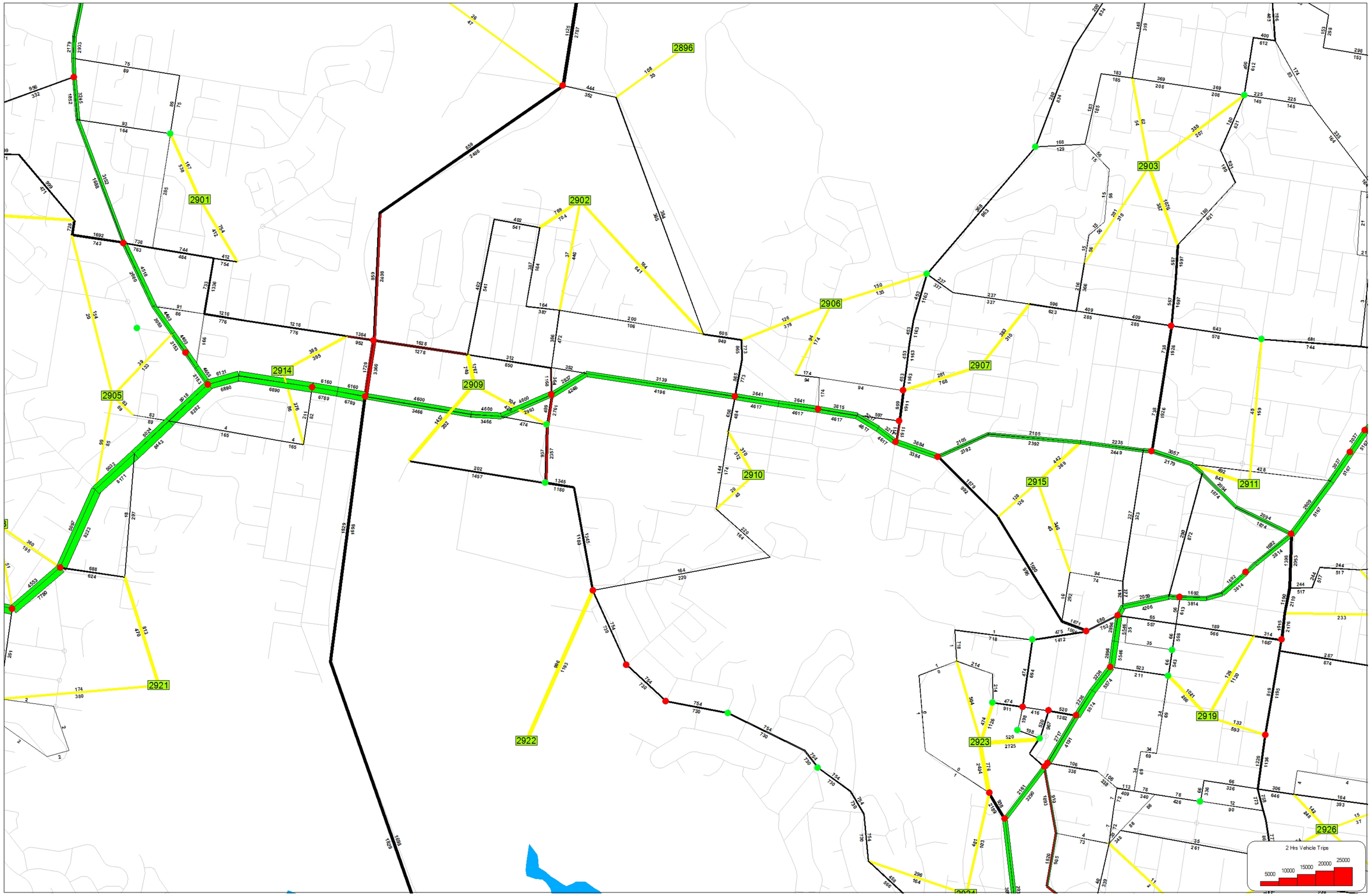
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 16: 2016 7-9am SYDRDNETWORK(mf41): 2016 FrenchsForest BASE
2011-08-09 09:38

LANE (1WAY):
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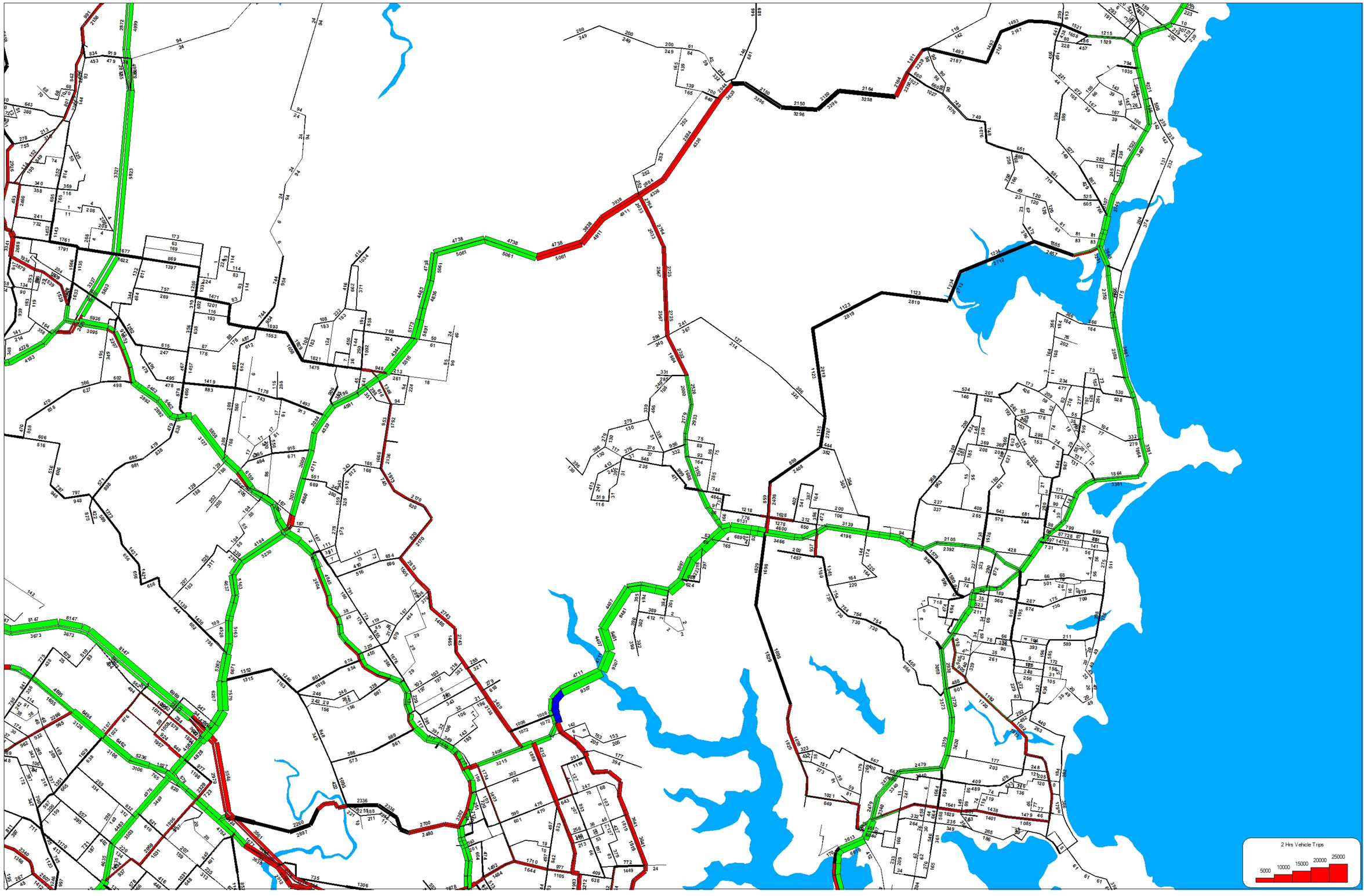
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 16: 2016 7-9am SYDRDNETWORK(mf41): 2016 FrenchsForest BASE
2011-08-09 09:49

LANE (1WAY):
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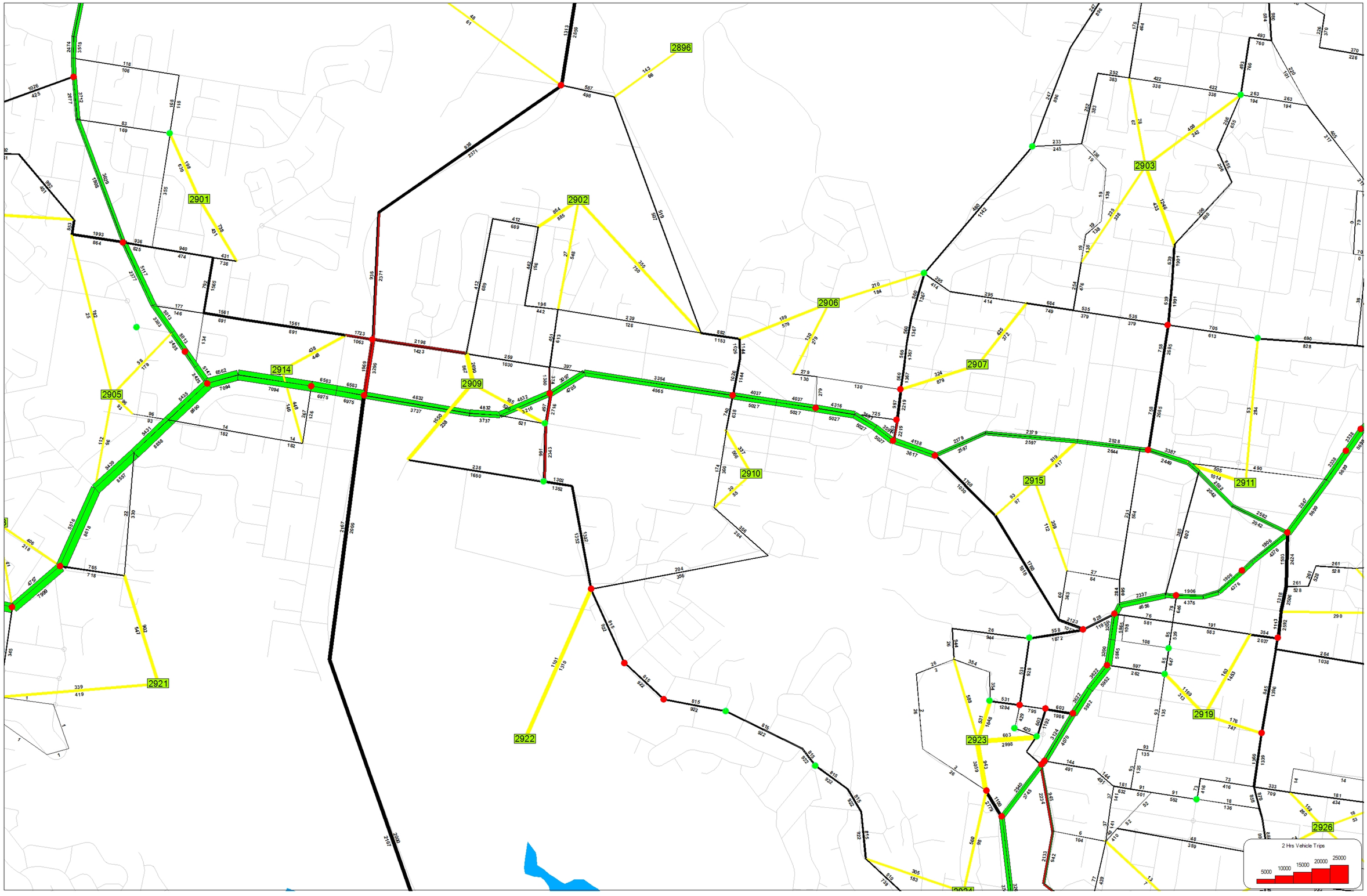
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 36: 2036 7-9am SYDRDNETWORK(mf42): 2036 FrenchsForest BASE
2011-08-09 09:38

LANE (1WAY):
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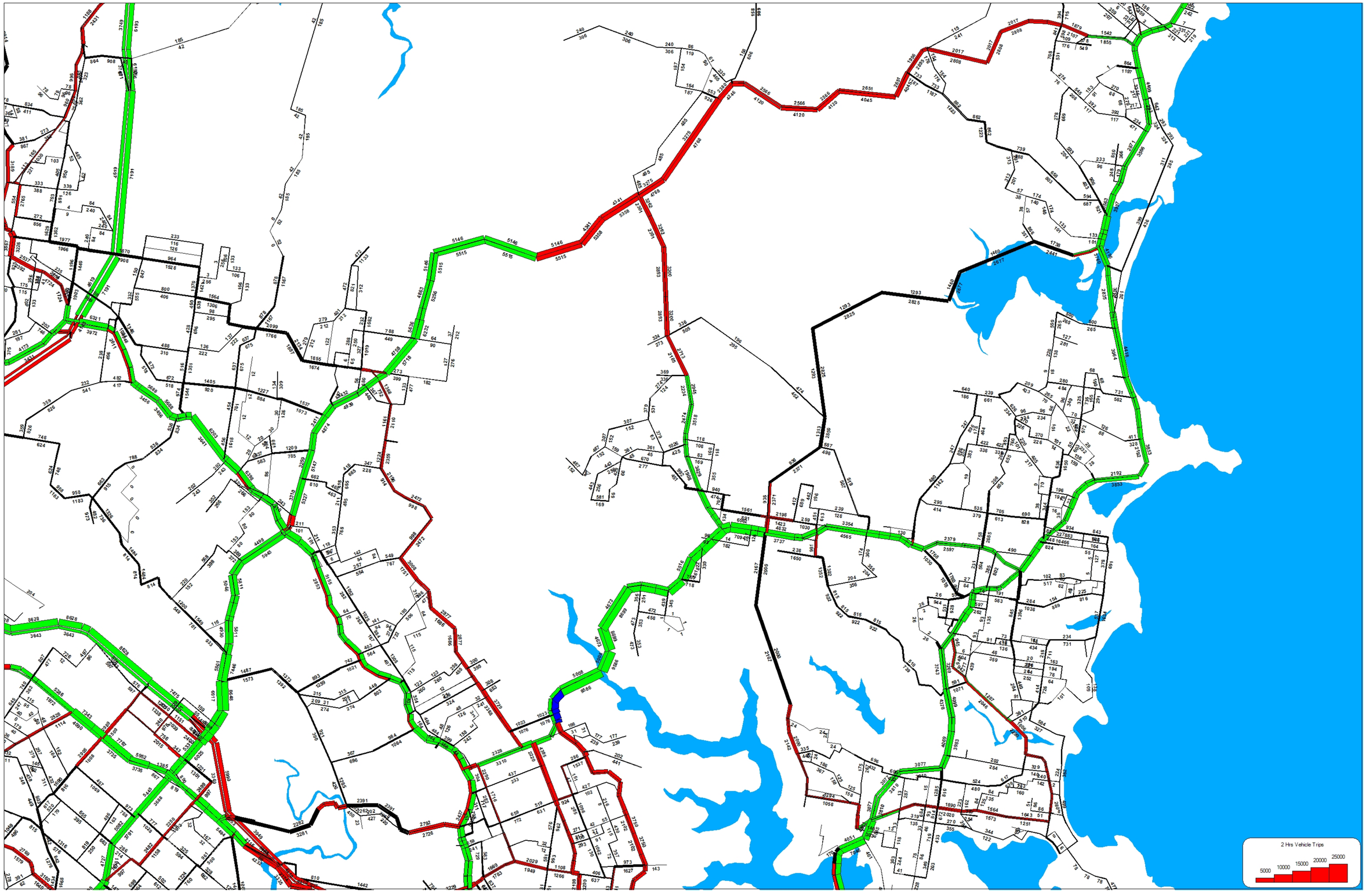
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 36: 2036 7-9am SYDRDNETWORK(mf42): 2036 FrenchsForest BASE
2011-08-09 09:50

LANE (1WAY):
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Appendix B

Sustainable Transport Strategy Case Studies

Appendix C –TDM Case Studies

C.2 Travel Behaviour Change Program– Case Studies

Travel Behaviour Change Programs have been implemented in many towns and cities across the world to encourage residents and people who work there to choose to walk, cycle and use public transport more often and to use their cars less. The UK has many examples of towns and cities that have implemented successful programs such as Worcester, Peterborough, Darlington and Sutton.

In 2004 the UK's Department for Transport selected Darlington, Peterborough and Worcester to be 'Sustainable Travel Towns'. The purpose was to demonstrate the effectiveness of smarter travel choices initiatives in reducing car use. The three towns all applied a package of measures to increase sustainable travel, including travel planning, marketing and improved information. Widespread personalised travel planning was a major part of this.

The **Worcester** project was branded Choose How You Move (CHYM) and comprised a range of initiatives including:

- Travel information - information on a specific CHYM section of Worcester City Council's website, new public transport, walking and cycling maps and timetables.
- Marketing and promotion - Individualised Travel Marketing, public transport, car sharing, and walking and cycling marketing campaigns and events structured around an annual calendar linked to the seasons.
- Travel planning - workplace travel plans, school travel plans.
- Public transport - service improvements, regular timetable change dates, improved infrastructure and information at bus stops, new ticketing initiatives.
- Cycling - cycle loan scheme, Tour of Britain, Pedal in the Park and Dr Bike events, adult and child cycle training, development of new maps and leisure route information.
- Walking - walk to school week, walking buses, walk to work events and summer walking pack
- Other measures - car club, car sharing database for employers.

Peterborough also implemented a holistic package of measures over 5 years to encourage greater use of walking, cycling, public transport and car sharing. The measures included:

- Individualised travel marketing – tailored travel information for households;
- Research and evaluation;
- Marketing and promotion – branding, adverts, competitions, local event participation, information leaflets and resources, maps, posters, flyers, press releases, campaigns and events;
- More cycling – city wide cycle map, rural cycle guidelines, cycle revolution festivals, bike week events, information leaflets, cycle maintenance classes, an e-newsletter, adult cycle training, infrastructure improvements, cycle parking provision, improved signage;
- Walking and safety – development of information materials on walking, coordination of walking promotions and events, advice on walking infrastructure for planning applications;
- Business travel planning – engaging with local businesses and delivering a support system to aid in the development of travel plans;
- Real time passenger information;
- Passenger information screens – installed at the local shopping centre;
- Interactive kiosk – installed in main bus station, enabling travellers to plan their journey by public transport then print out the details;
- Travel information centre – face to face help for customers;
- Interactive map – shows walking, cycling and bus routes as well as stop specific information;
- Integrated sustainable transport guide;
- Sustainable transport interchange information;
- Route branding;

- 'Text and go' – SMS text messaging service allowing users to find out the time and service number of the next 3 scheduled bus departures from their stop;
- Car sharing website – an online journey matching service; and
- School travel plans.

The London Borough of Sutton implemented a travel behaviour change programme called Smarter Travel Sutton (STS). This was a three year initiative to test whether it would be possible to encourage residents and people who work in Sutton to choose to walk, cycle and use public transport more often and their cars a little less. Sutton's residents, employees and visitors were all active participants in the programme. Measures implemented over the three years as part of the programme included:

- School travel planning;
- Workplace travel planning;
- Personal travel advice and information;
- Advertising, marketing and promotion;
- Car clubs;
- A car sharing scheme; and
- Cycle parking.

All three case studies are good examples of travel behaviour change programmes that have influenced a town/city as a whole to become more sustainable in the way they travel. Each programme was subject to funding provision to deliver successful outcomes and included a strong marketing and branding campaign.

Table C.1 indicates the result of the programmes and highlights what could potentially be achievable in Gosford if a similar level of funding were to be provided and all aspects of this TMAP were considered including; the walking and cycling strategy, public transport strategy, parking strategy, road network strategy, in conjunction with the overarching TDM strategy and measures.

Table C.1: Travel Behaviour Change Programmes Results

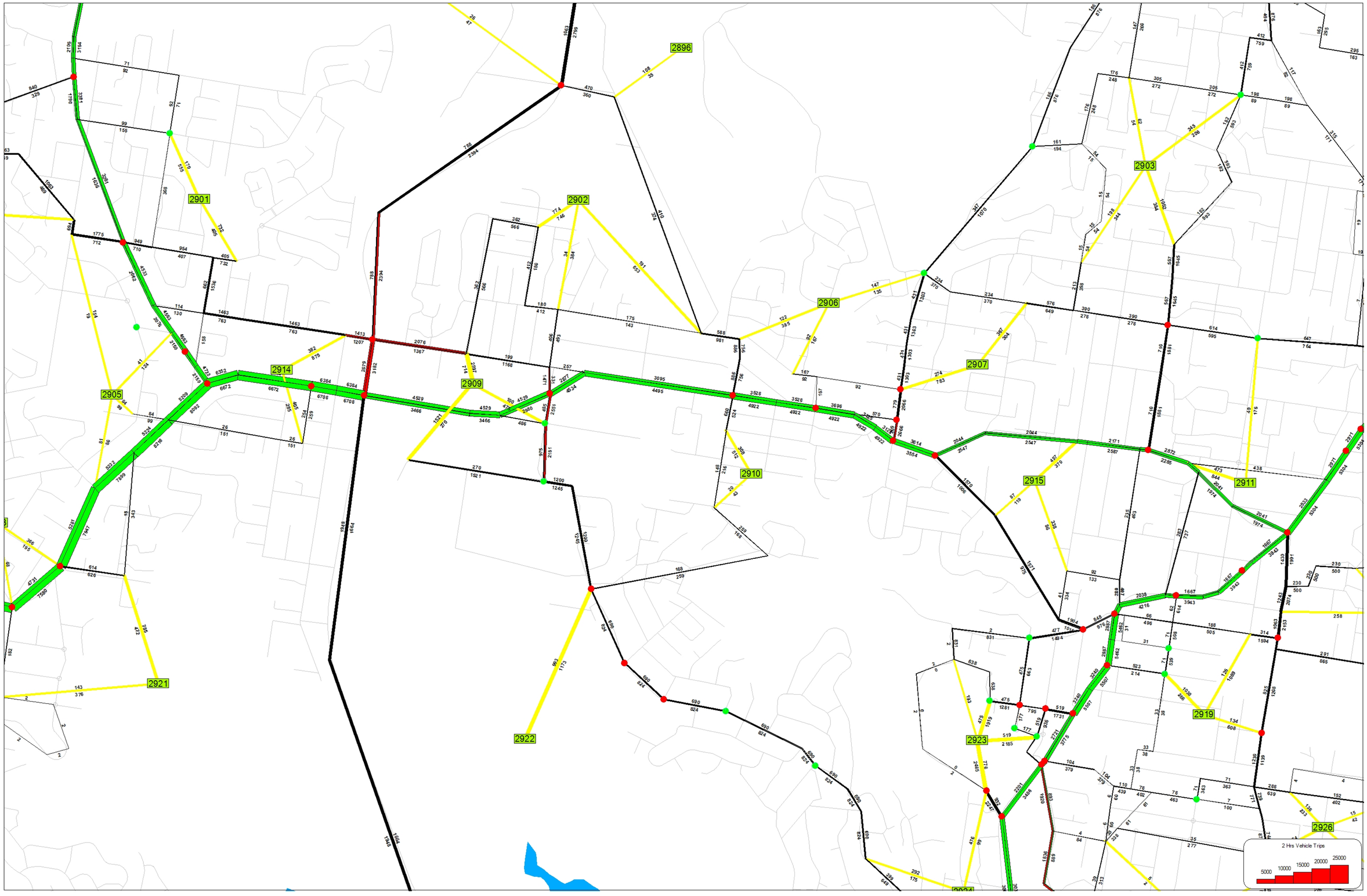
Area	Time Period	Mode Shift Change (%)			
		car driver trips	walking trips	cycling trips	public transport trips
Worcester	4 years	-7%	+12%	+19%	+20% (bus)
Peterborough	5 years	- 9%	+14%	+12%	+35% (bus)
Sutton	3 years	-6%	+3%	+75%	+16% (bus)
Range	3-5 years	-6% - -9%	+3% - +14%	+12% - +75%	+16% - +35%

Source: AECOM, 2010 and www.dft.gov.uk

Appendix C

RTA Scenario Volume Plots

TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 116: 2016 7-9am SYDRDNETWORK(mf43): 2016 FrenchsForest Hospital
2011-08-09 09:39

LANE (1WAY):

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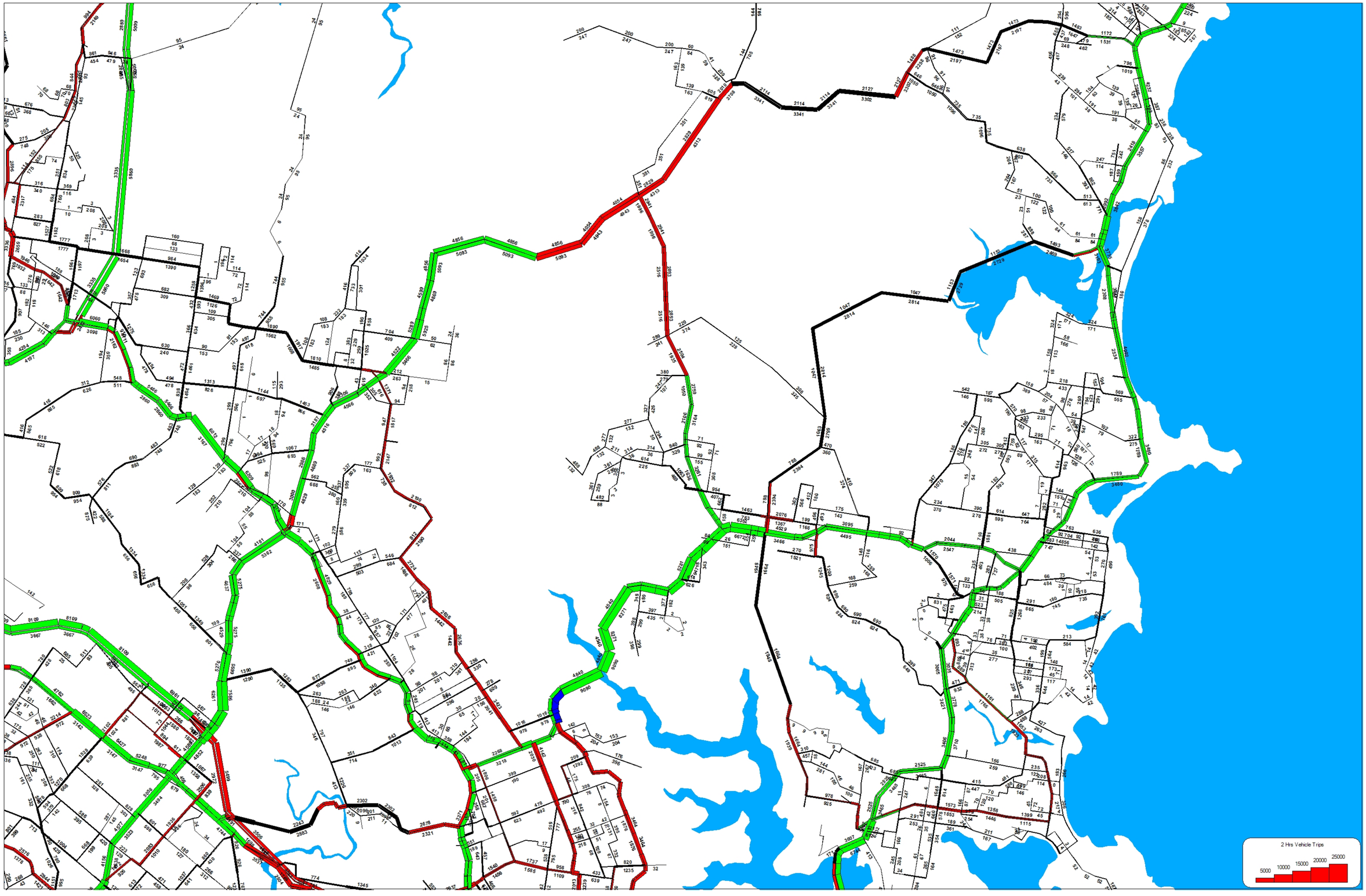
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 116: 2016 7-9am SYDRDNETWORK(mf43): 2016 FrenchsForest Hospital
2011-08-09 09:50

LANE (1WAY):
1
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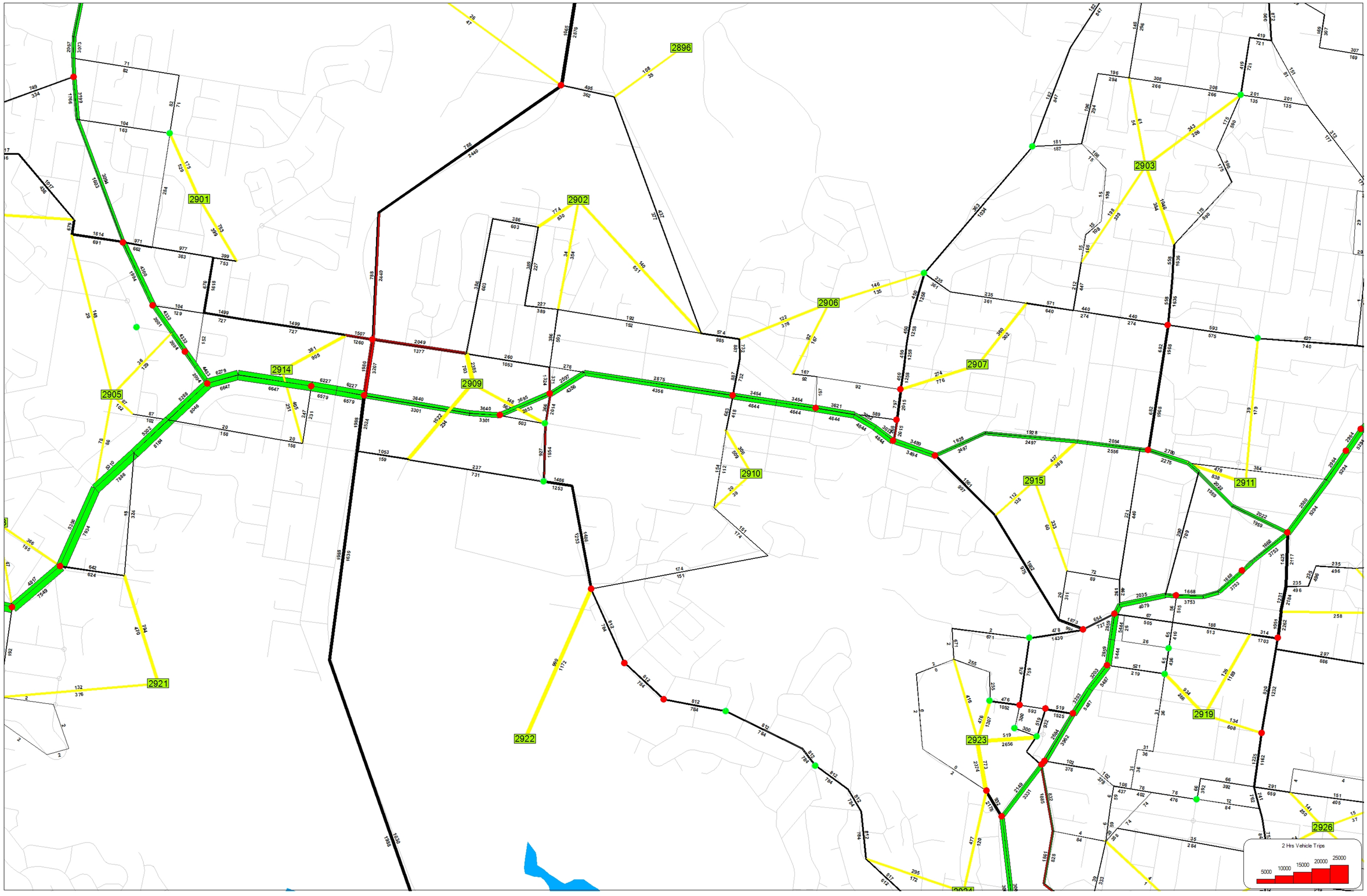
5

TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 1: 2016 7-9am SYDRDNET(I)mf01: FForest: options 1(A+B)
2011-08-09 09:40

LANE (1WAY):
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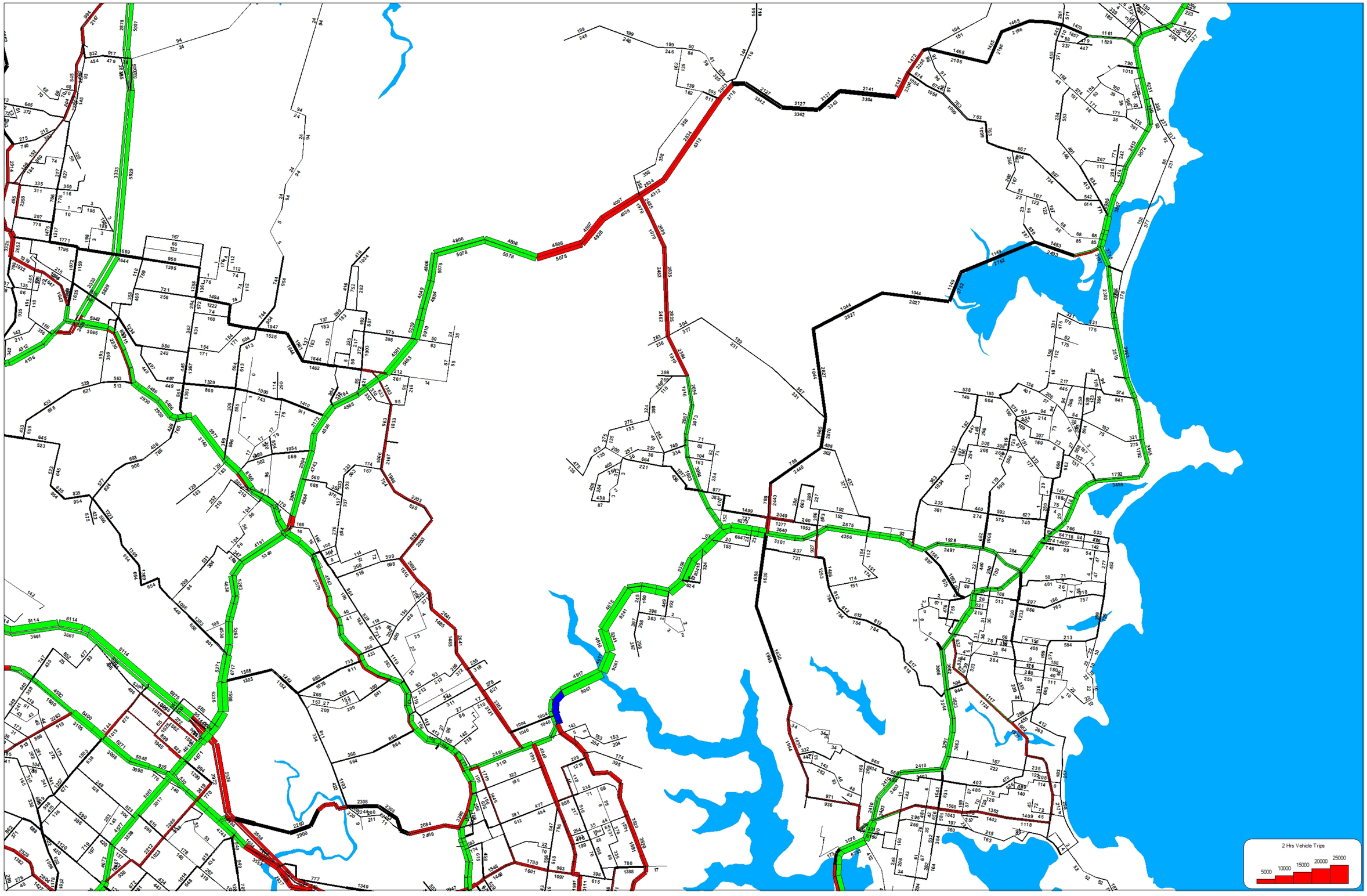
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 1: 2016 7-9am SYDRDNET(I)mf01: FForest: options 1(A+B)
2011-08-09 09:51

LANE (1WAY):
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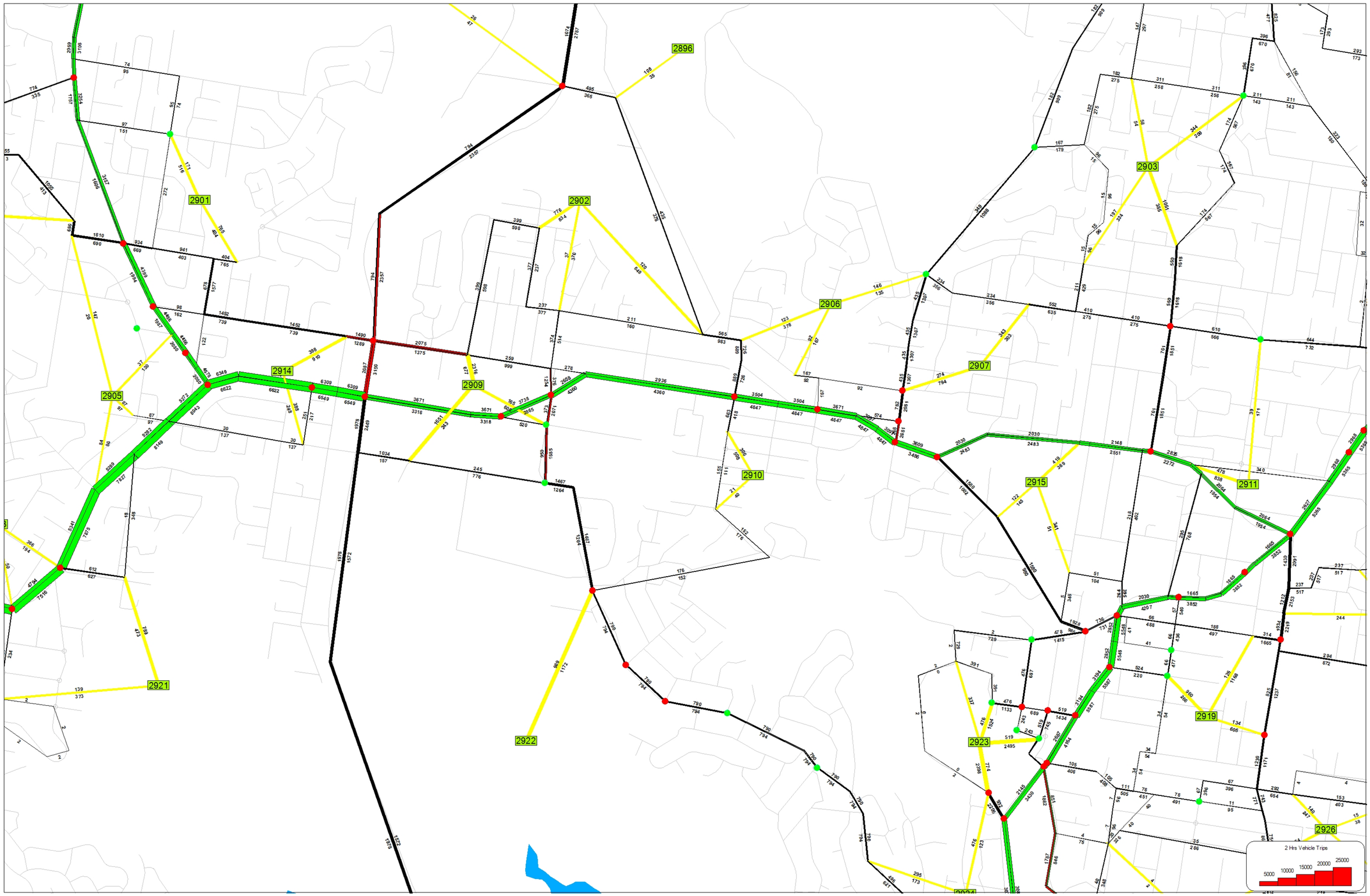
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 2: 2016 7-9am SYDRDNET(I)mf02: FForest: options 2(A+B)
2011-08-09 09:40

LANE (1WAY):
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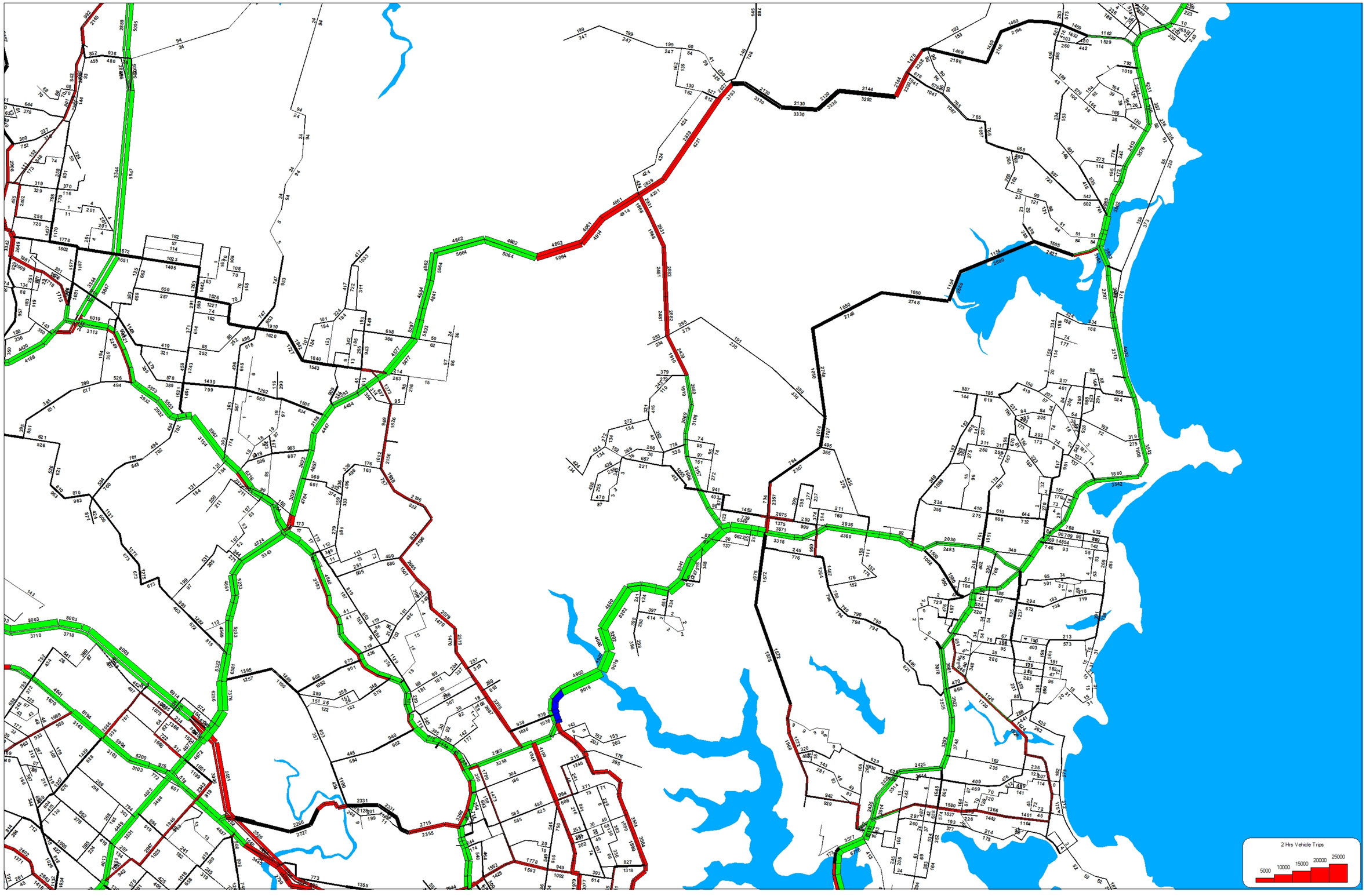
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 2: 2016 7-9am SYDRDNET(I)mf02: FForest: options 2(A+B)
2011-08-09 09:51

LANE (1WAY):
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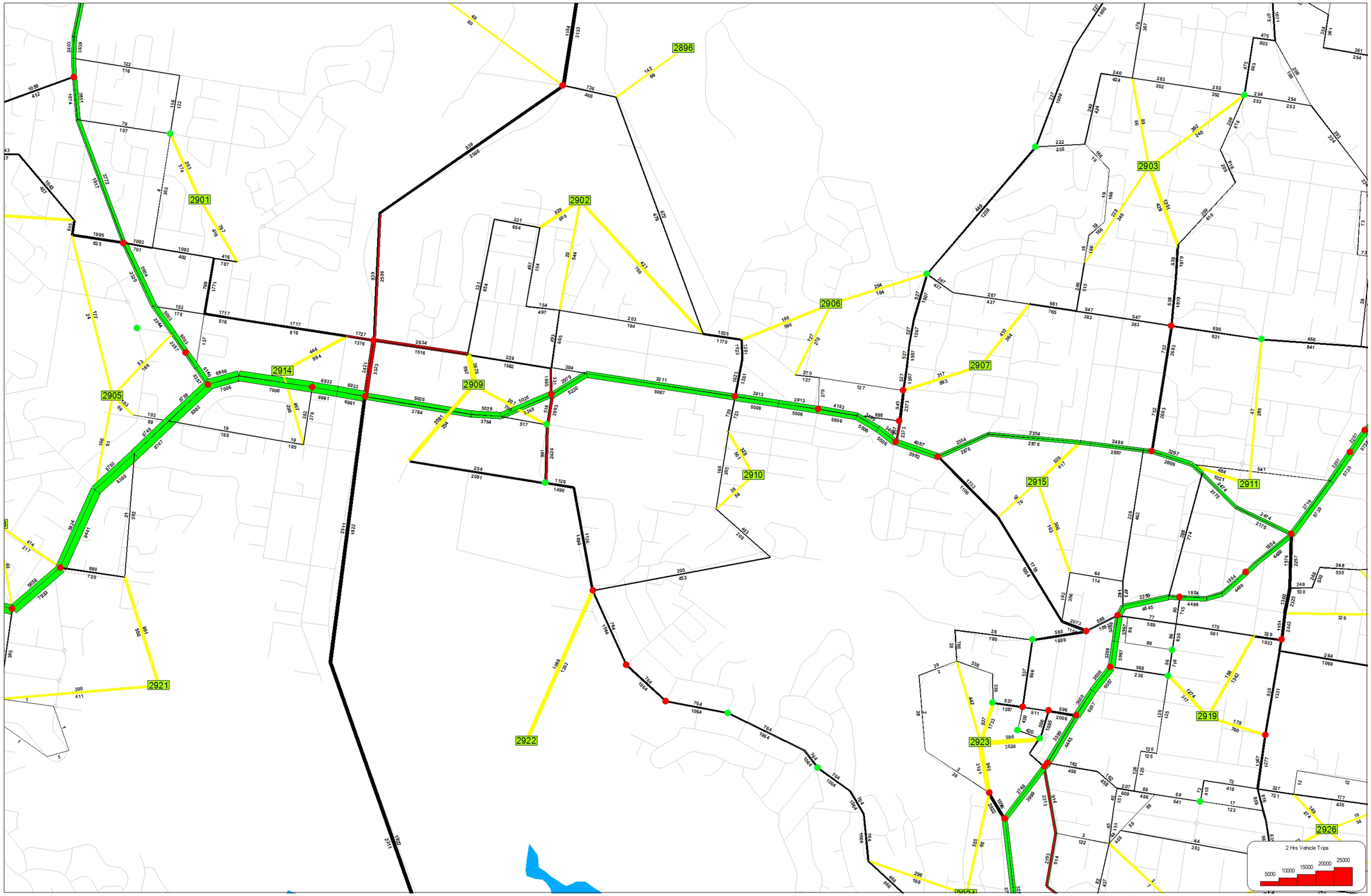
4
5

TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 236: 2036 7-9am SYDRDNETWORK(mf44): 2036 FrenchsForest FullDEV
2011-08-09 09:39

LANE (1WAY):
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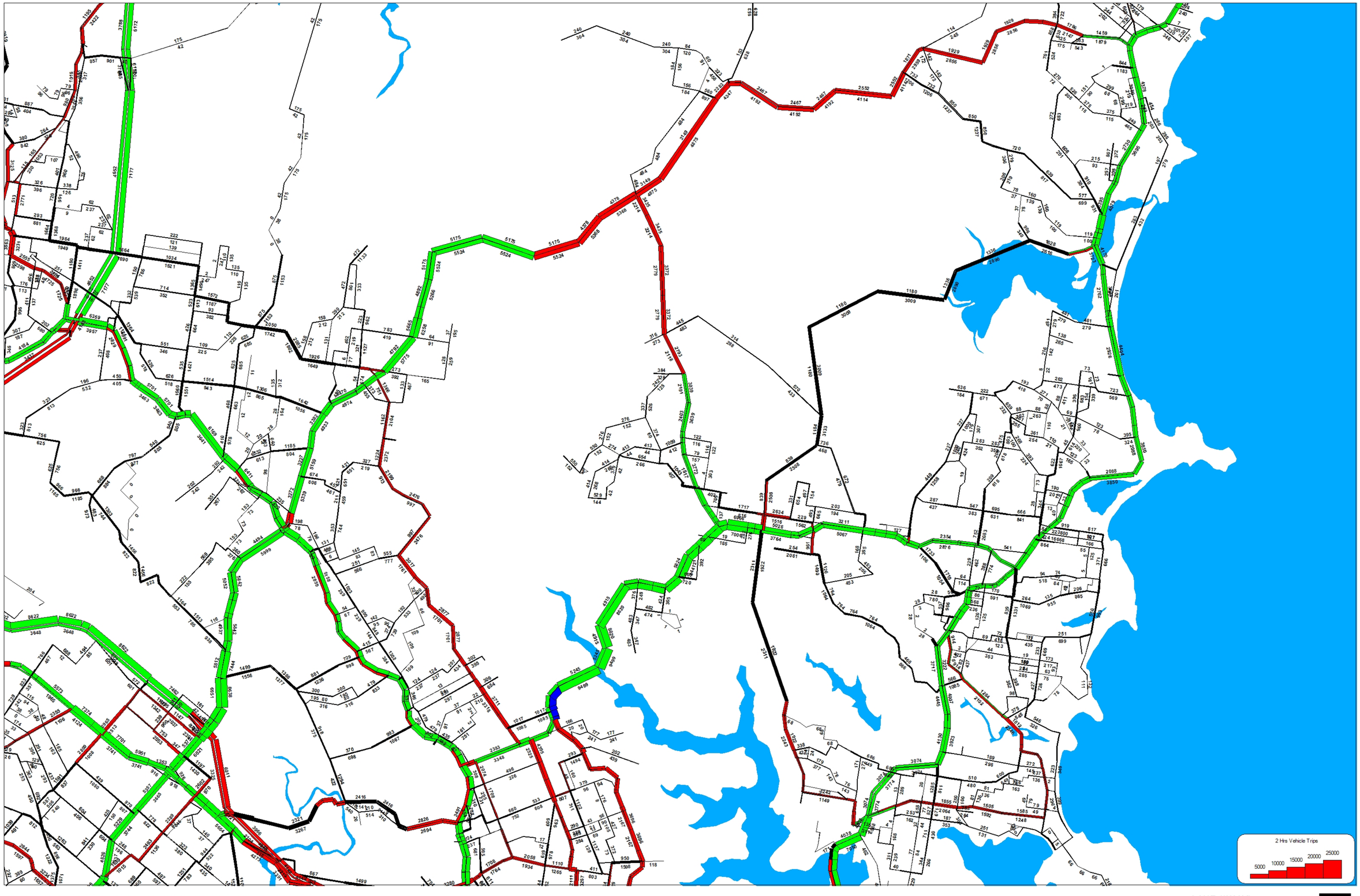
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 236: 2036 7-9am SYDRDNETWORK(mf44): 2036 FrenchsForest FullDEV
2011-08-09 09:50

LANE (1WAY):

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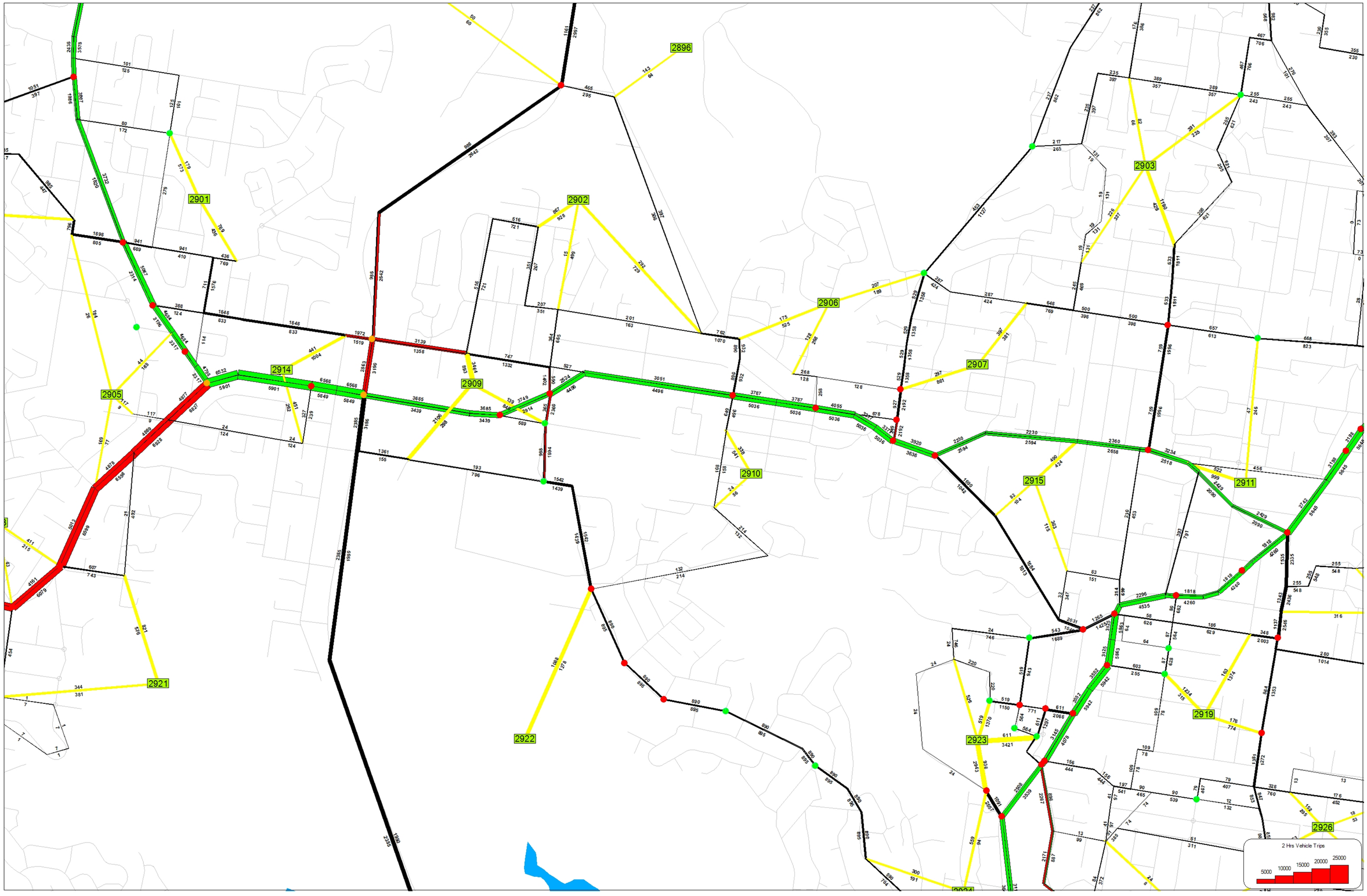
3
4
5

TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 3: 2036 7-9am SYDRDNET(I)mf03: FForest: options 3(A+B+C)
2011-08-09 09:41

LANE (1WAY):
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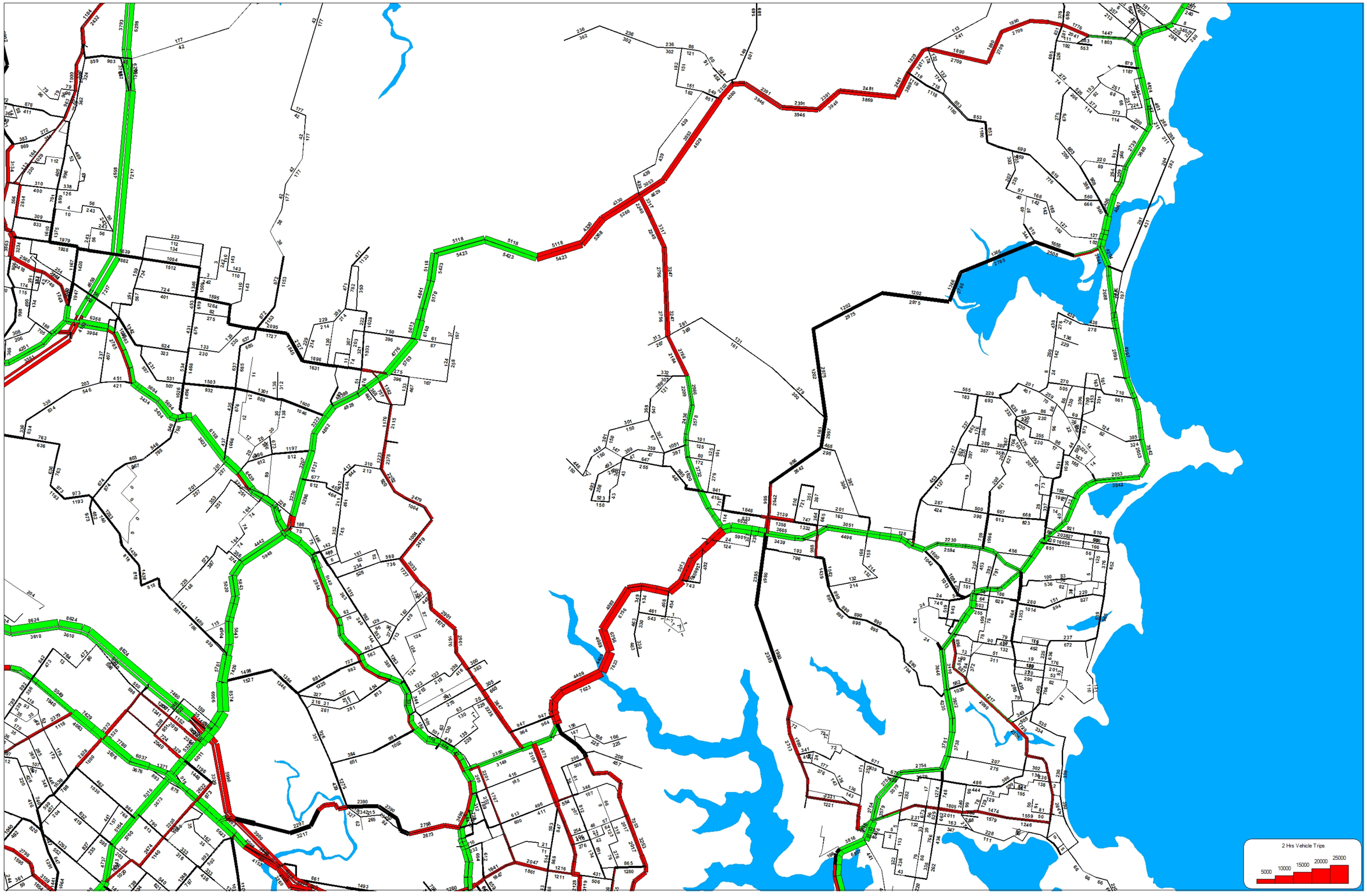
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 3: 2036 7-9am SYDRDNET(I)mf03: FForest: options 3(A+B+C)
2011-08-09 09:52

LANE (1WAY):

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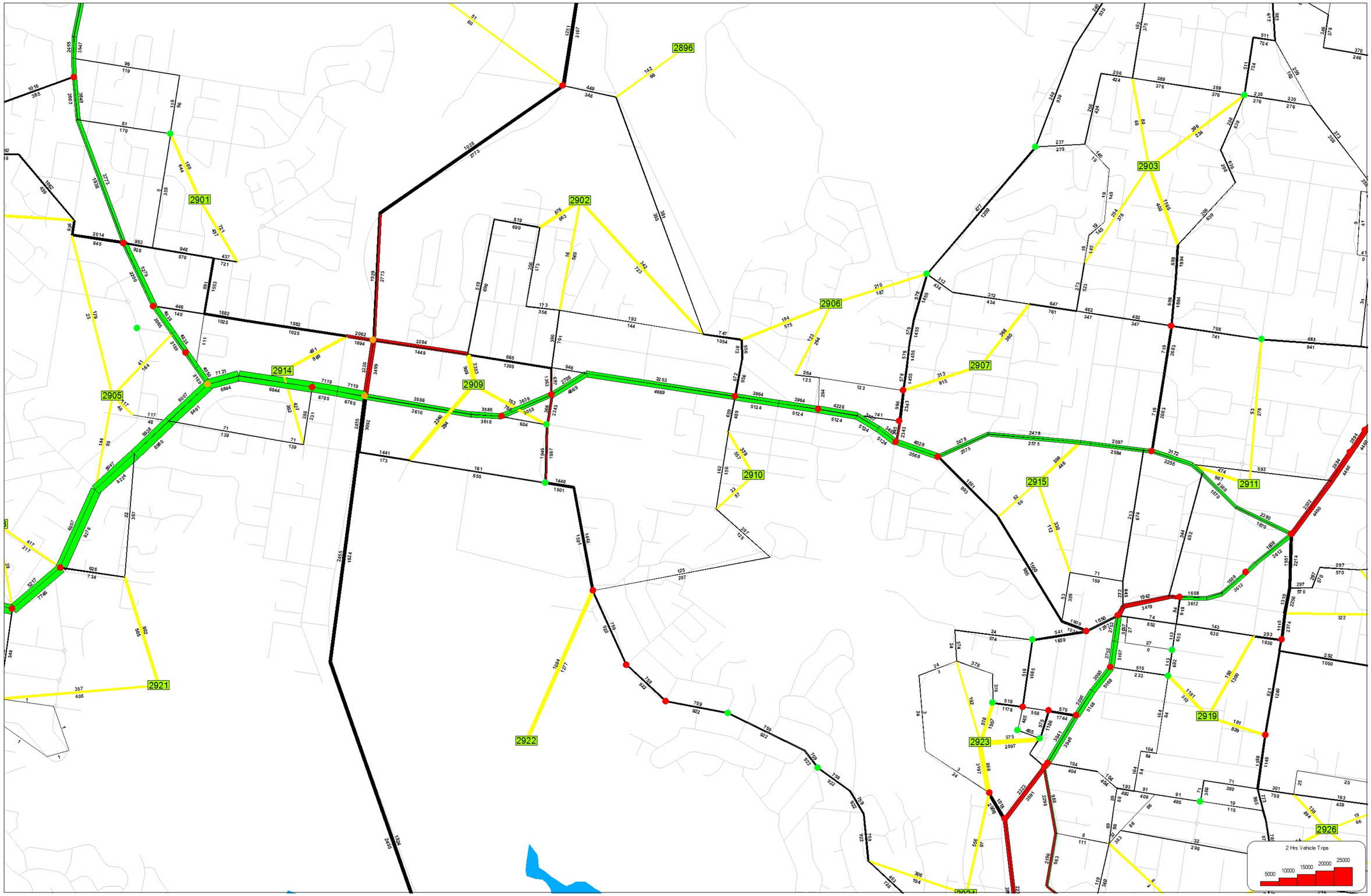
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 4: 2036 7-9am SYDRDNET(I)mf04: FForest: options 4(A+B+C)
2011-08-09 09:41

LANE (1WAY):
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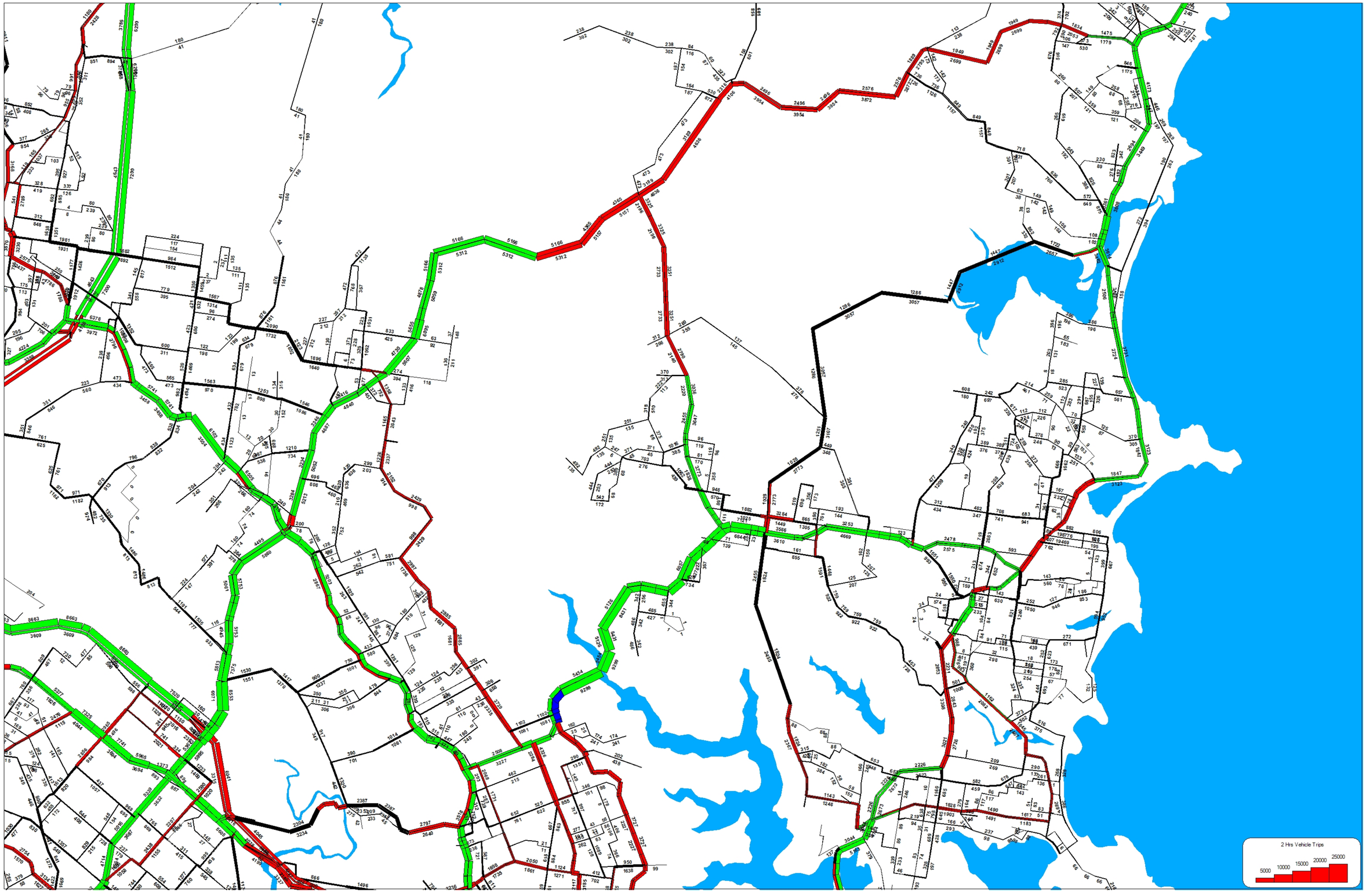
TRAFFIC VOLUMES__



2006TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 4: 2036 7-9am SYDRDNET(I)mf04: FForest: options 4(A+B+C)
2011-08-09 09:52

LANE (1WAY):
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Transport for NSW
11 November 2011
Document No. 003

Frenchs Forest Specialised Centre

Local Transport Assessment

Frenchs Forest Specialised Centre

Local Transport Assessment

Prepared for

Transport for NSW

Prepared by

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

11 November 2011

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Quality Information

Document Frenchs Forest Specialised Centre

Ref 60215773

Date 11 November 2011

Prepared by Russell Yell

Reviewed by Robin Jackson

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
C	04-Oct-2011	Final Draft	Robin Jackson Associate Director	
D	18-Oct-2011	Final Issue	Robin Jackson Associate Director	
E	11-Nov-2011	Final Issue	Robin Jackson Associate Director	

Table of Contents

Executive Summary

In May 2011, AECOM was appointed by TfNSW to undertake an assessment of the transport implications of a potential Specialised Centre at Frenchs Forest.

The potential Specialised Centre is to comprise a new hospital, ancillary healthcare services, redeveloped commercial properties and a commercial core that could support somewhere between 50,000 and 100,000 sqm of retail floor space. For the purposes of the assessment, the retail centre was assumed to have 80,000sqm of floor space.

The objective of this local assessment was to identify the existing transport condition in the local area that surrounds Frenchs Forest and assess the traffic generation of the specialised centre development (including the proposed Northern Beaches Hospital) and the impact of traffic growth in the future in years 2016 and 2036 with and without the development.

Existing conditions (2011)

Frenchs Forest has developed around the convergence of three major arterial roads in the Northern Beaches: Warringah Road, Forest Way, and Wakehurst Parkway. Warringah Road is the primary arterial road that links Warringah to Willoughby and the rest of Sydney.

Warringah Road currently carries approximately 70-80,000 vehicles per day, with high levels of congestion in the morning peak and average peak period travel speeds of around 20km/h. Current traffic volumes along Warringah Road during both peak periods exceed the capacity of the road. The intersections of Warringah Road with Wakehurst Parkway and Warringah Road with Forest Way are both operating at the maximum limits of their designed capacity and cannot be expanded any further as at-grade intersections.

Frenchs Forest sits on the border of two bus contract regions 8 (Sydney Buses) and 14 (Forest Coaches). The east-west services crossing the regions are limited and analysis of the routes serving Frenchs Forest highlights a lack of regular services around the potential specialised centre including the proposed hospital site.

The existing commercial developments have encouraged car usage, with large at-grade car parks and limited pedestrian and cyclist permeability. This has resulted in a poor level of pedestrian/cyclists connectivity between the north and south areas of Frenchs Forest. This severance is exacerbated by the scale of the roadway and lack of pedestrian/cyclist crossing facilities on Warringah Road and Wakehurst Parkway.

Future conditions (2016 and 2036)

The RTA's Strategic Highway Assignment model was used to estimate the traffic volumes on the road network in 2016 and 2036 with no specialised centre or hospital development. The volumes predicted for 2016 result in all of the key intersection in Frenchs Forest operating beyond their capacity and operating at a Level of Service F in both of the peaks with no improvements.

Outputs of the modelling analysis indicate that mid-block volumes on Warringah Road would be 3,810 in the afternoon peak by 2016 and 4,150 by 2036 - demonstrating an increase in traffic demand of 6% by 2016 and 16% by 2036 as compared to the base 2011 model. In the absence of any road improvements the analysis suggests that the predicted volumes of traffic will result in peak period travel speeds even lower than the 20km/h seen today.

Impacts of the Specialised Centre including the hospital site

The proposed hospital and ancillary services development are predicted to generate approximately 2,000 vehicle trips in the PM peak hour in 2016. The addition of these trips onto an already congested traffic network worsens the level of delay. Access to the hospital for visitors, staff and emergency vehicles is assumed to be on Frenchs Forest Road West, between Wakehurst Parkway and the Forest High School.

The increase in traffic generated by the hospital results in the mid-block volumes on Frenchs Forest Road increasing from just over 1,000 vehicles in the afternoon peak in 2016 to 1,900, representing a 90% increase in traffic and resulting in a volume to capacity ratio on Frenchs Forest East of 1.9, or 90% over capacity.

Analysis of the key intersections in the Frenchs Forest area suggests that the addition of the hospital accelerates the need to signalise Naree Road/Forest Way and increase intersection capacity at Frenchs Forest Road/Wakehurst Parkway as well as an increase in capacity at the intersections of Warringah Road/Wakehurst Parkway and Warringah Road/Forest Way.

The potential specialised centre, including the hospital and ancillary services development, is predicted to generate approximately 5,000 trips in the PM peak hour in 2036. The addition of this traffic onto the network in 2036 increases the mid-block traffic volume on Warringah Road from 4,150 to 4,890 in the afternoon peak. This raises the volume to capacity ratio to 1.6. The volume of traffic estimated to be on Frenchs Forest Road East rises to 3,480 in the afternoon peak, resulting in a volume to capacity ratio of 3.5.

Analysis of the key intersections in the study area indicates that the addition of the development will result in the lowest degree of saturation at any intersection along Warringah Road being 1.1 and the lowest average delay being 76 seconds.

Recommendations

The Frenchs Forest area will need significant investment in transport infrastructure to accommodate existing travel demand and background growth, prior to it being able to support the development of the specialised centre.

Based on the analysis described in this report, it is recommended that the following road infrastructure upgrades are investigated as part of the ongoing planning for the specialised centre:

- Forest Way/Naree Road intersection signalisation
- Frenchs Forest Road (East and West) duplication
- Warringah Road/Wakehurst Parkway intersection grade separation
- Warringah Road/Forest Way intersection grade separation
- Potential grade separated Warringah Road underpass
- Re-order traffic management at intersections of Warringah Road/Allambie Road and Warringah Road/Frenchs Forest Road East in favour of bus movements and allow easier access to Frenchs Forest Road.
- Introduce a new intersection at Wakehurst Parkway / Aquatic Drive to allow direct access to Wakehurst Parkway and a potential extension of bus routes from Allambie Road to Wakehurst Parkway

It is recommended that any major transport infrastructure works in Frenchs Forest should be undertaken simultaneously with the hospital development.

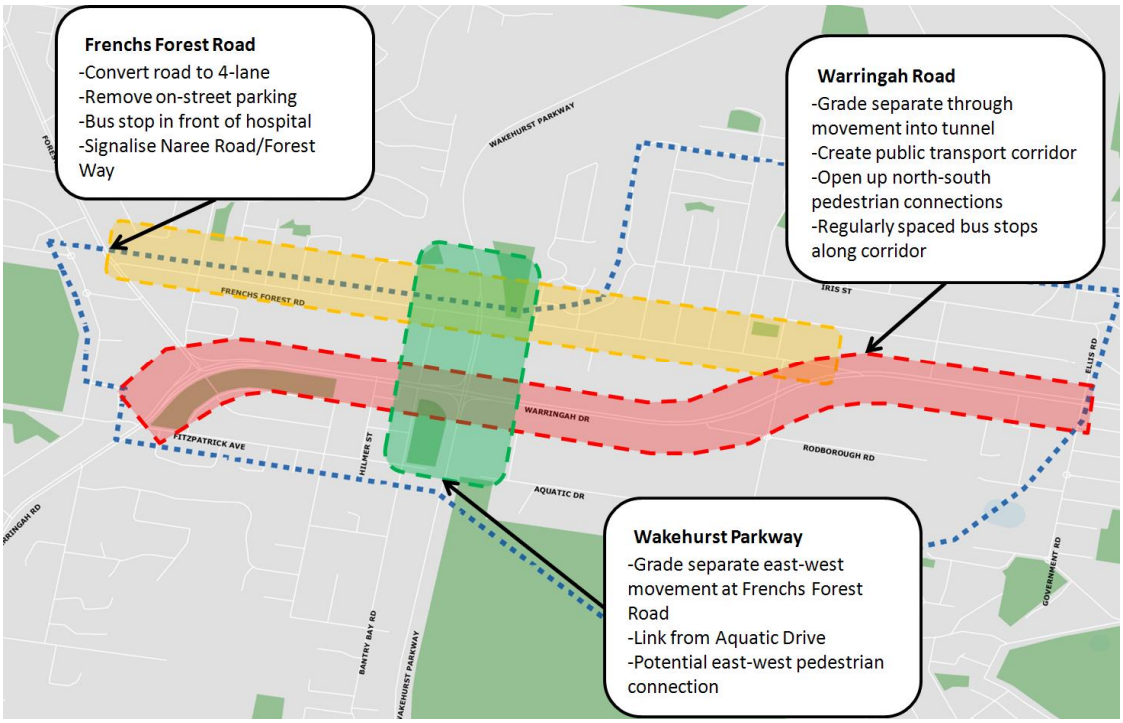
As well as road infrastructure upgrades, it is also recommended that the area would benefit from improved east-west public transport services and a review of bus stop locations to provide better coverage of the area.

The Northern Beaches Bus Rapid Transit (BRT) pre-feasibility study commissioned by TfNSW separately to this report, will identify short term options to build on the bus priority work already done by the RTA along the Pittwater Road corridor. It will assess the feasibility of long term BRT options linking the Northern Beaches with the Sydney, North Sydney and Chatswood CBD's. The Study will provide an indication of the likely future change in public transport patronage in the study area with the introduction of BRT, the road and bus network changes required to accommodate BRT operations and the physical and operational options to address some of the key pinch points.

Pedestrian and cycle connectivity should be regarded as a key principle in the planning of the specialised centre. To improve this connectivity it is recommended that the parking that is provided should be built underground with a pedestrian focussed street network above that encourages walking between the different precincts of Frenchs Forest.

Figure 1 highlights the key corridors and provides a summary of the measures proposed.

Figure 1 Proposed corridors and suggested measures



Conclusion

It is clear from this assessment that the transport network around Frenchs Forest is already at capacity and needs investment in the transport infrastructure to accommodate the growth predicted over the next 5 years. This assessment has identified potential strategic responses that could accommodate the predicted growth in travel demand through Frenchs Forest and provide a transport network that could accommodate the Specialised Centre.

The Frenchs Forest Specialised Centre should be developed around the principles of Transit Oriented Development, with excellent pedestrian and cycle connectivity and high capacity regular public transport services running through its heart. The Northern Beaches BRT pre-feasibility study will give an indication of the type of BRT system that could be implemented along Warringah Road.

1.0 Introduction

1.1 Background to this study

In December 2010 the NSW Department of Planning and Infrastructure (DP&I) and the Ministry of Health lodged a State Significant Site (SSS) for a new Specialised Centre at Frenchs Forest and the proposed Northern Beaches hospital. The SSS study indicated that the area could support an uplift in employment of 12-17,000 jobs and would incorporate a new activity centre supported by a significant amount of retail space.

The SSS proposal suggested modifications to the transport network around Frenchs Forest that would allow the potential specialised centre to develop as an accessible centre, with a focus on pedestrian and public transport connectivity.

1.2 The study purpose

The purpose of this local assessment is to identify the impact of The Northern Beaches Hospital and also Specialised Centre as a whole on local transport networks, and propose improvements to ameliorate the impact of these developments.

The Study also describes how the measures proposed in the Frenchs Forest Specialised Centre Strategic Transport Assessment (AECOM, 2011) would benefit access to the Frenchs Forest area and could support the development of the potential specialised centre.

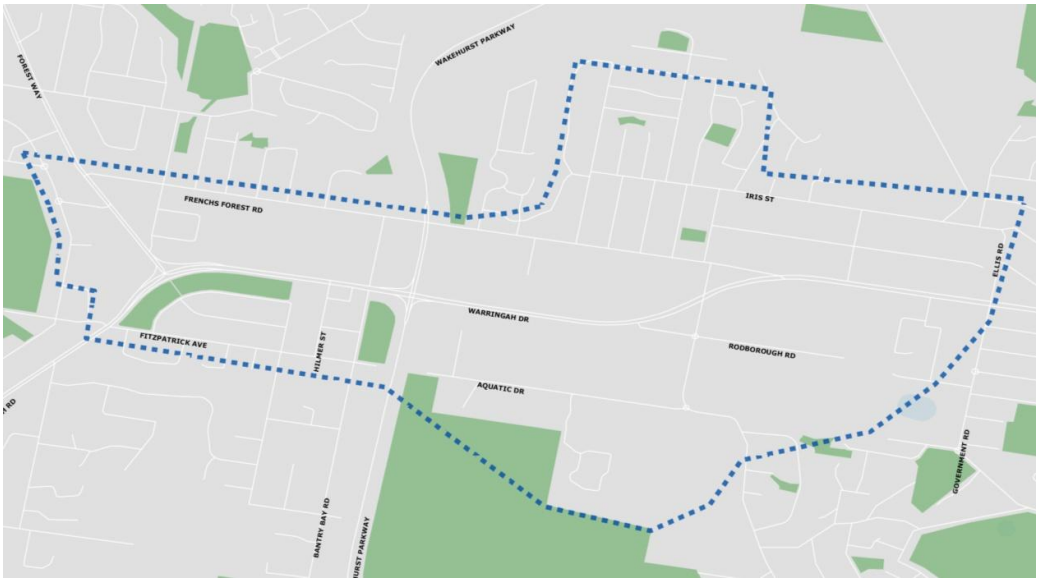
Planning for the Specialised Centre and Northern Beaches Hospital is at a strategic stage, and subsequent planning will advance the proposals to master plan and concept design phases. Therefore, while this study provides transport solutions that could be considered as the proposal develops, it remains strategic in nature.

This report is intended to be read in conjunction with the “Frenchs Forest Specialised Centre Strategic Transport Assessment” (The STR) report also produced by AECOM in 2011.

1.3 Scope of works

The extent of the potential Specialised Centre in Frenchs Forest roughly follows the area bounded by the blue dashed line seen in Figure 2.

Figure 2 Study Area



This report examines the local transport network around Frenchs Forest through the following tasks:

- Review the existing local transport conditions and identify the opportunities and constraints to movement for all transport modes in the area.
- Quantify the impact of background traffic growth on the local road network at forecast years of 2016 and 2036.
- Describe the scale of the proposed hospital and Specialised Centre and comment on the potential access requirements.
- Quantify the impact of the increase in development on the key intersections during the AM peak and PM peak periods at the forecast years of 2016 and 2036
- Define measures that could improve the operation of the transport network in the short (0-5 years) and medium to long (5-25 years) term
- Recommend measures and identify the required transport infrastructure that would support the development of the potential specialised centre and discuss how these measures may benefit modes other than private vehicle.

Traffic forecasts have been provided from the Strategic Highway Assignment Model maintained by the Roads and Traffic Authority (RTA). Trip generation rates for the Specialised Centre and Northern Beaches Hospital have been estimated using the Guide to Traffic Generating Developments (RTA, 2002) and traffic generation rates from similar developments.

The Strategic Highway Assignment Model is designed for strategic planning. The outputs of this model have been used to estimate annual growth rates for observed traffic to identify demands in the forecast years.

2.0 The Frenchs Forest transport network (constraints and opportunities)

2.1 Contextual analysis

2.1.1 Desktop review

AECOM undertook a desktop review of previous studies relevant to Frenchs Forest, including:

- Frenchs Forest Specialised Centre – Transport Report (Arup, December 2010)
- Improving transport on the Warringah peninsula: issues and options (BTRE, 2003)
- Shaping Our Future, Directions for transport, health, housing and jobs for a vibrant sustainable SHOROC region (SHOROC, 2010)
- Warringah Road Corridor Study (RTA, 2009)

These studies acknowledge the traffic congestion experienced by road users during the peak periods on Warringah Road and propose measures that could improve the local network performance.

The key points from these reports are:

- Recognition of the need to grade-separate the intersection of Warringah Road and Wakehurst Parkway
- Stronger east-west public transport links
- Grade separate through traffic movements on Warringah Road to allow the creation of a smaller scale street network

2.2 Site visit

AECOM undertook a site visit to the study area on Thursday 5 May 2011. The site visit was used to examine the traffic conditions in the area and to understand the scale of the road network and how this may form a barrier to pedestrian/cyclists connectivity and public transport access. The following sections discuss the outcomes of the site visit.

2.2.1 Warringah Road

Photograph 1 shows congestion on Warringah Road during the AM peak period. The queue of traffic on the right is destined for Forestville/Roseville Bridge.

Photograph 1 Congestion on Warringah Road (facing north)

As Photograph 2 demonstrates, Warringah Road is approximately 40 metres wide at its widest point. The scale of the corridor and the lack of activity along the road corridor create a barrier to pedestrian and cycle movement between the business parks and residential areas that border Warringah Road between Wakehurst Parkway and Allambie Road. The level of congestion, scale of the road and lack of direct access from surrounding development preclude this stretch of Warringah Road from accommodating bus stops. Further west, where buses travel along Warringah Road, there are bus stops around the retail activity at Hilmer Street. These stops serve the residential area to the south of Warringah Road.

Photograph 2 Scale of Warringah Road (facing east)

2.2.2 Allambie Road

The intersection of Warringah Road and Allambie Road is one of the main access points to the business parks in Frenchs Forest, with Allambie Road connecting with Aquatic Drive to the south and Frenchs Forest Road to the north. As Photograph 3 demonstrates, the traffic congestion around this intersection is high in the morning peak,

and it is acknowledged in the Warringah Road Corridor Study that this intersection is a cause of excessive delays in the PM peak.

Photograph 3 Heavy traffic on approach to Allambie Road (facing east)

2.2.3 Frenchs Forest Road East

Frenchs Forest Road East (Photograph 4) is a single lane collector road fronted by the business parks to the south and low density residential development to the north. This section of road forms part of Strategic Bus Corridors 15 and 17, serving the places of employment and residence in Frenchs Forest. As mentioned earlier, Warringah Road is not an ideal location for bus stops; Frenchs Forest Road provides a better catchment for passengers and location for stops.

Traffic travelling east along Frenchs Forest Road East and wishing to join Warringah Road can continue over the intersection of Allambie Road and merge at the uncontrolled intersection with Warringah Road.

The approaches to the intersection of Frenchs Forest Road with Wakehurst Parkway have steep grades, especially the approach from Wakehurst Parkway to the north. As can be seen in Photograph 5, the intersection has bus priority measures for bus services turning left to Wakehurst Parkway and continuing west to Frenchs Forest Road West.

Photograph 4 Frenchs Forest Road East (facing west)

Photograph 5 Frenchs Forest Road intersection with Wakehurst Parkway (facing west)

2.2.4 Frenchs Forest Road West

Frenchs Forest Road West runs between Wakehurst Parkway and Forest Way. The road is primarily fronted by low density residential developments, as well as Forest High School and the proposed hospital site.

The road corridor is narrow, as seen in Photograph 6, with buses and school related traffic likely to slow traffic movement during peak periods.

Photograph 6 Frenchs Forest Road West (facing west)

2.2.5 Wakehurst Parkway

Drivers on Wakehurst Parkway, linking Pittwater and Oxford Falls to Warringah Road experience queues on the approach to Warringah Road during the morning peak period. This congestion is caused by the Warringah Road congestion and delays at the intersections of Frenchs Forest Road and Warringah Road. The proposed hospital development will be located at the corner of this intersection, in the forested area seen in Photograph 7.

Photograph 7 Traffic on Wakehurst Parkway (facing south)

2.2.6 Forest Way

Forest Way links Mona Vale Road to Warringah Road and is the main access road to the suburbs of Belrose and Davidson. This road is a one of the main corridors for Forest Coaches bus services and has a bus priority measure at its intersection with Warringah Road. The intersection with Naree Road is the most likely access point to the hospital site, but at present this intersection is unsignalised, imposing significant delays on vehicles wishing to enter or exit Naree Road.

Photograph 8 Forest Way

2.2.7 Aquatic Drive

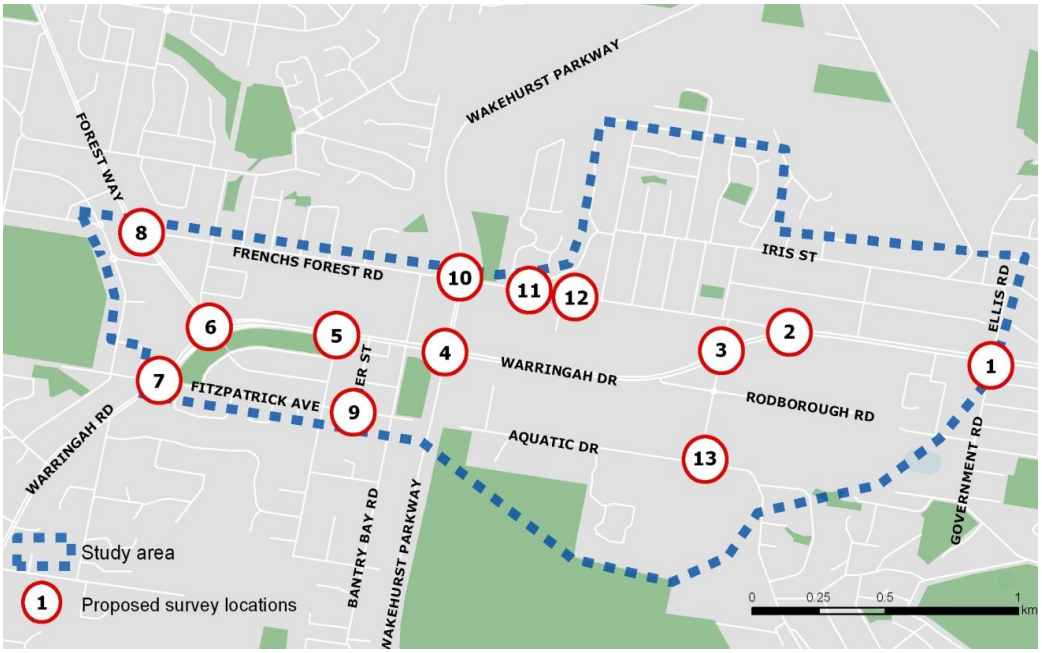
Aquatic Drive is the main access to the business parks to the south of Warringah Road, as well as the Warringah Aquatic Centre. The road terminates just before Wakehurst Parkway, as seen in **Photograph 9**.

Photograph 9 The end of Aquatic Drive (facing west, towards Wakehurst Parkway)

2.3 Intersection performance

Traffic surveys were commissioned at the following locations to obtain morning and afternoon peak period traffic flows:

Figure 3 Traffic survey locations



Source: AECOM 2011

The survey locations are as follows:

1) Warringah Road and Ellis Road
2) Warringah Road and Frenchs Forest Road
3) Warringah Road and Allambie Road
4) Warringah Road and Wakehurst Parkway
5) Warringah Road and Hilmer Street
6) Warringah Road and Forest way
7) Warringah Road and Fitzpatrick Avenue
8) Forest Way and Naree Road
9) Hilmer Street and Fitzpatrick Avenue
10) Wakehurst Parkway and Frenchs Forest Road
11) Frenchs Forest Road and Skyline Place
12) Frenchs Forest Road and Parkview Hotel Entrance
13) Allambie Road and Aquatic Drive

Analysis of the survey results, provided in **Appendix A**, identified the morning peak hour occurred between 07:45 and 08:45, and the afternoon peak hour occurred between 16:45 and 17:45.

2.3.1 Intersection Performance

The existing operation and performance of key intersections within the study site has been assessed using SIDRA Intersection 5.1, a computer based modelling package designed for calculating isolated intersection performance.

The main performance indicators for SIDRA 5.1 include:

- Degree of Saturation (DoS) – a measure of the ratio between traffic volumes and capacity of the intersection is used to measure the performance of isolated intersections. As DoS approaches 1.0, both queue length and delays increase. Satisfactory operations usually occur with a DoS range between 0.7-0.8 or below;
- Average Delay – duration, in seconds, of the average vehicle waiting at an intersection; and
- Level of Service (LoS) – a measure of the overall performance of the intersection (this is explained further in **Table 1**).

Table 1: Level of Service and Average Delay Performance Criteria for Intersections

Level of Service	Average Delay (secs/veh)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	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, RTA, 2002

Table 2 summarises the intersection performance based on the 2011 traffic flows for the AM and PM peak hour.

Table 2 2011 AM and PM peak SIDRA results

Intersection	LoS		Deg of Satn (v/c)		Ave Delay (sec)	
	AM	PM	AM	PM	AM	PM
1. Warringah Rd/ Ellis Rd	E	E	1.0	1.0	64	67
2. Warringah Rd/ Frenchs Forest Rd	A	A	1.0	1.0	4	3
3. Warringah Rd/ Allambie Road	D	F	0.9	1.3	50	259
4. Warringah Rd/ Wakehurst Parkway	F	E	1.0	1.0	73	63
5. Warringah Rd/ Hilmer St	B	B	0.8	0.8	15	17
6. Warringah Rd/ Forest Way	D	F	0.9	1.1	48	111
7. Warringah Rd/ Fitzpatrick Ave	F	F	3.3	1.5	168	17
8. Forestway/ Naree Rd	F	F	1.4	3.0	31	188
9. Hilmer St/ Fitzpatrick Ave	A	A	0.1	0.1	5	6
10. Frenchs Forest Rd/ Wakehurst Parkway	D	F	0.9	1.1	50	122
11. Frenchs Forest Rd/ Skyline Plc	A	A	0.6	0.6	7	8

Intersection	LoS		Deg of Satn (v/c)		Ave Delay (sec)	
12. Frenchs Forest Rd/ Parkway Hotel	A	A	0.7	0.8	5	8
13. Allambie Rd/ Aquatic Drive	A	A	0.6	0.6	6	6

Source: AECOM 2011

The intersection analysis indicates all major intersections along Warringah Road are operating at or near capacity during the peak periods. This would suggest the need for an increase in capacity through intersection upgrades.

2.4 Mid-block analysis

A comparison of the mid-block traffic volumes compared to the number of traffic lanes in each direction and each lane's traffic capacity indicates the road volume to capacity (V/C) ratio. This measure demonstrates the level of spare capacity there is on a road.

The mid-block analysis was undertaken at:

- Warringah Road (between Hilmer Street and Forest Way)
- Wakehurst Parkway (between Warringah Road and Frenchs Forest Road)
- Forest Way (south of Naree Road)
- Frenchs Forest Road (between Allambie Road and Wakehurst Parkway)

The table below summarises the mid-block analysis for the AM and PM peak.

Table 3 2011 Mid-Block Analysis

Road	Number of Lanes per direction	AM		PM	
		Peak direction traffic flow	Volume/Capacity Ratio	Peak direction traffic flow PM	Volume/Capacity Ratio
Warringah Road (Hilmer St)	3	3,250	1.1	3,600	1.2
Wakehurst Parkway (Frenchs Forest Road)	3	1,250	0.4	1,200	0.4
Forest Way (Naree Road)	3	2,230	0.7	1,939	0.7
Frenchs Forest Road (Parkview Hotel)	1	830	0.8	1,016	1.1

Based on a lane capacity of 1,000 veh/p/hr (reference Austroads) Source: Austraffic 2011

The analysis shows volume/capacity ratios on Frenchs Forest Road and Warringah Road are both above 1, indicating that these roads are carrying more traffic than their theoretical capacity. These two roads serve as the east-west connections across Frenchs Forest.

2.5 Road network constraints and opportunities

2.5.1 Constraints

The key road network constraints in Frenchs Forest can be summarised as:

1) Warringah Road: A major traffic arterial, carrying approximately 70,000 vehicle trip per day in both directions. The capacity of this road must be retained in some form to maintain traffic flow through Frenchs Forest
2) All of the key intersections along the Warringah Road corridor are already operating at or near capacity during peak periods
3) Forest Way/Naree Road: This priority controlled intersection restricts access to Naree Road and Frenchs Forest Road West during peak periods because of the heavy main movements on Forest Way.
4) Frenchs Forest Road: The residential nature of this road and the need to maintain safe school access may impose a limit on the volume of traffic that can be accommodated on this road. The V/C ratio for this road is already at 1.
5) Restricted road and intersection capacity downstream of Frenchs Forest to to the west results in queues of traffic limiting the ability of traffic to exit the intersection of Forest Way and Warringah Road during the morning peak period. This subsequently limits the flow of traffic through the intersections of Warringah Road/Wakehurst Parkway and Wakehurst Parkway/Frenchs Forest Road.

2.5.2 Opportunities

There is potential to improve the local traffic conditions in Frenchs Forest through intersection upgrades; however the effectiveness of these upgrades would be limited if no regional measures to improve capacity and/or reduce the volume of traffic were introduced.

1) Reduce intersection delays at Warringah Road and Wakehurst Parkway through grade separation.
2) Reduce intersection delays at Warringah Road and Forest Way through grade separation.
3) Open up new Aquatic Drive connection to Wakehurst Parkway to provide direct business park access and pedestrian access from Fitzpatrick Avenue to Aquatic Drive
4) Review operation of the intersections of Frenchs Forest Road, Allambie Road and Warringah Road to create more legible traffic circulation.
5) Signalise the intersection of Naree Road with Forestway to allow controlled access reduce delays to traffic entering and exiting Naree Road.
6) Separate through traffic from local traffic by way of a bypass link, as proposed in the SSS study.

2.6 Public transport

Figure 4 and Table 4 demonstrate there is good public transport coverage for journeys from the Belrose area south towards Forestville and on towards Chatswood and the CBD. However, the east-west connection served by routes L60, 136 and 137 has a lower capacity with 13 buses in the two hour morning peak period.

Table 4 Bus Services in Frenchs Forest

Route	Between	Route	Frequency (7-9am)	
			S-W Bound	N-E Bound
270	Belrose-City	Warringah Road / Forest Way	25	7
279-284	Duffys Forest - Chatswood	Warringah Road / Forest Way	17	10
280	Warringah Mall-Chatswood	Warringah Road / Forest Way	4	6
L60	Mona Vale-Chatswood	Warringah Road	3	0
136	Manly- Chatswood	Warringah Road / Forest Way / Frenchs Forest Road East	9	5
137	Chatswood to Bantry Bay	Warringah Road	0	1
169	Manly-City	Warringah Road / Forest Way / Frenchs Forest Road East / Wakehurst Parkway	4	1
E69	Manly-City	Warringah Road / Forest Way / Frenchs Forest Road East / Wakehurst Parkway	17	0
173	Narraweena to Milsons Point	Warringah Road / Forest Way / Frenchs Forest Road East / Wakehurst Parkway	3	0
142	Allambie Heights to Manly	Skyline Shops/ Allambie Road/ Condamine Street/Many	2	3
E66	Allambie Heights to City	Skyline Shops/ Allambie Road/ Military Road/ Wynyard Station	5	0

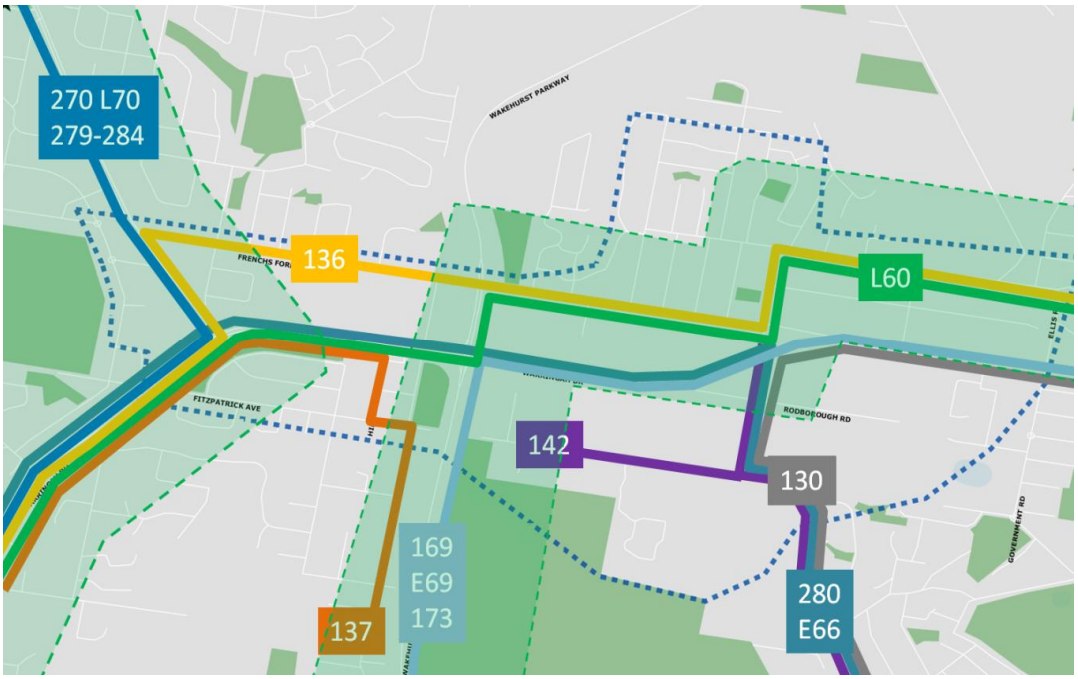
Source: www.131500.com.au

Figure 4 Bus services in Frenchs Forest

Source: AECOM 2011

Figure 5 shows the approximate 5 minute walk distance catchment areas and destinations of the regular (greater than 5 per hour) bus services in Frenchs Forest. This highlights the lack of east-west coverage in the area and suggests that people wishing to make bus journeys from Frenchs Forest towards Chatswood must walk to meet the more regular Forest Coaches services along the western edge of Frenchs Forest. The walk distance from the residential area to the north of Frenchs Forest Road East to the bus stops on Forest Way is approximately 15-20 minutes.

Figure 5 Approximate 5 minute catchment areas for regular peak period bus services



Source: AECOM 2011

2.7 Public transport constraints and opportunities

2.7.1 Constraints

The following constraints regarding public transport were identified:

1) Buses travelling along Warringah Road are subject to traffic congestion in peak periods
2) Buses turning into Naree Road from Forest Way do not have any priority over oncoming traffic.
3) The business parks to the south of Warringah Road on Aquatic Drive are only served by bus routes 142 and E66, which together provide 7 buses between 7-9am on a weekday.
4) The residential area to the west of Bantry Bay Road and south of Warringah Road is limited to using the bus stops on Warringah Road, which is an uninviting environment for pedestrians.
5) The quality of bus stops and signage is generally fairly poor, with old wooden shelters in places and minimal signposting and lighting.

2.7.2 Opportunities

The following opportunities to improve the level of public transport coverage in Frenchs Forest were identified:

1) Improve east-west services to link Frenchs Forest with Chatswood and beyond

2) Extend Aquatic Drive to Wakehurst Parkway and potentially across to Fitzpatrick Avenue to create a bus corridor that could better serve the residential and employment areas to the south of Warringah Road.

3) Signalising the intersection of Forest Way and Naree Road would improve bus journey time reliability.

4) Review quality and location of bus stops to improve attractiveness and catchment areas

2.8 Pedestrian/cycle constraints and opportunities

The development of the Frenchs Forest business parks along Warringah Road has in the past focussed on access by private vehicle, with the pedestrian movement internalised between the building entrance and the car park. Warringah Road itself is a wide, congested arterial road with limited opportunities for pedestrians to cross and minimal pedestrian facilities. The combination of these two factors has resulted in the Warringah Road corridor severing the residential developments to the north and south.

The scale of Wakehurst Parkway and the volumes of traffic in the peak periods also create an uninviting pedestrian environment, creating a north-south severance as well as the east–west barrier along Warringah Road. This results in the central core of Frenchs Forest being hard to reach for cyclists and pedestrians, as shown in Figure 6.

Figure 6 Pedestrian severance caused by development and road corridor

Source: AECOM 2011

2.8.1 Constraints

The key constraints to pedestrian movement are:

1) Severance caused by internalised, car-based development along the Warringah Road corridor

2) Wide road corridors are not attractive pedestrian environments

3) Long signal cycle times delay pedestrians

4) The topography and walk distances in the surrounding low density residential areas are not an ideal walking environment

5) Topography and level of traffic congestion may deter recreational cyclists

6) Lack of pedestrian focussed amenities – public realm

2.8.2 Opportunities

The ability to improve the pedestrian environment largely depends on the wider redevelopment of the area to resolve the car-focused, internalised design of the business parks.

1) As mentioned in the SSS study, there is potential to open up north south links to connect the business parks across Warringah Road and the surrounding residential areas.

2) If a new link from Aquatic Drive were opened up this would allow pedestrians from the west of Wakehurst Parkway to access the Aquatic Centre and businesses on Aquatic Drive.

3) A signalised intersection at Naree Road would create another safe crossing point for local residents and pupils of Forest High School.

3.0 Future transport conditions

The forecast peak period network conditions were assessed in order to determine the volume of traffic that would be travelling through the study area and the resulting performance of the road network, assuming no development and according to the existing growth targets for the North East subregion.

The RTA's Strategic Highway Assignment model was used to identify background traffic growth in the Frenchs Forest area for the forecast years of 2016 and 2036. It was found that the traffic growth between 2011 and 2016 was an average of approximately 6% in the Frenchs Forest area. Traffic growth between 2011 and 2036 averages 16% in the Frenchs Forest area.

3.1 2016 and 2036 SIDRA assessment

The following tables show the results of the SIDRA intersection modelling of the AM and PM peak hours for the forecast years.

Table 5 Intersection performance, AM and PM Peak Hours, 2016 and 2036

Intersection	2016						2036					
	LoS		Deg of Satn (v/c)		Ave Delay (sec)		LoS		Deg of Satn (v/c)		Ave Delay (sec)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1. Warringah Rd/ Ellis Rd	**E**	**E**	1.0	1.0	70	67	**F**	**F**	1.0	1.0	85	86
2. Warringah Rd/ Frenchs Forest Rd	**A**	**A**	1.0	1.0	3	2	**A**	**A**	1.0	1.0	3	2
3. Warringah Rd/ Allambie Rd	**F**	**F**	1.1	1.3	74	337	**F**	**F**	1.1	1.5	142	430
4. Warringah Rd/ Wakehurst Parkway	**F**	**F**	1.0	1.0	114	82	**F**	**F**	1.1	1.1	174	142
5. Warringah Rd/ Hilmer St	**B**	**B**	0.8	0.8	16	18	**B**	**B**	0.9	0.9	19	25
6. Warringah Rd/ Forest Way	**E**	**F**	1.0	1.2	65	209	**F**	**F**	1.0	1.4	88	302
7. Warringah Rd/ Fitzpatrick Ave	**F**	**B**	3.5	1.5	184	21	**F**	**B**	3.8	1.7	208	26
8. Forestway/ Naree Rd	**F**	**F**	1.3	3.1	25	198	**F**	**F**	1.9	3.5	65	215
9. Hilmer St/ Fitzpatrick Ave	**A**	**A**	0.1	0.1	5	6	**A**	**A**	0.1	0.1	5	6
10. Frenchs Forest Rd/ Wakehurst Parkway	**E**	**F**	1.0	1.1	65	180	**F**	**F**	1.1	1.3	159	295
11. Frenchs Forest Rd/ Skyline Plc	**A**	**A**	0.6	0.8	8	11	**A**	**C**	0.7	1.3	12	32
12. Frenchs Forest Rd/	**A**	**A**	0.7	0.9	5	10	**A**	**B**	0.8	1.0	5	16

	2016						2036					
Parkway Hotel												
13. Allambie Rd/ Aquatic Drive	**A**	**A**	0.7	0.7	6	6	**A**	**A**	0.8	0.7	7	7

Source: TfNSW/AECOM 2011

The intersection analysis indicates all key intersections along Warringah Road will operate at a Level of Service F in both the AM and PM peak periods by 2036.

Even by 2016, the intersections are all operating at LoS E/F in both peak periods and with degrees of saturation over 1.

The level of delay experienced at the intersections is high, with delays reaching over 170 seconds.

3.2 2016 and 2036 Mid-block analysis

The mid-block values for the 3 key roads in the Frenchs Forest area in 2016 and 2036 can be seen below, along with the 2011 values for comparison.

Table 6 Mid-Block Analysis

Road	Number of Lanes	2011				2016				2036			
		AM		PM		AM		PM		AM		PM	
		Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C
Warringah Road (Hilmer St)	3	3,250	1.1	3,600	1.2	3,450	1.2	3,810	1.3	3,550	1.2	4,150	1.4
Wakehurst Parkway (Frenchs Forest Road)	3	1,250	0.4	1,200	0.4	1,680	0.6	1,280	0.4	1,650	0.6	1,390	0.5
Forest Way (Naree Road)	3	2,230	0.7	1,940	0.7	2,330	0.8	2,060	0.7	2,570	0.9	2,240	0.8
Frenchs Forest Road (Parkview Hotel)	1	830	0.8	1,020	1.1	820	0.8	1,080	1.1	1,100	1.1	1,170	1.2

Based on a lane capacity of 1,000 veh/p/hr (reference Austroads) Source: TfNSW/AECOM 2011

The peak direction for the AM peak on Warringah Road is westbound, and the PM peak is eastbound.

Similarly, with Wakehurst Parkway and Forest Way, the AM peak direction is southbound, and the PM peak is northbound.

These mid-block results further demonstrate the high volumes of traffic that travel through the Frenchs Forest area and the relative lack of road capacity to carry these volumes.

The analysis predicts that Warringah Road will be carrying 40% more traffic than its theoretical capacity in the PM peak by 2036. Similarly, Frenchs Forest Road is predicted to carry 20% more traffic than its theoretical capacity.

4.0 The Frenchs Forest Specialised Centre

4.1 Northern Beaches Hospital

The Northern Beaches Hospital proposal involves the construction of a major regional hospital at Frenchs Forest. Currently, the North East subregion is serviced by two hospitals located at Mona Vale and Manly. However, the existing location of these hospitals results in the centrally located communities of the North East subregion not having local access to a hospital.

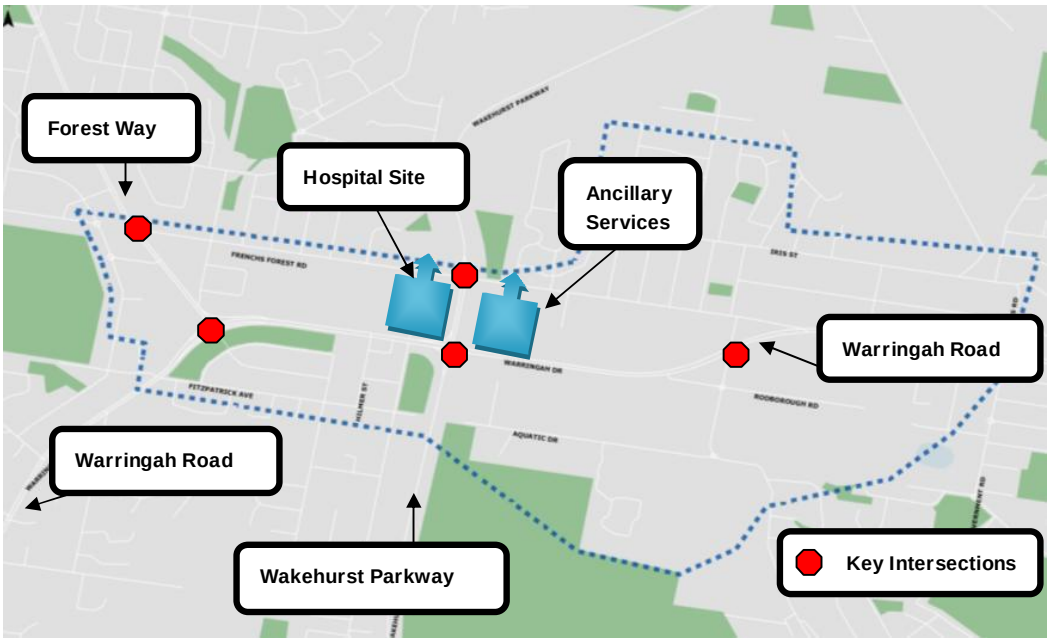
The Royal North Shore hospital is currently the nominated major hospital which serves the North East subregion, but this hospital sits outside the boundaries of the North East subregion and is a considerable distance from the coastal suburbs on the Northern Beaches.

The hospital itself is anticipated to have somewhere in the order of 500 beds. The Strategic Transport Report (STR) (AECOM, 2011) assumed that the hospital would have 2,000 direct healthcare employees at the hospital, with an additional 3,000 jobs in health-related ancillary services.

4.1.1 Location and access

Access to the proposed hospital site is assumed to be from Frenchs Forest Road, as shown in **Figure 7** below.

Figure 7: Frenchs Forest Hospital Location



Source: AECOM 2011

4.1.2 AM peak hospital and ancillary trip generation

The vehicle trip generation for the hospital development and the ancillary healthcare related employment was estimated in the RTA's Strategic Highway Assignment Model. This strategic modelling exercise was informed the STR and provided estimates for the total net increase in traffic generation in 2016 with the introduction of the hospital.

The AM peak traffic generation associated with the hospital development was found to be:

Table 7 Hospital Trip Generation, Morning Peak Hour

Land Use	Volume arriving	Volume leaving	Total Trips
Hospital	376	13	389
Ancillary Services	941	34	974
Total	1,317	46	1,363

4.1.3 PM peak hospital and ancillary services trip generation

The vehicle trip generation associated with the hospital has been estimated according to the hospital trip generation rate prescribed in the RTA's "Guide to Traffic Generating Developments". The guide sets out a rate according to the expected number of beds at a private hospital. The Northern Beaches hospital is likely to be a mix of private and public beds. For the purposes of this assessment it has been assumed that all beds are private and the trip generation rate has been applied uniformly. The trip generation rate in the evening peak is:

Evening peak hospital trip generation = -11.96 + 0.69(number of beds)*

Assumptions on trip distribution are as follows:

- For the evening peak, it is assumed that 20% of trips are arriving and 80% are departing for the hospital area
- The ancillary hospital services have been assumed to be of a commercial nature in a B7 business park zone to the east of Wakehurst Parkway.
- The traffic generation rate for the ancillary services area, as per the RTA "Guide to Traffic Generating Development" is 2 trips per 100sqm of floor space in the evening peak period.
- It has been assumed that the average floor space per employee is 29sqm. This results in a total floor space for this function of 87,000sqm.
- The distribution of the ancillary hospital trips is assumed to be 90% departures in the evening peak and 10% arrivals.

The vehicle trip generation and distribution for the ancillary services has been estimated:

Table 8 Hospital Trip Generation, Afternoon Peak Hour

Land use	Distribution arriving	Distribution leaving	Volume arriving	Volume leaving	Number of trips during peak hour
Hospital	20%	80%	64	255	319
Ancillary	10%	90%	174	1,566	1,740
Total			238	2,821	2,059

4.2 Specialised Centre

Frenchs Forest has been identified as a potential Specialised Centre by DP&I in the State Significant Site study and is to be developed around the Northern Beaches hospital and conceived with the objective to concentrate employment and create an activity centre that will provide better amenity to the western and central areas of the North East subregion.

The extent of the potential Specialised Centre as proposed by the DP&I is shown approximately as the blue dashed line in Figure 8.

The State Significant Site study for the Frenchs Forest Specialised Centre (December 2010) suggested the potential to provide employment from 8,000 today to between 20,000-25,000 jobs - an increase of up to 17,000 jobs. While the land use and development controls proposed under the State Significant Site study could

theoretically support this employment target, for the purpose of the strategic and local assessment, 7,000 additional jobs were modelled at Frenchs Forest to reflect the predicted employment growth and demand within the subregion up to 2036.

Table 9: Frenchs Forest Additional Employment

Scenario	Health Employment	Health Associated	Retail/ Professional	Total additional employment
2016 + Hospital	2,000	3,000	0	5,000
2036 Full Development	2,000	3,000	2,000	7,000

The SSS Study proposed 50,000 to 100,000 sqm of retail space across the centre. For the purpose of this study, it was assumed that the floorspace was 80,000sqm. An assessment of this floor space has been focussed in a B3 mixed-use commercial core, the location of which is shown in Figure 8.

Figure 8 Proposed Commercial Core

For the purposes of this assessment, it has been assumed that all other background growth outlined in Section 3 would remain the same. The commercial core has been treated as an additional development site and absorbs all of the additional 2,000 jobs outlined in Table 9.

4.2.1 Full development AM peak trip generation

As with the AM peak traffic generation for the hospital, the AM peak traffic generation for the commercial core was estimated as part of the Strategic Transport Assessment (AECOM, 2011).

The AM peak traffic generation for the commercial core can be seen in Table 10

Table 10 Full development traffic generation, AM Peak Hour

Land Use	Total Trips	Volume arriving	Volume leaving
Hospital	389	376	13
Ancillary Services	974	941	34
Commercial Core	620	596	24
Total	1,983	1,913	71

4.2.2 Full development PM peak trip generation

The B3 Commercial Core has been assumed to be 100% retail use for the purposes of this assessment.

The weekday trip generation rate for retail is highest in the afternoon peak period. The RTA guide specifies traffic generation rates for retail centres ranging in size from up to 40,000 sqm. The rates specified in the guide are outdated and do not account for the scale and changed function of modern day retail centres. The RTA has recently undertaken a study that surveyed the traffic generation rates of several retail centres in NSW. This study indicates that the average Thursday peak hour vehicle trip generation rate for a retail centre of between 60-80,000sqm would be 3.7 trips per 100sqm.

Based on a peak period trip generation rate of 3.7 trips per 100sqm the Commercial Core would generate 2,960 trips. By comparison, a smaller 50,000sqm retail centre would generate in the order of 1,850 trips and a 100,000sqm centre would develop in the order of 3,700 trips in the afternoon peak.

Given that the retail/commercial core will be sited within an established employment and residential area and the development will front onto a major arterial road, it has been assumed that there will be a high proportion of linked trips, these being trips of a combined purpose, such as a commute trip that also includes a stop at a retail centre to shop rather than an additional trip on the network solely taken for the purpose of shopping. In line with the discount to generation rates suggested in the RTA guide, it has been assumed that 15% of all trips will be linked and thereby discounted from the total trip generation volume for the Core.

The distribution of the retail trips in the evening peak has been assumed as 60% arrivals and 40% departures. The trip generation for the commercial core, as well as the hospital development, is shown in Table 11.

Table 11 PM peak Specialised Centre trip generation

Land Use	Distribution arriving	Distribution leaving	Volume arriving	Volume leaving	Number of additional trips during peak hour
Commercial Core	60%	40%	1,510	1,006	2,516
Hospital	20%	80%	64	255	319
Ancillary	10%	90%	174	1,566	1,740
Total			1,748	2,827	4,575

4.3 Traffic assignment

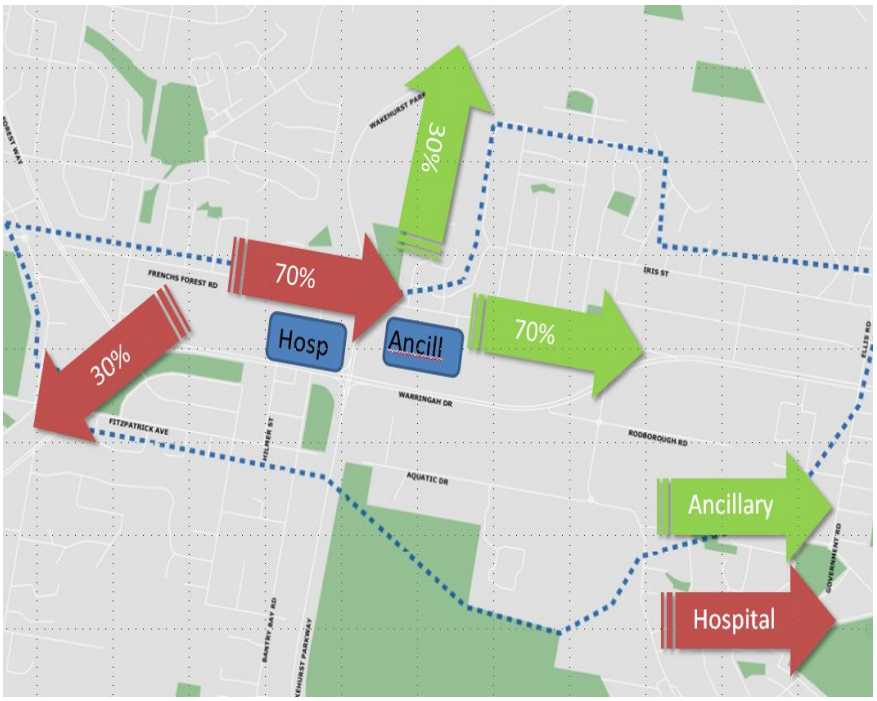
4.3.1 Hospital and ancillary services trip assignment

The hospital is expected to directly replace a proportion of beds and employment currently located at Mona Vale and Manly hospitals. Analysis of the number of jobs at those hospitals and the healthcare employment targets for the subregion identified that 1,000 of the hospital jobs would have to come from outside the North East subregion.

For the PM peak it has been assumed that 30% of the hospital trips would originate from the west of Frenchs Forest, with the other 70% coming from the east and North.

The ancillary services employment is assumed to be predominantly internal to the subregion, with 70% coming from within Warringah and the other 30% coming from Pittwater.

Figure 9 Hospital traffic assignment



4.3.2 Commercial Centre trip assignment

Assumptions regarding the trip assignment for the commercial centre were based on the locality of other retail facilities in the Northern Beaches.

Warringah Mall to the east is likely to cater for the vast majority of the population living in the eastern areas of Warringah LGA. It has been assumed that any through trips along Warringah Road that live closer to Warringah Mall would continue past Frenchs Forest.

Pittwater residents have less retail choice and as such are likely to use Frenchs Forest as an alternative to Warringah Mall or the smaller centre at Warriewood. It has been assumed that 30% of the retail trips would come from Pittwater.

The suburbs of Forestville, Belrose and Terry Hills are likely to benefit from a new retail centre at Frenchs Forest. Of the remaining 70% of retail trips, 70% would come from Forestville and beyond, with the other 30% coming from Belrose/Terry Hills.

Figure 10 Commercial core traffic assignment

5.0 Impact of the Specialised Centre

5.1 2016 with Northern Beaches Hospital scenario

5.1.1 Mid-block assessment

Mid-block analysis of the key roads in Frenchs Forest identifies where there is an increase in traffic on key links in the network.

The following tables show the peak mid-block traffic flows in 2016, with a comparison against the base model flows:

Table 12 2016 Hospital mid-block assessment

Road	Number of Lanes	2016				2016 Hospital			
		AM		PM		AM		PM	
		Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C
Warringah Road (Hilmer St)	3	3450	1.2	3810	1.3	3340	1.1	3810	1.3
Wakehurst Parkway (Frenchs Forest Road)	3	1680	0.6	1280	0.4	1600	0.5	1280	0.4
Forest Way (Naree Road)	3	2330	0.8	2060	0.7	2370	0.8	2140	0.7
Frenchs Forest Road (Parkview Hotel)	1	820	0.8	1080	1.1	1040	1.1	1900	1.9

The mid-block analysis identifies the lack of road capacity in Frenchs Forest. Both Warringah Road and Frenchs Forest Road are predicted to be operating with a V/C ratio well over 1. With the addition of the hospital related traffic Frenchs Forest Road is predicted to carry 90% more traffic than its existing capacity.

5.1.2 SIDRA assessment

The earlier chapters of this assessment identified 13 intersections across Frenchs Forest and described the SIDRA modelling results in 2011, 2016 and 2036.

The traffic assignment identified the following intersections were likely to be directly affected by the Northern Beaches Hospital:

- Frenchs Forest Road/Wakehurst Parkway
- Warringah Road/Frenchs Forest Road
- Warringah Road/Allambie Road
- Warringah Road/Forest Way
- Forest Way/ Naree Road
- Warringah Road/Ellis Road

The AM peak SIDRA models were based on turning count plots from the RTA Highway Assignment Model developed for the Strategic Transport Review (AECOM, 2011).

Additional traffic (detailed in Section 4) was added to the base PM peak SIDRA models for 2016 and 2036 to reflect a higher potential traffic generation from the retail and commercial developments during this period.

Table 13 2016 Hospital SIDRA results

Intersection	LoS		Deg of Satn (v/c)		Ave Delay (sec)	
	AM	PM	AM	PM	AM	PM
1. Warringah Rd/ Ellis Rd	E	F	1.0	1.1	70	153
3. Warringah Rd/ Allambie Rd	F	F	1.1	1.4	127	332
4. Warringah Rd/ Wakehurst Parkway	F	F	1.0	1.0	91	82
6. Warringah Rd/ Forest Way	F	F	1.0	1.3	71	224
8. Forest Way/ Naree Rd	E	F	1.7	3.4	51	4,000
10. Frenchs Forest Rd/ Wakehurst Parkway	F	F	1.0	1.6	88	550

As Table 13 demonstrates, the key intersections in Frenchs Forest are operating at LoS of F in both peaks with the development of the hospital.

5.2 2036 Full Development

5.2.1 Mid-block assessment

Mid-block analysis of the key roads in Frenchs Forest identifies where there is an increase in traffic on key links in the network.

The following tables show the mid-block traffic flows in 2036, with a comparison against the 2036 base model flows:

Table 14 2036 Full Development mid-block assessment

Road	Number of Lanes	2036				2036 Full Dev			
		AM		PM		AM		PM	
		Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C
Warringah Road (Hilmer St)	3	3,550	1.2	4,150	1.4	3,500	1.2	4,890	1.6
Wakehurst Parkway (Frenchs Forest Road)	3	1,650	0.6	1,390	0.5	1,660	0.6	2,130	0.7
Forest Way (Naree Road)	3	2,570	0.9	2,240	0.8	2,570	0.9	2,260	0.8
Frenchs Forest Road (Parkview Hotel)	1	1,100	1.1	1,170	1.2	1,320	1.3	3,480	3.5

The addition of the retail centre, as well as the hospital development to the 2036 traffic network results in a significant increase in the V/C ratio on Frenchs Forest Road, with the volume of eastbound peak direction traffic on Frenchs Forest Road increasing from 1,170 to 3,480 in the PM peak.

5.2.2 SIDRA assessment

The traffic generation for the full development was added to the key intersections with the 2036 forecast volumes. The addition of the retail centre traffic in the PM peak increases the burden on the key intersections, which were already operating at LoS F.

The traffic assignment identified the following intersections were likely to be directly affected by the specialised centre:

- Frenchs Forest Road/Wakehurst Parkway
- Warringah Road/Wakehurst Parkway
- Warringah Road/Frenchs Forest Road

- Warringah Road/Allambie Road
- Warringah Road/Forest Way
- Forest Way/ Naree Road
- Warringah Road/Ellis Road

Table 15 2036 full development SIDRA results

Intersection	LoS		Deg of Satn (v/c)		Ave Delay (sec)	
	AM	PM	AM	PM	AM	PM
1. Warringah Rd/ Ellis Rd	F	F	1.1	1.1	90	166
3. Warringah Rd/ Allambie Rd	F	F	1.2	1.5	120	440
4. Warringah Rd/ Wakehurst Parkway	F	F	1.2	1.3	160	330
6. Warringah Rd/ Forest Way	F	F	1.1	1.6	210	470
8. Forest Way/ Naree Rd	F	F	2	4.6	76	>2,000
10. Frenchs Forest Rd/ Wakehurst Parkway	F	F	1.5	2.5	320	1,500

6.0 Recommended measures

This analysis confirms a need for substantial investment in transport infrastructure in the Frenchs Forest area in order to accommodate background growth over the coming years. The mid-block analysis and intersection analysis demonstrates that by 2016, the road network will reach significant levels of congestion in the peak periods even without any development.

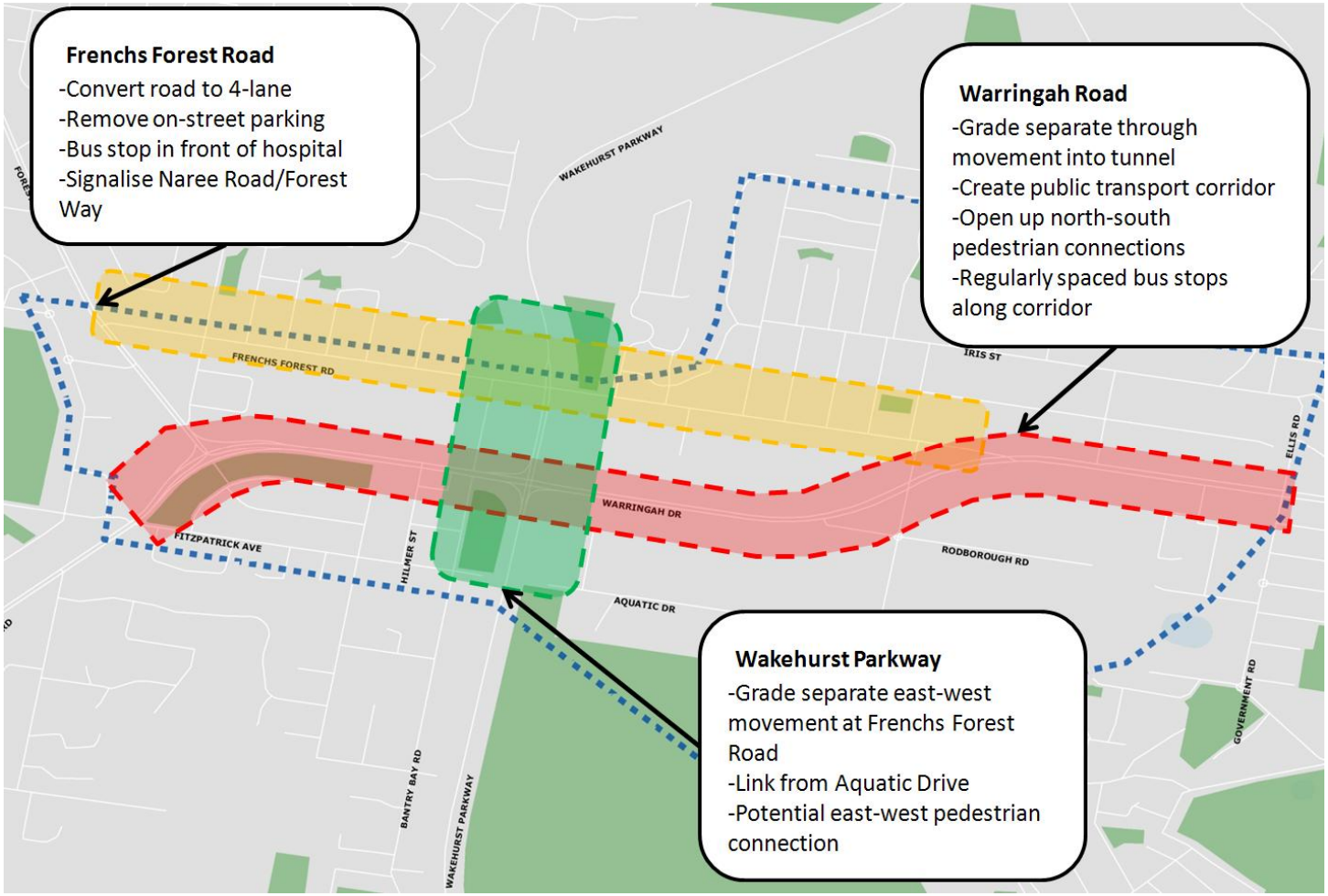
A multi-modal suite of measures is proposed to connect the Northern Beaches Hospital and Specialised Centre to the surrounding subregion. These measures can be grouped into three defined corridors: Frenchs Forest Road; Wakehurst Parkway; and Waringah Road.

The principles of the proposed transport improvements should be integrated into future planning for the proposed developments. The principles include:

- Increasing public transport supply and locating public transport stops to serve new developments.
- Creating streetscapes that encourage active modes (i.e. walking and cycling), through improved amenity, reduced severance, and connectivity (particularly across major roads).
- Improving the efficiency of intersection through grade-separation of some movements to reduce congestion, provide emergency vehicle access, and provide crossing opportunities.
- Working with owners and tenants in new developments to encourage less private car use.

Figure 11 shows these three corridors and the key measures proposed.

Figure 11 Frenchs Forest corridor strategies



6.1 Frenchs Forest Road (East and West) corridor

As a priority there is a need for modifications to the local transport network to accommodate short term growth and improve accessibility in the area. The hospital will need improved access from Frenchs Forest Road to allow turning movements into and out of the hospital entrance and allow space for bus stops.

6.1.1 Road network

Signalise Forest Way/Naree Road

Signalising this intersection would benefit traffic wishing to enter or exit Naree Road from Forest Way. This would also have the added benefit of providing the opportunity to install bus priority facilities. It also presents an opportunity to gate traffic that approaches Warringah Road, managing the volumes of traffic arriving at the Warringah Road intersection. The interaction of this intersection with Russell Avenue and the pedestrian crossing outside the Forest Way shopping centre needs further investigation.

Widen Frenchs Forest Road (East and West)

Frenchs Forest Road is currently only one lane in each direction, with kerbside parking and bus stops along its length. It currently has a kerb to kerb width of around 12m and could potentially be expanded to 14m in the long term to allow for two traffic lanes in each direction using verges in the road reserve. Widening at the western end towards Naree Road may require land acquisition. This widening could support the ring–road concept proposed in the SSS Study.

Modify operation of Allambie Road/Warringah Road and Frenchs Forest Road East

The two intersections of Warringah Road/Allambie Road, and Allambie Road/Frenchs Forest Road are in close proximity and could be re-engineered/optimised to improve circulation and potentially reduce delays at the intersection of Warringah Road/Allambie Road.

6.1.2 Public Transport

Extend services along Frenchs Forest Road

Frenchs Forest Road West is currently only served by bus route 136. There would be a need for more services to stop outside the hospital, as well as the commercial/retail development on Frenchs Forest Road East.

Review of bus stop locations and quality

As well as establishing where new or diverted routes could run there may be a benefit to be gained from investing in improved bus stop infrastructure and investigating the potential to relocate or add stops. This will be of particular importance when planning the access requirements for the hospital and how this will need to be accommodated in the local bus service and stopping patterns.

6.2 Warringah Road corridor

In the longer term, the exact form that the Frenchs Forest specialised centre may take is unclear. The following recommendations relate to infrastructure that would be needed with or without the development and should be used as a guide on the scale of upgrades, rather than specific schemes.

6.2.1 Road network

The intersection analysis described in this report clearly demonstrates the need for an increase in intersection capacity along the Warringah Road corridor. The following recommendations would improve the intersection operation by grade separating conflicting traffic movements. The interaction of the intersections together needs to be investigated further to determine what would be the best staging for improving network capacity.

Warringah Road/ Wakehurst Parkway grade separation

The need to grade separate this intersection has been documented in several studies and planning documents. The reality is that this would be a major scheme that would require complex planning and design to minimise disruption to traffic during construction.

A possible solution would be to tunnel a grade separated section east-west along Warringah Road that removes all through movements and creates an opportunity to reduce the scale of the intersection.

Forest Way and Warringah Road grade separation

As with the intersection of Wakehurst Parkway, the capacity of this intersection cannot be expanded any further with all movement at-grade. It is predicted that by 2016 this intersection will be operating at a LoS F.

This intersection would also benefit from removing the though movement by constructing a tunnelled underpass.

Wakehurst Parkway and Frenchs Forest Road grade separation

The intersection is predicted to carry a large proportion of development related traffic and as such is likely to need improved capacity. The grade separation of this intersection is proposed to improve the operation of the intersection, and in particular improve the public transport movements across Frenchs Forest Road by providing an elevated roadway that would bypass the intersection.

This could also be used as an emergency vehicle access route to the hospital, depending on emergency vehicle access routes.

Frenchs Forest Underpass

An underpass through the length of Warringah Road in Frenchs Forest would create an opportunity to re-connect the areas of development and the residential communities on each side of Warringah Road by reducing the scale of the corridor and reduce the traffic volumes, allowing for the introduction of more pedestrian links and the creation of streets and boulevards.

An underpass through Frenchs Forest is likely to remove around 50% of the traffic currently on Warringah Road and also reduce the scale of intersections needed at street level.

The individual grade separation of intersections along Warringah Road could be designed in such a way that a final scheme of a complete underpass could be finished in the longer term.

6.2.2 Public Transport

BRT service from Dee-Why/Mona Vale to Chatswood

The exact BRT product that could be delivered is as yet unknown and the subject of a separate study by TfNSW. However if it were a fully segregated system this would require the re-allocation of road space and may only work as a concept alongside the underpass scheme. The BRT would allow for a re-orientation of development addresses to front onto Warringah Road and would support the creation of improved pedestrian connectivity through the area.

The Northern Beaches BRT pre-feasibility study is due to report its preliminary findings by February 2012, at which time it will be possible to consider what impact the BRT proposal may have on traffic volumes in the Frenchs Forest area and whether or not the east-west BRT corridor is being considered for further analysis.

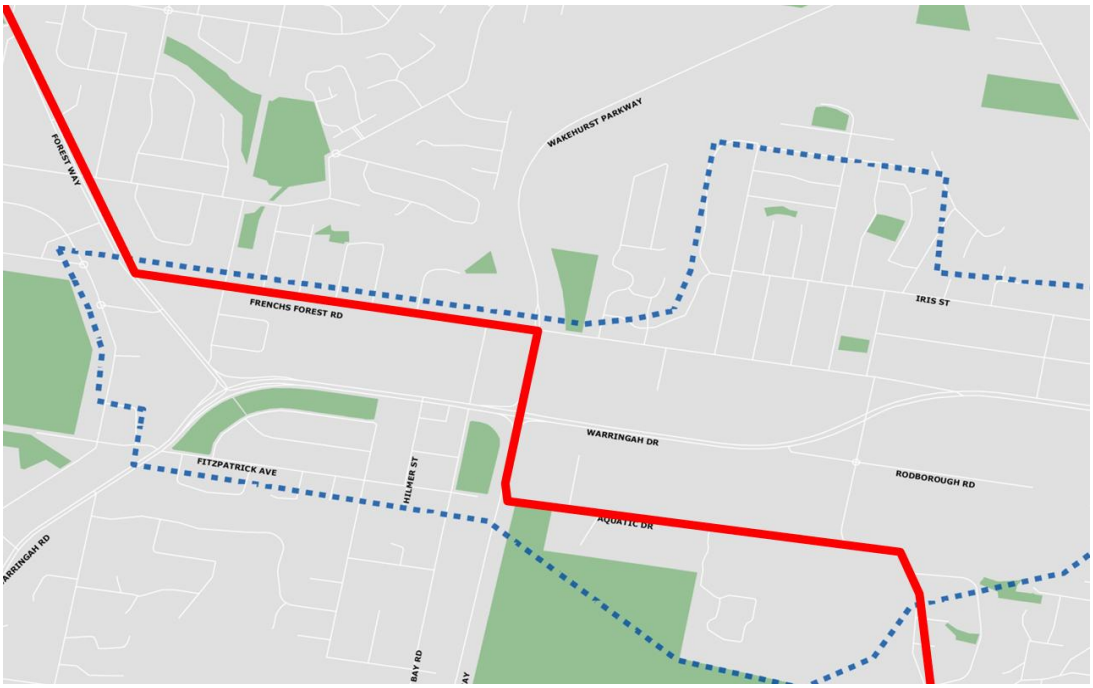
6.3 Wakehurst Parkway corridor

Wakehurst Parkway will serve as an important connection to the Specialised Centre from Pittwater and the Seaforth area and as such is predicted to carry a proportion of the traffic destined for the hospital, employment lands and the retail centre.

Its intersection with Warringah Road could be reduced in scale with the introduction of an underpass on Warringah Road. There may also be a need to introduce a grade separated movement at the intersection of Frenchs Forest Road. If the north-south movement were grade separated this would present the opportunity to reduce the scale of the intersection and also improve its operation.

It was also noted that there is potential to provide a new connection from Aquatic Drive to Wakehurst Parkway. While this wouldn't directly benefit the hospital or the main development area between Frenchs Forest Road and Warringah Road, it is possible that this link would remove some traffic from Warringah Road and also allows for a new bus routing that would route from Aquatic Drive to Frenchs Forest Road – linking the two areas as shown in Figure 12.

Figure 12 Potential bus route extension with Aquatic Drive



7.0 Conclusion and recommendations

7.1 Summary of findings

This assessment documents the condition of the local transport network in Frenchs Forest and assesses the operation of the network in 2016 and 2036, with and without the Specialised Centre.

The current level of congestion in the Frenchs Forest area in peak periods causes significant delays to travel along Warringah Road during both peak periods.

It is estimated that the forecast traffic volumes for 2016 will overload the traffic network in Frenchs Forest, resulting in the key intersections along Warringah Road and Wakehurst Parkway all operating at a Level of Service F in the peak periods.

By 2036 the situation is worsened, with levels of delay at intersections that would suggest complete gridlock across the Frenchs Forest network.

The traffic generated by the hospital and ancillary development adds approximately 2,100 trips onto the local network during the PM peak.

With the introduction of a nominal 80,000 sqm of commercial core/retail centre the level of traffic generated by the development increases to approximately 4,600 vehicle trips in the weekday PM peak period.

7.2 Recommendations

It is recommended that the signalisation of Naree Road and Forest Way would provide better access to Forest High School and Frenchs Forest Road in the short term.

The traffic network through Frenchs Forest is already operating beyond its capacity. As a priority, it is recommended that the planning for infrastructure upgrades along the Warringah Corridor is accelerated. The planning of upgrades to Warringah Road would benefit from a detailed corridor study that considers the land use and transport relationship along its length. This could be undertaken in a mesoscopic traffic simulation model of the corridor and the wider subregion.

The east-west public transport connections and the level of coverage across the area should be enhanced to address the lack of connectivity between Pittwater, Dee Why and Chatswood. The Northern Beaches BRT pre-feasibility study that has been commissioned by TfNSW, should provide some insight to the level of mode shift achievable on the Warringah Road corridor.

7.3 Conclusion

It is clear from this assessment that the transport network in Frenchs Forest is already carrying volumes of traffic greater than its capacity. The morning and afternoon peak periods see daily occurrences of traffic congestion through the area and travel speeds at only 20% of the posted limit on Warringah Road.

Improved public transport services could achieve some mode shift, but the balance between network capacity and existing traffic volumes is so delicate that any move that may reduce traffic capacity must be guaranteed to also achieve substantial mode shift to reduce the private car travel demand.

Given the existing levels of congestion that limit access to the development site, it does not appear possible that the hospital or the Specialised Centre could be developed without first securing significant funding for the necessary infrastructure upgrades. The local infrastructure upgrades should be considered in their context with the subregion and what impact any improvement to traffic flow in Frenchs Forest may have elsewhere in the network.

Appendix A

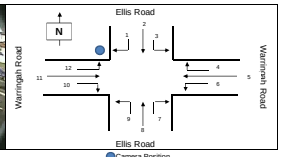
Survey Results

Intersection of Warringah Road and Ellis Road

Thursday, 12 May 2011

Austraffic

Survey Start	7:00 AM 16:00 PM
Intersection Type	Cross Junction
Intersection No.	1
North Approach	Ellis Road
East Approach	Warringah Road
South Approach	Ellis Road
West Approach	Warringah Road
Date	12/05/11
Classification	Light Heavy Bus Cyclist



Camera Position

TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	5	1	0	0	6	6	0	0	0	6	7	0	1	0	8	98	1	0	0	99	432	17	6	0	455	3	0	0	0	3
7:15 - 7:30	1	0	0	0	1	4	0	0	0	4	13	1	0	0	14	94	0	0	0	94	424	10	6	0	440	8	0	0	0	8
7:30 - 7:45	4	0	0	0	4	4	1	0	0	5	17	2	0	0	19	89	1	0	0	90	395	15	5	0	415	8	0	0	0	8
7:45 - 8:00	3	0	0	0	3	13	0	0	0	13	30	0	0	0	30	107	4	0	0	111	462	12	6	0	480	21	0	0	0	21
8:00 - 8:15	1	0	0	0	1	11	0	0	0	11	16	1	0	0	17	121	4	0	0	125	394	24	2	0	420	13	0	1	0	14
8:15 - 8:30	2	0	0	0	2	12	0	0	0	12	29	1	0	0	30	99	0	0	0	99	451	21	1	0	473	14	0	0	0	14
8:30 - 8:45	7	0	0	0	7	8	0	0	0	8	42	1	0	0	43	102	1	1	0	104	428	13	2	0	443	15	0	0	0	15
8:45 - 9:00	6	0	0	0	6	6	0	0	0	6	37	1	1	0	39	75	0	1	0	76	496	21	3	0	520	18	0	0	0	18
Σ	29	1	0	0	30	64	1	0	0	65	191	7	2	0	200	785	11	2	0	798	3482	133	33	0	3648	100	0	1	0	101

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	19	0	0	0	19	18	0	0	0	18	4	0	0	0	4	3	0	0	0	3	241	21	1	0	263	3	1	0	0	4	839	41	8	0	888
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7:45 - 8:00	35	1	0	0	36	30	0	0	0	30	4	0	0	0	4	1	0	0	0	1	416	22	5	0	443	4	0	0	0	4	1126	39	11	0	1176
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8:45 - 9:00	55	0	0	0	55	22	0	0	0	22	4	0	0	0	4	1	0	0	0	1	353	22	2	0	377	2	1	0	0	3	1075	45	7	0	1127
Σ	275	3	0	0	278	197	0	0	0	197	51	1	0	0	52	28	1	0	0	29	2939	159	18	0	3116	21	5	0	0	26	8162	322	54	0	8538

TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
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16:15 - 16:30	5	0	0	0	5	6	1	0	0	7	13	2	0	0	15	77	0	0	0	77	409	17	4	1	431	11	0	0	0	11
16:30 - 16:45	2	0	0	0	2	14	0	0	0	14	18	0	0	0	18	92	2	0	0	94	397	17	4	0	418	20	1	0	0	21
16:45 - 17:00	2	0	0	0	2	2	0	0	0	2	17	0	0	0	17	94	1	0	0	95	356	13	3	0	372	13	0	0	0	13
17:00 - 17:15	4	0	0	0	4	11	0	0	0	11	23	0	0	0	23	98	0	1	0	99	424	12	3	0	439	20	0	0	0	20
17:15 - 17:30	3	0	0	0	3	3	0	0	0	3	20	0	0	0	20	128	0	0	0	128	453	8	1	0	462	12	0	0	0	12
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Σ	23	0	0	0	23	59	2	0	0	61	144	2	0	0	146	733	6	3	0	742	3232	98	24	1	3355	106	1	0	0	107

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
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17:15 - 17:30	41	0	0	0	41	18	0	0	0	18	10	1	0	0	11	13	0	0	0	13	557	5	4	0	566	3	0	0	0	3	1261	14	5	0	1280
17:30 - 17:45	45	0	0	0	45	15	0	0	0	15	3	0	0	0	3	10	0	0	0	10	621	3	2	1	627	4	0	0	0	4	1257	14	5	1	1277
17:45 - 18:00	41	0	0	0	41	16	0	0	0	16	3	0	0	0	3	20	0	0	0	20	573	6	2	1	582	2	0	0	0	2	1135	13	3	1	1152
Σ	325	2	0	0	327	103	3	0	0	106	50	1	0	0	51	132	1	0	0	133	4461	79	23	8	4571	30	1	0	0	31	9398	196	50	9	9653

HOURLY FLOW

TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
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7:15 - 8:15	9	0	0	0	9	32	1	0	0	33	76	4	0	0	80	411	9	0	0	420	1675	61	19	0	1755	50	0	1	0	51
7:30 - 8:30	10	0	0	0	10	40	1	0	0	41	92	4	0	0	96	416	9	0	0	425	1702	72	14	0	1788	56	0	1	0	57
7:45 - 8:45	**13**	**0**	**0**	**0**	**13**	**44**	**0**	**0**	**0**	**44**	**117**	**3**	**0**	**0**	**120**	**429**	**9**	**1**	**0**	**439**	**1735**	**70**	**11**	**0**	**1816**	**63**	**0**	**1**	**0**	**64**
8:00 - 9:00	16	0	0	0	16	37	0	0	0	37	124	4	1	0	129	397	5	2	0	404	1769	79	8	0	1856	60	0	1	0	61

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
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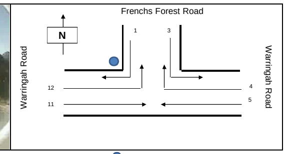
7:15 - 8:15	102	0	0	0	102	29	0	0	0	29	15	1	0	0	16	1446	78	11	0	1535	11	3	0	0	14	3970	160	31	0	4161						
7:30 - 8:30	106	0	0	0	106	27	1	0	0	28	16	1	0	0	17	1573	77	14	0	1664	12	2	0	0	14	4178	170	29	0	4377						
7:45 - 8:45	**117**	**0**	**0**	**0**	**117**	**30**	**1**	**0**	**0**	**31**	**14**	**0**	**0**	**0**	**14**	**1665**	**73**	**13**	**0**	**1751**	**11**	**1**	**0**	**0**	**12**	**4393**	**159**	**26**	**0**	**4578**	**Peak**					
8:00 - 9:00	109	0	0	0	109	30	1	0	0	31	14	0	0	0	14	1602	73	10	0	1685	9	2	0	0	11	4342	165	22	0	4529						

TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	12	0	0	0	12	31	2	0	0	33	67	2	0	0	69	325	4	2	0	331	1569	62	16	1	1648	55	1	0	0	56
16:15 - 17:15	13	0	0	0	13	33	1	0	0	34	71	2	0	0	73	361	3	1	0	365	1586	59	14	1	1660	64	1	0	0	65
16:30 - 17:30	11	0	0	0	11	30	0	0	0	30	78	0	0	0	78	412	3	1	0	416	1630	50	11	0	1691	65	1	0	0	66
16:45 - 17:45	11	0	0	0	11	24	0	0	0	24	73	0	0	0	73	418	3	1	0	422	1659	42	10	0	1711	57	0	0	0	57
17:00 - 18:00	**11**	**0**	**0**	**0**	**11**	**28**	**0**	**0**	**0**	**28**	**77**	**0**	**0**	**0**	**77**	**408**	**2**	**1**	**0**	**411**	**1663**	**36**	**8**	**0**	**1707**	**51**	**0**	**0**	**0**	**51**

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	155	2	0	0	157	38	3	0	0	38	25	0	0	0	25	65	1	0	0	66	2113	56	15	6	2190	18	1	0	0	19	4470	134	33	7	4644	
16:15 - 17:15	157	2	0	0	159	49	2	0	0	51	27	0	0	0	27	70	1	0	0	71	2211	49	12	4	2276	17	0	0	0	17	4659	120	27	5	4811	
16:30 - 17:30	173	2	0	0	175	59	1	0	0	60	30	1	0	0	31	69	1	0	0	70	2192	48	9	2	2251	14	0	0	0	14	4763	107	21	2	4893	
16:45 - 17:45	174	1	0	0	175	62	0	0	0	62	28	1	0	0	29	65	1	0	0	66	2264	32	8	1	2325	12	0	0	0	12	4867	80	19	1	4967	
17:00 - 18:00	**170**	**0**	**0**	**0**	**170**	**68**	**0**	**0**	**0**	**68**	**25**	**1**	**0**	**0**	**26**	**67**	**0**	**0**	**0**	**67**	**2348**	**23**	**8**	**2**	**2381**	**12**	**0**	**0**	**0**	**12**	**4928**	**62**	**17**	**2**	**5009**	**Peak**

Intersection of	Warringah Road and Frenchs Forest Road	Thursday, 12 May 2011
		Austraffic

Survey Start	7:00 AM 16:00 PM
Intersection Type	T Junction
Intersection No.	2
North Approach	Frenchs Forest Road
East Approach	Warringah Road
South Approach	
West Approach	Warringah Road
Date	12/05/11
Classification	Light Heavy Bus Cyclist



Camera Position

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	0	0	0	0	0						52	4	1	0	57	1	0	10	0	11	440	20	0	1	461																										228	15	0	0	243	0	0	0	0	0	721	39	11	1	772
7:15 - 7:30	0	0	0	0	0						79	1	1	0	81	1	0	5	0	6	451	10	0	1	462																										239	21	0	0	260	0	0	0	0	0	770	32	6	1	809
7:30 - 7:45	0	0	0	0	0						81	2	1	0	84	0	0	5	0	5	406	14	1	1	422																										313	24	1	0	338	0	0	0	0	0	800	40	8	1	849
7:45 - 8:00	0	0	0	0	0						85	1	2	0	88	1	1	9	0	11	459	11	1	0	471																										332	20	2	0	354	0	0	0	0	0	877	33	14	0	924
8:00 - 8:15	0	0	0	0	0						79	2	3	0	84	2	0	5	0	7	397	24	0	1	422																										291	15	0	0	306	0	0	0	0	0	769	41	8	1	819
8:15 - 8:30	0	0	0	0	0						91	2	3	0	96	2	0	4	0	6	442	21	0	0	463																										371	14	1	0	386	1	0	0	0	1	907	37	8	0	952
8:30 - 8:45	0	0	0	0	0						101	3	0	0	104	0	0	2	0	2	473	15	0	0	488																										325	17	0	0	342	0	0	0	0	0	899	35	2	0	936
8:45 - 9:00	0	0	0	0	0						77	3	0	0	80	0	0	1	0	1	507	15	2	0	524																										278	21	2	0	301	0	0	0	0	0	862	39	5	0	906
Σ	0	0	0	0	0						645	18	11	0	674	7	1	41	0	49	3575	130	4	4	3713																										2377	147	6	0	2530	1	0	0	0	1	6605	296	62	4	6967

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	0	0	0	0	0						107	1	5	0	113	0	0	15	0	15	399	15	1	0	415																										453	15	3	1	472	0	0	0	0	0	959	31	24	1	1015
16:15 - 16:30	0	0	0	0	0						106	1	4	0	111	1	0	2	0	3	449	17	3	0	469																										487	7	0	1	495	0	0	0	0	0	1043	25	9	1	1078
16:30 - 16:45	0	0	0	0	0						122	1	1	0	124	0	0	3	0	3	408	18	1	0	427																										453	17	1	0	471	0	0	0	0	0	983	36	6	0	1025
16:45 - 17:00	0	0	0	0	0						109	1	2	0	112	1	0	2	0	3	380	13	1	0	394																										447	12	0	0	459	0	0	0	0	0	937	26	5	0	968
17:00 - 17:15	0	0	0	0	0						165	0	0	0	165	2	0	6	0	8	413	13	2	0	428																										473	7	1	0	481	0	0	0	0	0	1053	20	9	0	1082
17:15 - 17:30	0	0	0	0	0						146	0	6	0	152	0	0	2	0	2	487	9	1	1	498																										416	5	1	0	422	0	0	0	0	0	1049	14	10	1	1074
17:30 - 17:45	0	0	0	0	0						152	0	2	0	154	0	0	3	0	3	438	9	0	1	448																										480	3	0	0	483	0	0	0	0	0	1070	12	5	1	1088
17:45 - 18:00	0	0	0	0	0						103	0	4	0	107	0	0	3	0	3	370	7	0	0	377																										533	5	0	0	538	0	0	0	0	0	1006	12	7	0	1025
Σ	0	0	0	0	0						1010	4	24	0	1038	4	0	36	0	40	3344	101	9	2	3456																										3742	71	6	2	3821	0	0	0	0	0	8100	176	75	4	8355

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00	0	0	0	0	0						297	8	5	0	310	3	1	29	0	33	1756	55	2	3	1816																										1112	80	3	0	1195	0	0	0	0	0	3168	144	39	3	3354	
7:15 - 8:15	0	0	0	0	0						324	6	7	0	337	4	1	24	0	29	1713	59	2	3	1777																										1175	80	3	0	1258	0	0	0	0	0	3216	146	36	3	3401	
7:30 - 8:30	0	0	0	0	0						336	7	9	0	352	5	1	23	0	29	1704	70	2	2	1778																										1307	73	4	0	1384	1	0	0	0	1	3353	151	38	2	3544	
7:45 - 8:45	**0**	**0**	**0**	**0**	**0**						**356**	**8**	**8**	**0**	**372**	**5**	**1**	**20**	**0**	**26**	**1771**	**71**	**1**	**1**	**1844**																										**1319**	**66**	**3**	**0**	**1388**	**1**	**0**	**0**	**0**	**1**	**3452**	**146**	**32**	**1**	**3631**	**Peak**
8:00 - 9:00	0	0	0	0	0						348	10	6	0	364	4	0	12	0	16	1819	75	2	1	1897																										1265	67	3	0	1335	1	0	0	0	1	3437	152	23	1	3613	

VEHICLE MOVEMENT

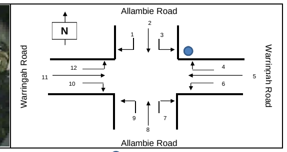
TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	0	0	0	0	0						444	4	12	0	460	2	0	22	0	24	1636	63	6	0	1705																										1840	51	4	2	1897	0	0	0	0	0	3922	118	44	2	4086	
16:15 - 17:15	0	0	0	0	0						502	3	7	0	512	4	0	13	0	17	1650	61	7	0	1718																										1860	43	2	1	1906	0	0	0	0	0	4016	107	29	1	4153	
16:30 - 17:30	0	0	0	0	0						542	2	9	0	553	3	0	13	0	16	1688	53	5	1	1747																										1789	41	3	0	1833	0	0	0	0	0	4022	96	30	1	4149	
16:45 - 17:45	0	0	0	0	0						572	1	10	0	583	3	0	13	0	16	1718	44	4	2	1768																										1816	27	2	0	1845	0	0	0	0	0	4109	72	29	2	4212	
17:00 - 18:00	**0**	**0**	**0**	**0**	**0**						**566**	**0**	**12**	**0**	**578**	**2**	**0**	**14**	**0**	**16**	**1708**	**38**	**3**	**2**	**1751**																										**1902**	**20**	**2**	**0**	**1924**	**0**	**0**	**0**	**0**	**0**	**4178**	**58**	**31**	**2**	**4269**	**Peak**

Intersection of Warringah Road and Allambie Road

Thursday, 12 May 2011

Austraffic

Survey Start	7:00 AM	16:00 PM
Intersection Type	Cross Junction	
Intersection No.	3	
North Approach	Allambie Road	
East Approach	Warringah Road	
South Approach	Allambie Road	
West Approach	Warringah Road	
Date	12/05/11	
Classification	Light Heavy Bus Cyclist	



Camera Position

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	0	0	0	0	0	26	1	1	0	28	0	0	0	0	0	101	2	0	0	103
7:15 - 7:30	0	0	0	0	0	40	1	2	0	43	0	0	0	0	0	83	1	0	0	84
7:30 - 7:45	0	0	0	0	0	44	1	1	0	46	3	0	0	0	3	75	0	0	0	75
7:45 - 8:00	0	0	0	0	0	55	2	2	0	59	0	0	0	0	0	78	1	1	0	80
8:00 - 8:15	0	0	0	0	0	63	0	4	0	67	0	0	0	0	0	98	0	0	0	98
8:15 - 8:30	0	0	0	0	0	60	0	0	0	60	0	0	0	0	0	81	3	0	0	84
8:30 - 8:45	0	0	0	0	0	60	0	2	0	62	0	0	0	0	0	106	1	0	0	107
8:45 - 9:00	0	0	0	0	0	53	1	0	0	54	0	0	0	0	0	69	1	0	0	70
Σ	0	0	0	0	0	401	6	12	0	419	3	0	0	0	3	691	9	1	0	701

TIME PERIOD	5					6					7					8				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	320	16	0	0	336	23	2	0	0	25	26	2	0	0	28	73	1	1	1	76
7:15 - 7:30	340	12	1	0	353	32	2	0	0	34	19	1	0	0	20	64	2	1	0	67
7:30 - 7:45	296	12	1	0	309	42	2	0	0	44	15	1	0	0	16	49	0	0	1	50
7:45 - 8:00	334	13	0	0	347	52	0	0	0	52	23	1	0	0	24	71	1	3	0	75
8:00 - 8:15	284	19	0	0	303	32	2	0	0	34	20	1	0	0	21	73	2	1	1	77
8:15 - 8:30	331	13	0	0	344	43	2	0	0	45	30	2	0	0	32	77	2	2	0	81
8:30 - 8:45	324	16	0	0	340	56	1	0	0	57	22	2	0	0	24	63	1	0	0	64
8:45 - 9:00	364	13	2	1	380	62	2	0	0	64	25	2	0	0	27	71	1	0	0	72
Σ	2593	114	4	1	2712	342	13	0	0	355	180	12	0	0	192	541	10	8	3	562

TIME PERIOD	9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	0	0	0	0	0	111	6	0	0	117	205	16	0	0	221	6	1	0	0	7	891	47	2	1	941
7:15 - 7:30	0	0	0	0	0	103	2	1	0	106	237	18	0	0	255	6	2	0	1	9	924	41	5	1	971
7:30 - 7:45	0	0	0	0	0	149	8	1	0	158	290	22	0	0	312	20	0	0	0	20	983	46	3	1	1033
7:45 - 8:00	0	0	0	0	0	160	5	0	0	165	329	19	3	0	351	14	0	0	0	14	1116	42	9	0	1167
8:00 - 8:15	0	0	0	0	0	195	7	0	0	202	278	14	0	0	292	19	1	0	0	20	1062	46	5	1	1114
8:15 - 8:30	1	0	0	0	1	239	5	2	0	246	313	12	2	0	327	14	0	0	0	14	1189	39	6	0	1234
8:30 - 8:45	3	0	0	0	3	209	4	1	0	214	314	15	0	0	329	17	1	0	0	18	1174	41	3	0	1218
8:45 - 9:00	0	0	0	0	0	175	7	4	0	186	250	19	2	0	271	14	1	0	0	15	1083	47	8	1	1139
Σ	4	0	0	0	4	1341	44	9	0	1394	2216	135	7	0	2358	110	6	0	1	117	8422	349	41	5	8817

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	0	0	0	0	0	42	0	0	0	42	0	0	0	0	0	60	1	0	0	61
16:15 - 16:30	0	0	0	0	0	46	0	0	0	46	0	0	0	0	0	59	0	0	0	59
16:30 - 16:45	0	0	0	0	0	63	5	1	0	69	0	0	0	0	0	77	1	0	0	78
16:45 - 17:00	0	0	0	0	0	45	0	0	0	45	2	0	0	0	2	51	1	0	0	52
17:00 - 17:15	0	0	0	0	0	65	0	0	0	65	2	0	0	0	2	66	0	1	0	67
17:15 - 17:30	0	0	0	0	0	61	0	0	0	61	4	0	0	0	4	74	0	0	0	74
17:30 - 17:45	0	0	0	0	0	53	1	1	0	55	2	0	0	0	2	74	0	0	0	74
17:45 - 18:00	0	0	0	0	0	49	0	0	0	49	1	0	0	0	1	50	0	0	0	50
Σ	0	0	0	0	0	424	6	2	0	432	11	0	0	0	11	511	3	1	0	515

TIME PERIOD	5					6					7					8				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	316	13	1	0	330	31	1	1	0	33	67	1	0	0	68	86	2	1	0	89
16:15 - 16:30	358	12	3	0	373	32	3	0	0	35	42	0	0	0	42	95	0	0	0	95
16:30 - 16:45	323	17	1	1	342	17	0	0	0	17	57	2	1	0	60	106	0	0	0	106
16:45 - 17:00	311	10	1	0	322	36	1	0	0	37	49	1	0	0	50	120	0	0	0	120
17:00 - 17:15	323	12	1	0	336	32	0	0	0	32	78	0	0	0	78	118	0	1	0	119
17:15 - 17:30	376	7	1	1	385	38	0	0	0	38	57	1	0	0	58	103	0	2	0	105
17:30 - 17:45	344	7	0	0	351	31	0	0	0	31	71	0	0	0	71	115	0	0	0	115
17:45 - 18:00	323	7	0	0	330	16	0	0	0	16	70	0	0	0	70	95	0	0	0	95
Σ	2674	85	8	2	2769	233	5	1	0	239	491	5	1	0	497	838	2	4	0	844

TIME PERIOD	9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	1	0	0	0	1	110	2	0	0	112	367	15	3	0	385	14	1	0	0	15	1094	36	6	0	1136
16:15 - 16:30	0	0	0	0	0	154	3	1	0	158	444	6	0	0	450	15	0	0	0	15	1245	24	4	0	1273
16:30 - 16:45	1	1	0	0	2	121	2	0	0	123	377	16	0	0	393	4	1	0	0	5	1146	45	3	1	1195
16:45 - 17:00	1	0	0	0	1	153	2	1	0	156	389	12	0	0	401	16	0	0	0	16	1173	27	2	0	1202
17:00 - 17:15	2	0	0	0	2	117	2	1	0	120	392	7	1	0	400	12	0	0	0	12	1207	21	5	0	1233
17:15 - 17:30	0	0	0	0	0	146	1	0	0	147	381	4	1	0	386	6	0	0	0	6	1246	13	4	1	1264
17:30 - 17:45	4	0	0	0	4	144	2	1	0	147	403	3	0	1	407	6	0	0	0	6	1247	13	2	1	1263
17:45 - 18:00	0	0	0	0	0	107	1	0	0	108	432	5	0	0	437	9	0	0	0	9	1152	13	0	0	1165
Σ	9	1	0	0	10	1052	15	4	0	1071	3185	68	5	1	3259	82	2	0	0	84	9510	192	26	3	9731

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	0	0	0	0	0	165	5	6	0	176	3	0	0	0	3	337	4	1	0	342
7:15 - 8:15	0	0	0	0	0	202	4	9	0	215	3	0	0	0	3	334	2	1	0	337
7:30 - 8:30	0	0	0	0	0	222	3	7	0	232	3	0	0	0	3	332	4	1	0	337
7:45 - 8:45	**0**	**0**	**0**	**0**	**0**	**238**	**2**	**8**	**0**	**248**	**0**	**0**	**0**	**0**	**0**	**363**	**5**	**1**	**0**	**369**
8:00 - 9:00	0	0	0	0	0	236	1	6	0	243	0	0	0	0	0	354	5	0	0	359

TIME PERIOD	5					6					7					8				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	1290	53	2	0	1345	149	6	0	0	155	83	5	0	0	88	257	4	5	2	268
7:15 - 8:15	1254	56	2	0	1312	158	6	0	0	164	77	4	0	0	81	257	5	5	2	269
7:30 - 8:30	1245	57	1	0	1303	169	6	0	0	175	88	5	0	0	93	270	5	6	2	283
7:45 - 8:45	**1273**	**61**	**0**	**0**	**1334**	**183**	**5**	**0**	**0**	**188**	**95**	**6**	**0**	**0**	**101**	**284**	**6**	**6**	**1**	**297**
8:00 - 9:00	1303	61	2	1	1367	193	7	0	0	200	97	7	0	0	104	284	6	3	1	294

TIME PERIOD	9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00	0	0	0	0	0	523	21	2	0	546	1061	75	3	0	1139	46	3	0	1	50	3914	176	19	3	4112	
7:15 - 8:15	0	0	0	0	0	607	22	2	0	631	1134	73	3	0	1210	59	3	0	1	63	4085	175	22	3	4285	
7:30 - 8:30	1	0	0	0	1	743	25	3	0	771	1210	67	5	0	1282	67	1	0	0	68	4350	173	23	2	4548	
7:45 - 8:45	**4**	**0**	**0**	**0**	**4**	**803**	**21**	**3**	**0**	**827**	**1234**	**60**	**5**	**0**	**1299**	**64**	**2**	**0**	**0**	**66**	**4541**	**168**	**23**	**1**	**4733**	**Peak**
8:00 - 9:00	4	0	0	0	4	818	23	7	0	848	1155	60	4	0	1219	64	3	0	0	67	4508	173	22	2	4705	

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	0	0	0	0	0	196	5	1	0	202	2	0	0	0	2	247	3	0	0	250
16:15 - 17:15	0	0	0	0	0	219	5	1	0	225	4	0	0	0	4	253	2	1	0	256
16:30 - 17:30	0	0	0	0	0	234	5	1	0	240	8	0	0	0	8	268	2	1	0	271
16:45 - 17:45	**0**	**0**	**0**	**0**	**0**	**224**	**1**	**1**	**0**	**226**	**10**	**0**	**0**	**0**	**10**	**265**	**1**	**1**	**0**	**267**
17:00 - 18:00	0	0	0	0	0	228	1	1	0	230	9	0	0	0	9	264	0	1	0	265

TIME PERIOD	5					6					7					8				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	1308	52	6	1	1367	116	5	1	0	122	215	4	1	0	220	407	2	1	0	410
16:15 - 17:15	1315	51	6	1	1373	117	4	0	0	121	226	3	1	0	230	439	0	1	0	440
16:30 - 17:30	1333	46	4	2	1385	123	1	0	0	124	241	4	1	0	246	447	0	3	0	450
16:45 - 17:45	**1354**	**36**	**3**	**1**	**1394**	**137**	**1**	**0**	**0**	**138**	**255**	**2**	**0**	**0**	**257**	**456**	**0**	**3**	**0**	**459**
17:00 - 18:00	1366	33	2	1	1402	117	0	0	0	117	276	1	0	0	277	431	0	3	0	434

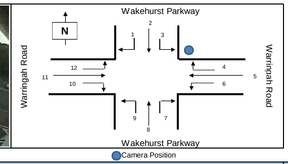
TIME PERIOD	9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	3	1	0	0	4	538	9	2	0	549	1577	49	3	0	1629	49	2	0	0	51	4658	132	15	1	4806	
16:15 - 17:15	4	1	0	0	5	545	9	3	0	557	1602	41	1	0	1644	47	1	0	0	48	4771	117	14	1	4903	
16:30 - 17:30	4	1	0	0	5	537	7	2	0	546	1539	39	2	0	1580	38	1	0	0	39	4772	106	14	2	4894	
16:45 - 17:45	**7**	**0**	**0**	**0**	**7**	**560**	**7**	**3**	**0**	**570**	**1565**	**26**	**2**	**1**	**1594**	**40**	**0**	**0**	**0**	**40**	**4873**	**74**	**13**	**2**	**4962**	**Peak**
17:00 - 18:00	6	0	0	0	6	514	6	2	0	522	1608	19	2	1	1630	33	0	0	0	33	4852	60	11	2	4925	

Intersection of Warringah Road and Wakehurst Parkway

Thursday, 12 May 2011

Austraffic

Survey Start	7:00 AM	16:00 PM
Intersection Type	Cross Junction	
Intersection No.	4	
North Approach	Wakehurst Parkway	
East Approach	Warringah Road	
South Approach	Wakehurst Parkway	
West Approach	Warringah Road	
Date	12/05/11	
Classification	Light Heavy Bus Cyclist	



TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	255	6	2	0	263	31	2	3	5	41	3	0	0	0	3	0	0	0	0	0	392	12	1	1	406	5	0	0	0	5
7:15 - 7:30	258	4	0	1	263	39	1	4	1	45	2	1	0	0	3	0	0	0	0	0	382	16	1	0	399	5	2	0	0	7
7:30 - 7:45	306	7	2	0	315	45	1	5	2	53	0	0	0	0	0	0	0	0	0	0	307	7	0	0	314	2	1	0	0	3
7:45 - 8:00	279	6	2	0	287	27	0	2	0	29	3	0	0	0	3	0	0	0	0	0	274	17	1	0	292	4	1	0	0	5
8:00 - 8:15	297	6	2	0	305	42	2	3	1	48	4	1	0	0	5	0	0	0	0	0	314	16	1	0	331	6	0	0	0	6
8:15 - 8:30	241	7	1	1	250	46	0	1	0	47	4	1	0	0	5	0	0	0	0	0	295	15	2	0	312	7	0	0	0	7
8:30 - 8:45	217	5	0	0	222	39	0	1	0	40	3	0	0	0	3	0	0	0	0	0	364	17	0	0	381	16	0	0	0	16
8:45 - 9:00	201	2	2	0	205	75	0	1	0	76	9	0	0	0	9	0	0	0	0	0	380	17	3	0	400	18	0	0	0	18
Σ	2054	43	11	2	2110	344	6	20	9	379	28	3	0	0	31	0	0	0	0	0	2708	117	9	1	2835	63	4	0	0	67

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	16	0	0	0	16	32	1	0	0	33	140	5	0	0	145	66	8	1	0	75	319	24	0	0	343	63	5	1	0	69	1322	63	8	6	1399
7:15 - 7:30	11	0	0	0	11	41	1	0	0	42	146	6	0	1	153	54	4	0	0	58	341	24	1	0	366	75	3	2	0	80	1354	62	8	3	1427
7:30 - 7:45	14	0	0	0	14	30	0	1	1	32	166	5	0	0	171	98	8	0	0	106	443	29	1	0	473	86	5	0	1	92	1497	63	9	4	1573
7:45 - 8:00	16	3	0	0	19	35	4	1	0	40	172	7	1	0	180	69	5	0	0	74	511	27	2	0	540	98	9	2	0	109	1488	79	11	0	1578
8:00 - 8:15	8	1	0	0	9	33	0	2	0	35	124	6	0	1	131	69	9	0	0	78	469	16	2	1	488	140	3	3	0	146	1506	60	13	3	1582
8:15 - 8:30	16	1	0	0	17	42	1	0	0	43	160	8	0	0	168	117	5	0	0	122	521	15	2	0	538	136	6	0	0	142	1585	59	6	1	1651
8:30 - 8:45	9	1	0	0	10	45	1	1	1	48	165	6	0	0	171	98	8	2	0	108	544	20	1	1	566	113	5	1	0	119	1613	63	6	2	1684
8:45 - 9:00	27	0	0	0	27	54	1	0	1	56	127	5	0	0	132	83	11	0	1	95	409	28	5	1	443	103	4	3	0	110	1486	68	14	3	1571
Σ	117	6	0	0	123	312	9	5	3	329	1200	48	1	2	1251	654	58	3	1	716	3557	183	14	3	3757	814	40	12	1	867	11851	517	75	22	12465

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	172	4	14	0	190	49	2	3	0	54	3	0	1	0	4	0	0	0	0	0	323	17	1	0	341	14	0	0	0	14
16:15 - 16:30	144	0	5	0	149	52	1	0	0	53	7	0	0	0	7	0	0	0	0	0	371	14	3	1	389	13	0	0	0	13
16:30 - 16:45	134	6	13	0	153	51	2	1	0	54	3	0	0	0	3	0	0	0	0	0	355	21	4	0	380	12	1	0	0	13
16:45 - 17:00	121	2	7	0	130	53	0	0	0	53	1	0	0	0	1	0	0	0	0	0	375	18	1	0	394	15	0	0	0	15
17:00 - 17:15	148	2	3	0	153	52	0	0	0	52	5	0	0	0	5	0	0	0	0	0	332	15	1	0	348	30	0	0	0	30
17:15 - 17:30	157	2	7	0	166	67	0	2	0	69	6	0	0	0	6	0	0	0	0	0	405	12	2	0	419	22	0	0	0	22
17:30 - 17:45	201	2	4	0	207	56	1	0	0	57	6	0	0	0	6	0	0	0	0	0	382	12	1	1	396	20	0	0	0	20
17:45 - 18:00	180	0	2	0	182	57	0	1	0	58	2	0	0	0	2	0	0	0	0	0	365	6	1	1	373	25	0	1	0	26
Σ	1257	18	55	0	1330	437	6	7	0	450	33	0	1	0	34	0	0	0	0	0	2908	115	14	3	3040	151	1	1	0	153

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	36	1	0	0	37	87	3	1	1	92	162	6	0	0	168	103	4	0	0	107	480	19	2	0	501	217	3	2	0	222	1646	59	24	1	1730
16:15 - 16:30	28	0	0	0	28	75	1	2	0	78	131	8	0	0	139	122	1	0	0	123	593	9	1	1	604	215	9	0	0	224	1751	43	11	2	1807
16:30 - 16:45	20	0	0	0	20	55	2	1	0	58	150	5	0	2	157	118	2	0	0	120	517	19	0	0	536	230	4	0	0	234	1645	62	19	2	1728
16:45 - 17:00	27	0	0	0	27	78	0	2	0	80	193	5	0	0	198	136	0	0	0	136	527	13	1	0	541	215	5	1	0	221	1741	43	12	0	1796
17:00 - 17:15	25	0	0	0	25	66	2	0	0	68	177	5	0	0	182	147	1	0	0	148	517	9	2	0	528	255	3	0	0	258	1754	37	6	0	1797
17:15 - 17:30	26	0	0	0	26	75	0	3	1	79	190	1	0	0	191	137	2	0	0	139	522	7	1	0	530	241	1	0	0	242	1848	25	15	1	1889
17:30 - 17:45	30	0	0	0	30	83	1	2	0	86	198	2	1	0	201	103	2	1	0	106	521	3	1	0	525	191	2	1	0	194	1791	25	11	1	1828
17:45 - 18:00	20	0	0	0	20	53	1	2	0	56	182	2	0	0	184	146	1	0	0	147	487	5	0	0	492	227	1	0	0	228	1744	16	7	1	1768
Σ	212	1	0	0	213	572	10	13	2	597	1383	34	1	2	1420	1012	13	1	0	1026	4164	84	8	1	4257	1791	28	4	0	1823	13920	310	105	8	14343

HOURLY FLOW

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	1098	23	6	1	1128	142	4	14	8	168	8	1	0	0	9	0	0	0	0	0	1355	52	3	1	1411	16	4	0	0	20
7:15 - 8:15	1140	23	6	1	1170	153	4	14	4	175	9	2	0	0	11	0	0	0	0	0	1277	56	3	0	1336	17	4	0	0	21
7:30 - 8:30	1123	26	7	1	1157	160	3	11	3	177	11	2	0	0	13	0	0	0	0	0	1190	55	4	0	1249	19	2	0	0	21
7:45 - 8:45	**1034**	**24**	**5**	**1**	**1064**	**154**	**2**	**7**	**1**	**164**	**14**	**2**	**0**	**0**	**16**	**0**	**0**	**0**	**0**	**0**	**1247**	**65**	**4**	**0**	**1316**	**33**	**1**	**0**	**0**	**34**
8:00 - 9:00	956	20	5	1	982	202	2	6	1	211	20	2	0	0	22	0	0	0	0	0	1353	65	6	0	1424	47	0	0	0	47

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00	57	3	0	0	60	138	6	2	1	147	624	23	1	1	649	287	25	1	0	313	1614	104	4	0	1722	322	22	5	1	350	5661	267	36	13	5977	
7:15 - 8:15	49	4	0	0	53	139	5	4	1	149	608	24	1	2	635	290	26	0	0	316	1764	96	6	1	1867	399	20	7	1	427	5845	264	41	10	6160	
7:30 - 8:30	54	5	0	0	59	140	5	4	1	150	622	26	1	1	650	353	27	0	0	380	1944	87	7	1	2039	460	23	5	1	489	6076	261	39	8	6384	
7:45 - 8:45	**49**	**6**	**0**	**0**	**55**	**155**	**6**	**4**	**1**	**166**	**621**	**27**	**1**	**1**	**650**	**353**	**27**	**2**	**0**	**382**	**2045**	**78**	**7**	**2**	**2132**	**487**	**23**	**6**	**0**	**516**	**6192**	**261**	**36**	**6**	**6495**	**Peak**
8:00 - 9:00	60	3	0	0	63	174	3	3	2	182	576	25	0	1	602	367	33	2	1	403	1943	79	10	3	2035	492	18	7	0	517	6190	250	39	9	6488	

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	571	12	39	0	622	205	5	4	0	214	14	0	1	0	15	0	0	0	0	0	1424	70	9	1	1504	54	1	0	0	55
16:15 - 17:15	547	10	28	0	585	208	3	1	0	212	16	0	0	0	16	0	0	0	0	0	1433	68	9	1	1511	70	1	0	0	71
16:30 - 17:30	560	12	30	0	602	223	2	3	0	228	15	0	0	0	15	0	0	0	0	0	1467	66	8	0	1541	79	1	0	0	80
16:45 - 17:45	**627**	**8**	**21**	**0**	**656**	**228**	**1**	**2**	**0**	**231**	**18**	**0**	**0**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**1494**	**57**	**5**	**1**	**1557**	**87**	**0**	**0**	**0**	**87**
17:00 - 18:00	686	6	16	0	708	232	1	3	0	236	19	0	0	0	19	0	0	0	0	0	1484	45	5	2	1536	97	0	1	0	98

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	111	1	0	0	112	295	6	6	1	308	636	24	0	2	662	479	7	0	0	486	2117	60	4	1	2182	877	21	3	0	901	6783	207	66	5	7061	
16:15 - 17:15	100	0	0	0	100	274	5	5	0	284	651	23	0	2	676	523	4	0	0	527	2154	50	4	1	2209	915	21	1	0	937	6891	185	48	4	7128	
16:30 - 17:30	98	0	0	0	98	274	4	6	1	285	710	16	0	2	728	538	5	0	0	543	2083	48	4	0	2135	941	13	1	0	955	6988	167	52	3	7210	
16:45 - 17:45	**108**	**0**	**0**	**0**	**108**	**302**	**3**	**7**	**1**	**313**	**758**	**13**	**1**	**0**	**772**	**523**	**5**	**1**	**0**	**529**	**2087**	**32**	**5**	**0**	**2124**	**902**	**11**	**2**	**0**	**915**	**7134**	**130**	**44**	**2**	**7310**	**Peak**
17:00 - 18:00	101	0	0	0	101	277	4	7	1	289	747	10	1	0	758	533	6	1	0	540	2047	24	4	0	2075	914	7	1	0	922	7137	103	39	3	7282	

Intersection of Warringah Road and Hilmer Street

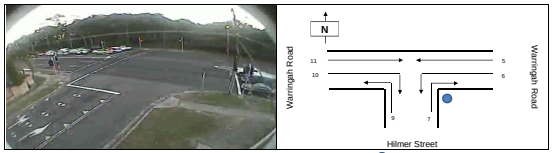
Thursday, 12 May 2011

Austraffic

Survey Start 7:00 AM 16:00 PM
Intersection Type T Junction
Intersection No. 5
North Approach
East Approach Warringah Road
South Approach Hilmer Street
West Approach Warringah Road

Date 12/05/11

Classification Light Heavy Bus Cyclist



TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15																					755	33	3	0	791	0	0	0	0	0
7:15 - 7:30																					753	34	0	0	787	2	0	0	0	2
7:30 - 7:45																					761	24	1	0	786	0	0	0	0	0
7:45 - 8:00																					732	29	4	0	765	1	1	0	0	2
8:00 - 8:15																					738	19	3	0	760	1	0	0	0	1
8:15 - 8:30																					714	26	3	2	745	1	0	0	0	1
8:30 - 8:45																					742	21	3	0	766	1	0	0	0	1
8:45 - 9:00																					714	29	5	1	749	4	0	0	0	4
Σ																					5909	215	22	3	6149	10	1	0	0	11

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	3	0	0	0	3						2	0	0	0	2	1	0	0	0	1	414	37	2	16	469						1175	70	5	16	1266
7:15 - 7:30	8	0	0	0	8						4	1	0	0	5	0	2	0	0	2	494	31	4	0	529						1261	68	4	0	1333
7:30 - 7:45	11	0	0	0	11						14	1	0	0	15	5	0	0	0	5	622	40	2	0	664						1413	65	3	0	1481
7:45 - 8:00	16	0	0	0	16						10	0	0	0	10	7	0	0	0	7	642	40	3	1	686						1408	70	7	1	1486
8:00 - 8:15	16	1	0	0	17						3	1	0	0	4	8	1	0	0	9	705	28	6	0	739						1471	50	9	0	1530
8:15 - 8:30	21	0	0	0	21						14	0	0	0	14	16	0	1	0	17	761	27	3	1	792						1527	53	7	3	1590
8:30 - 8:45	18	0	0	0	18						10	0	0	0	10	16	0	1	0	17	662	33	3	2	700						1449	54	7	2	1512
8:45 - 9:00	27	1	1	0	29						14	0	0	0	14	20	0	0	0	20	623	38	7	2	670						1402	68	13	3	1486
Σ	120	2	1	0	123						71	3	0	0	74	73	3	2	0	78	4923	274	30	22	5249						11106	498	55	25	11684

TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15																					685	26	6	0	717	2	0	0	0	2
16:15 - 16:30																					686	24	1	0	711	1	0	0	0	1
16:30 - 16:45																					650	32	7	0	689	6	0	0	0	6
16:45 - 17:00																					670	26	6	0	702	2	0	0	0	2
17:00 - 17:15																					675	24	16	0	715	5	0	0	0	5
17:15 - 17:30																					741	15	7	0	763	3	0	0	0	3
17:30 - 17:45																					754	14	16	0	784	1	1	0	0	2
17:45 - 18:00																					763	10	8	0	781	4	0	0	0	4
Σ																					5624	171	67	0	5862	24	1	0	0	25

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	22	0	0	0	22						17	1	0	0	18	12	0	0	0	12	808	25	3	3	839						1546	52	9	3	1610
16:15 - 16:30	30	1	0	0	31						17	0	0	0	17	23	0	1	0	24	880	18	0	0	898						1637	43	2	0	1682
16:30 - 16:45	31	1	0	0	32						18	0	0	0	18	13	0	0	0	13	837	22	2	0	861						1555	55	9	0	1619
16:45 - 17:00	29	1	0	0	30						15	0	0	0	15	16	1	0	0	17	854	16	1	0	871						1586	44	7	0	1637
17:00 - 17:15	31	0	0	0	31						19	0	0	0	19	21	0	0	0	21	898	12	2	3	915						1649	36	18	3	1706
17:15 - 17:30	29	0	0	0	29						24	1	1	0	26	17	0	0	0	17	894	9	1	2	906						1708	25	9	2	1744
17:30 - 17:45	28	0	0	0	28						10	0	0	0	10	28	1	0	0	29	825	11	1	0	837						1646	27	17	0	1690
17:45 - 18:00	24	2	0	0	26						21	2	0	0	23	19	0	0	0	19	845	7	0	0	852						1676	21	8	0	1705
Σ	224	5	0	0	229						141	4	1	0	146	149	2	1	0	152	6841	120	10	8	6978						13003	303	79	8	13393

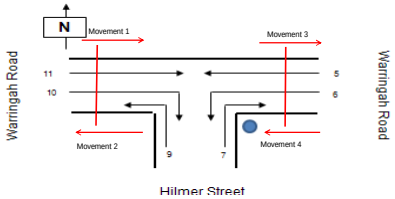
HOURLY FLOW

TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00																					3001	120	8	0	3129	3	1	0	0	4
7:15 - 8:15																					2984	106	8	0	3098	4	1	0	0	5
7:30 - 8:30																					2945	98	11	2	3056	3	1	0	0	4
7:45 - 8:45																					**2926**	**95**	**13**	**2**	**3036**	**4**	**1**	**0**	**0**	**5**
8:00 - 9:00																					**2908**	**95**	**14**	**3**	**3020**	**7**	**0**	**0**	**0**	**7**

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00	38	0	0	0	38						30	2	0	0	32	13	2	0	0	15	2172	148	11	17	2348						5257	273	19	17	5566	
7:15 - 8:15	51	1	0	0	52						31	3	0	0	34	20	3	0	0	23	2463	139	15	1	2618						5553	253	23	1	5830	
7:30 - 8:30	64	1	0	0	65						41	2	0	0	43	36	1	1	0	38	2730	135	14	2	2881						5819	238	26	4	6087	
7:45 - 8:45	**71**	**1**	**0**	**0**	**72**						**37**	**1**	**0**	**0**	**38**	**47**	**1**	**2**	**0**	**50**	**2770**	**128**	**15**	**4**	**2917**						**5855**	**227**	**30**	**6**	**6118**	**Peak**
8:00 - 9:00	**82**	**2**	**1**	**0**	**85**						**41**	**1**	**0**	**0**	**42**	**60**	**1**	**2**	**0**	**63**	**2751**	**126**	**19**	**5**	**2901**						**5849**	**225**	**36**	**8**	**6118**	**Peak**

TIME PERIOD	VEHICLE MOVEMENT 1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00																					2691	108	20	0	2819	11	0	0	0	11
16:15 - 17:15																					2681	106	30	0	2817	14	0	0	0	14
16:30 - 17:30																					2736	97	36	0	2869	16	0	0	0	16
16:45 - 17:45																					2840	79	45	0	2964	11	1	0	0	12
17:00 - 18:00																					**2933**	**63**	**47**	**0**	**3043**	**13**	**1**	**0**	**0**	**14**

TIME PERIOD	VEHICLE MOVEMENT 7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	112	3	0	0	115						67	1	0	0	68	64	1	1	0	66	3379	81	6	3	3469						6324	194	27	3	6548	
16:15 - 17:15	121	3	0	0	124						69	0	0	0	69	73	1	1	0	75	3469	68	5	3	3545						6427	178	36	3	6644	
16:30 - 17:30	120	2	0	0	122						76	1	1	0	78	67	1	0	0	68	3483	59	6	5	3553						6498	160	43	5	6706	
16:45 - 17:45	117	1	0	0	118						68	1	1	0	70	82	2	0	0	84	3471	48	5	5	3529						6589	132	51	5	6777	
17:00 - 18:00	**112**	**2**	**0**	**0**	**114**						**74**	**3**	**1**	**0**	**78**	**85**	**1**	**0**	**0**	**86**	**3462**	**39**	**4**	**5**	**3510**						**6679**	**109**	**52**	**5**	**6845**	**Peak**



	7-8	8-9	total 2hr
Movement 1	2363	2964	5327
Movement 2	3161	3062	6223
Movement 3	2386	2986	5372
Movement 4	3133	3027	6160

Intersection of Warringah Road and Forest way

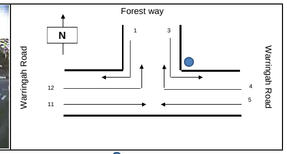
Thursday, 12 May 2011

Austraffic

Survey Start: 7:00 AM 16:00 PM
Intersection Type: T Junction
Intersection No.: 6
North Approach: Forest way
East Approach: Warringah Road
South Approach:
West Approach: Warringah Road

Date: 12/05/11

Classification: Light Heavy Bus Cyclist



Camera Position

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	324	3	7	0	334						169	18	0	0	187	110	8	2	0	120	670	7	1	1	679					
7:15 - 7:30	373	8	8	1	390						188	16	3	0	207	95	15	1	0	111	659	13	0	2	674					
7:30 - 7:45	338	6	11	0	355						203	24	1	0	228	112	8	2	1	123	664	5	0	2	671					
7:45 - 8:00	307	3	7	0	317						237	19	1	1	258	134	21	2	0	157	627	12	2	0	641					
8:00 - 8:15	244	7	7	0	258						234	19	5	1	259	143	19	2	1	165	601	13	1	0	615					
8:15 - 8:30	173	4	6	0	183						241	10	3	1	255	146	25	2	0	173	594	15	1	1	611					
8:30 - 8:45	229	3	3	0	235						197	11	2	0	210	188	17	1	0	206	578	14	2	0	594					
8:45 - 9:00	251	6	4	0	261						249	26	3	1	279	167	15	4	0	186	578	15	1	0	594					
Σ	2239	40	53	1	2333						1718	143	18	4	1883	1095	128	16	2	1241	4971	94	8	6	5079					

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15																					250	19	2	0	271	55	5	0	1	61	1578	60	12	2	1652
7:15 - 7:30																					325	17	1	0	343	80	5	2	0	87	1720	74	15	3	1812
7:30 - 7:45																					435	13	1	0	449	121	5	4	0	130	1873	61	19	3	1956
7:45 - 8:00																					405	17	2	0	424	116	8	6	0	130	1826	80	20	1	1927
8:00 - 8:15																					504	11	1	0	516	137	7	6	0	150	1863	76	22	2	1963
8:15 - 8:30																					539	15	1	0	555	141	12	8	0	161	1834	81	21	2	1938
8:30 - 8:45																					437	20	2	1	460	119	4	3	0	126	1748	69	13	1	1831
8:45 - 9:00																					425	15	4	0	444	153	7	9	0	169	1823	84	25	1	1933
Σ																					3320	127	14	1	3462	922	53	38	1	1014	14265	585	147	15	15012

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	116	0	12	0	128						240	20	0	1	261	249	16	3	0	268	419	14	7	0	440					
16:15 - 16:30	128	6	5	0	139						226	10	1	0	237	260	13	3	0	276	454	8	7	0	469					
16:30 - 16:45	144	3	4	0	151						262	13	2	0	277	244	16	2	1	263	415	15	14	1	445					
16:45 - 17:00	148	3	4	0	155						272	6	0	0	278	237	13	0	0	250	427	13	7	0	447					
17:00 - 17:15	137	2	4	0	143						263	9	2	1	275	298	11	1	0	310	437	14	5	0	456					
17:15 - 17:30	156	2	3	0	161						259	4	1	0	264	304	11	0	0	315	460	5	9	0	474					
17:30 - 17:45	139	2	4	0	145						258	7	1	0	266	243	8	1	0	252	493	3	5	0	501					
17:45 - 18:00	137	2	2	0	141						283	3	0	0	286	261	8	1	0	270	522	4	2	0	528					
Σ	1105	20	38	0	1163						2063	72	7	2	2144	2096	96	11	1	2204	3627	76	56	1	3760					

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15																					592	4	3	0	599	153	4	9	0	166	1769	58	34	1	1862
16:15 - 16:30																					682	8	0	0	690	162	1	2	0	165	1912	46	18	0	1976
16:30 - 16:45																					590	8	0	0	598	193	6	7	0	206	1848	61	29	2	1940
16:45 - 17:00																					604	9	1	0	614	171	2	3	0	176	1859	46	15	0	1920
17:00 - 17:15																					650	2	0	0	652	220	2	3	0	225	2005	40	15	1	2061
17:15 - 17:30																					609	5	0	0	614	224	3	4	0	231	2012	30	17	0	2059
17:30 - 17:45																					558	4	0	0	562	215	2	6	0	223	1906	26	17	0	1949
17:45 - 18:00																					610	3	0	0	613	234	0	2	0	236	2047	20	7	0	2074
Σ																					4895	43	4	0	4942	1572	20	36	0	1628	15358	327	152	4	15841

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	1342	20	33	1	1396						797	77	5	1	880	451	52	7	1	511	2620	37	3	5	2665					
7:15 - 8:15	1262	24	33	1	1320						862	78	10	2	952	484	63	7	2	556	2551	43	3	4	2601					
7:30 - 8:30	**1062**	**20**	**31**	**0**	**1113**						**915**	**72**	**10**	**3**	**1000**	**535**	**73**	**8**	**2**	**618**	**2486**	**45**	**4**	**3**	**2538**					
7:45 - 8:45	953	17	23	0	993						909	59	11	3	982	611	82	7	1	701	2400	54	6	1	2461					
8:00 - 9:00	897	20	20	0	937						921	66	13	3	1003	644	76	9	1	730	2351	57	5	1	2414					

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00																					1415	66	6	0	1487	372	23	12	1	408	6997	275	66	9	7347	
7:15 - 8:15																					1669	58	5	0	1732	454	25	18	0	497	7282	291	76	9	7658	
7:30 - 8:30																					**1883**	**56**	**5**	**0**	**1944**	**515**	**32**	**24**	**0**	**571**	**7396**	**298**	**82**	**8**	**7784**	**Peak**
7:45 - 8:45																					1885	63	6	1	1955	513	31	23	0	567	7271	306	76	6	7659	
8:00 - 9:00																					1905	61	8	1	1975	550	30	26	0	606	7268	310	81	6	7665	

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	536	12	25	0	573						1000	49	3	1	1053	990	58	8	1	1057	1715	50	35	1	1801					
16:15 - 17:15	557	14	17	0	588						1023	38	5	1	1067	1039	53	6	1	1099	1733	50	33	1	1817					
16:30 - 17:30	585	10	15	0	610						1056	32	5	1	1094	1083	51	3	1	1138	1739	47	35	1	1822					
16:45 - 17:45	580	9	15	0	604						1052	26	4	1	1083	1082	43	2	0	1127	1817	35	26	0	1878					
17:00 - 18:00	**569**	**8**	**13**	**0**	**590**						**1063**	**23**	**4**	**1**	**1091**	**1106**	**38**	**3**	**0**	**1147**	**1912**	**26**	**21**	**0**	**1959**					

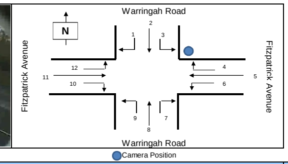
TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00																					2468	29	4	0	2501	679	13	21	0	713	7388	211	96	3	7698	
16:15 - 17:15																					2526	27	1	0	2554	746	11	15	0	772	7624	193	77	3	7897	
16:30 - 17:30																					2453	24	1	0	2478	808	13	17	0	838	7724	177	76	3	7980	
16:45 - 17:45																					2421	20	1	0	2442	830	9	16	0	855	7782	142	64	1	7989	
17:00 - 18:00																					**2427**	**14**	**0**	**0**	**2441**	**893**	**7**	**15**	**0**	**915**	**7970**	**116**	**56**	**1**	**8143**	**Peak**

Intersection of Warringah Road and Fitzpatrick Avenue

Thursday, 12 May 2011

Austraffic

Survey Start	7:00	AM	16:00	PM
Intersection Type	Cross Junction			
Intersection No.	7			
North Approach	Warringah Road			
East Approach	Fitzpatrick Avenue			
South Approach	Warringah Road			
West Approach	Fitzpatrick Avenue			
Date	12/05/11			
Classification	Light Heavy Bus Cyclist			



VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	0	0	0	0	0	1028	12	8	1	1049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	17
7:15 - 7:30	0	0	0	0	0	1070	22	9	1	1102	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	33	1	0	0	34
7:30 - 7:45	0	0	0	0	0	957	9	11	0	977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	1	0	0	22
7:45 - 8:00	0	0	0	0	0	983	16	9	0	1008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	1	0	0	33
8:00 - 8:15	0	0	0	0	0	874	19	8	0	901	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	18	0	0	0	18
8:15 - 8:30	0	0	0	0	0	752	19	8	1	780	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	32	0	0	0	32
8:30 - 8:45	0	0	0	0	0	789	18	3	0	810	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	32	0	0	0	32
8:45 - 9:00	0	0	0	0	0	854	22	5	0	881	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	19	0	0	0	19
Σ	0	0	0	0	0	7307	137	61	3	7508	5	0	1	0	6	0	0	0	0	0	0	0	0	0	0	204	3	0	0	207

VEHICLE MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	0	0	0	0	0	331	21	3	1	356	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	11	3	1	0	15	1389	36	12	2	1439
7:15 - 7:30	0	0	0	0	0	401	23	2	0	426	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	21	1	0	0	22	1529	47	11	1	1588
7:30 - 7:45	0	0	0	0	0	524	22	6	0	552	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	40	0	1	0	41	1547	32	18	0	1597
7:45 - 8:00	0	0	0	0	0	515	28	5	0	548	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	44	0	1	0	45	1579	45	15	0	1639
8:00 - 8:15	0	0	0	0	0	589	15	8	0	612	3	1	0	0	4	0	0	0	0	0	0	0	0	0	0	46	0	2	0	48	1532	35	18	0	1585
8:15 - 8:30	0	0	0	0	0	603	23	8	0	634	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	51	1	0	0	52	1444	43	16	1	1504
8:30 - 8:45	0	0	0	0	0	535	28	8	1	572	6	0	0	0	6	0	0	0	0	0	0	0	0	0	0	54	0	0	0	54	1416	46	12	1	1475
8:45 - 9:00	0	0	0	0	0	520	19	11	0	550	12	0	0	0	12	0	0	0	0	0	0	0	0	0	0	33	0	0	0	33	1439	41	16	0	1496
Σ	0	0	0	0	0	4018	179	51	2	4250	41	1	0	0	42	0	0	0	0	0	0	0	0	0	0	300	5	5	0	310	11875	325	118	5	12323

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	0	0	0	0	0	559	15	20	0	594	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	15
16:15 - 16:30	0	0	0	0	0	610	14	12	0	636	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	15	0	0	0	15
16:30 - 16:45	0	0	0	0	0	593	17	18	0	628	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	1	19
16:45 - 17:00	0	0	0	0	0	576	16	12	0	604	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	17	1	0	0	18
17:00 - 17:15	0	0	0	0	0	558	16	7	0	581	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	18	0	0	0	18
17:15 - 17:30	0	0	0	0	0	623	7	12	0	642	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	17	0	0	0	17
17:30 - 17:45	0	0	0	0	0	670	4	9	0	683	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	18	0	0	0	18
17:45 - 18:00	0	0	0	0	0	695	6	4	0	705	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	16	0	0	0	16
Σ	0	0	0	0	0	4884	95	94	0	5073	8	0	0	0	8	0	0	0	0	0	0	0	0	0	0	134	1	0	1	136

VEHICLE MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	0	0	0	0	0	760	7	11	0	778	12	0	0	0	12	0	0	0	0	0	0	0	0	0	0	17	0	0	0	17	1363	22	31	0	1416
16:15 - 16:30	0	0	0	0	0	791	12	2	1	806	44	0	0	0	44	0	0	0	0	0	0	0	0	0	0	35	0	0	0	35	1496	26	14	1	1537
16:30 - 16:45	0	0	0	0	0	770	12	7	0	789	32	0	0	0	32	0	0	0	0	0	0	0	0	0	0	24	0	0	0	24	1437	29	25	1	1492
16:45 - 17:00	0	0	0	0	0	770	10	4	0	784	35	0	0	0	35	0	0	0	0	0	0	0	0	0	0	15	0	0	0	15	1415	27	16	0	1458
17:00 - 17:15	0	0	0	0	0	862	5	3	0	870	31	0	0	0	31	0	0	0	0	0	0	0	0	0	0	26	0	0	0	26	1496	21	10	0	1527
17:15 - 17:30	0	0	0	0	0	806	8	5	0	819	29	0	0	0	29	0	0	0	0	0	0	0	0	0	0	20	0	0	0	20	1497	15	17	0	1529
17:30 - 17:45	0	0	0	0	0	773	5	6	0	784	33	0	0	0	33	0	0	0	0	0	0	0	0	0	0	17	0	0	0	17	1512	9	15	0	1536
17:45 - 18:00	0	0	0	0	0	820	4	2	0	826	25	0	0	0	25	0	0	0	0	0	0	0	0	0	0	24	0	0	0	24	1581	10	6	0	1597
Σ	0	0	0	0	0	6352	63	40	1	6456	241	0	0	0	241	0	0	0	0	0	0	0	0	0	0	178	0	0	0	178	11797	159	134	2	12092

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	0	0	0	0	0	4038	59	37	2	4136	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	103	3	0	0	106
7:15 - 8:15	**0**	**0**	**0**	**0**	**0**	**3884**	**66**	**37**	**1**	**3988**	**3**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**104**	**3**	**0**	**0**	**107**
7:30 - 8:30	0	0	0	0	0	3566	63	36	1	3666	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	103	2	0	0	105
7:45 - 8:45	0	0	0	0	0	3398	72	28	1	3499	3	0	1	0	4	0	0	0	0	0	0	0	0	0	0	114	1	0	0	115
8:00 - 9:00	0	0	0	0	0	3269	78	24	1	3372	4	0	1	0	5	0	0	0	0	0	0	0	0	0	0	101	0	0	0	101

VEHICLE MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00	0	0	0	0	0	1771	94	16	1	1882	15	0	0	0	15	0	0	0	0	0	0	0	0	0	0	116	4	3	0	123	6044	160	56	3	6263	
7:15 - 8:15	**0**	**0**	**0**	**0**	**0**	**2029**	**88**	**21**	**0**	**2138**	**16**	**1**	**0**	**0**	**17**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**151**	**1**	**4**	**0**	**156**	**6187**	**159**	**62**	**1**	**6409**	**Peak**
7:30 - 8:30	0	0	0	0	0	2231	88	27	0	2346	18	1	0	0	19	0	0	0	0	0	0	0	0	0	0	181	1	4	0	186	6102	155	67	1	6325	
7:45 - 8:45	0	0	0	0	0	2242	94	29	1	2366	19	1	0	0	20	0	0	0	0	0	0	0	0	0	0	195	1	3	0	199	5971	169	61	2	6203	
8:00 - 9:00	0	0	0	0	0	2247	85	35	1	2368	26	1	0	0	27	0	0	0	0	0	0	0	0	0	0	184	1	2	0	187	5831	165	62	2	6060	

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	0	0	0	0	0	2338	62	62	0	2462	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	65	1	0	1	67
16:15 - 17:15	0	0	0	0	0	2337	63	49	0	2449	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	68	1	0	1	70
16:30 - 17:30	0	0	0	0	0	2350	56	49	0	2455	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	70	1	0	1	72
16:45 - 17:45	0	0	0	0	0	2427	43	40	0	2510	6	0	0	0	6	0	0	0	0	0	0	0	0	0	0	70	1	0	0	71
17:00 - 18:00	**0**	**0**	**0**	**0**	**0**	**2546**	**33**	**32**	**0**	**2611**	**5**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**69**	**0**	**0**	**0**	**69**

VEHICLE MOVEMENT

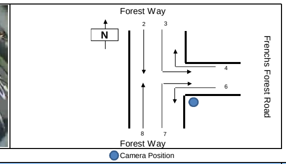
TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	0	0	0	0	0	3091	41	24	1	3157	123	0	0	0	123	0	0	0	0	0	0	0	0	0	0	91	0	0	0	91	5711	104	86	2	5903	
16:15 - 17:15	0	0	0	0	0	3193	39	16	1	3249	142	0	0	0	142	0	0	0	0	0	0	0	0	0	0	100	0	0	0	100	5844	103	65	2	6014	
16:30 - 17:30	0	0	0	0	0	3208	35	19	0	3262	127	0	0	0	127	0	0	0	0	0	0	0	0	0	0	85	0	0	0	85	5845	92	68	1	6006	
16:45 - 17:45	0	0	0	0	0	3211	28	18	0	3257	128	0	0	0	128	0	0	0	0	0	0	0	0	0	0	78	0	0	0	78	5920	72	58	0	6050	
17:00 - 18:00	**0**	**0**	**0**	**0**	**0**	**3261**	**22**	**16**	**0**	**3299**	**118**	**0**	**0**	**0**	**118**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**87**	**0**	**0**	**0**	**87**	**6086**	**55**	**48**	**0**	**6189**	**Peak**

Intersection of Forest Way and Frenchs Forest Road

Thursday, 12 May 2011

Austraffic

Survey Start	7:00 AM	16:00 PM
Intersection Type	T Junction	
Intersection No.	8	
North Approach	Forest Way	
East Approach	Frenchs Forest Road	
South Approach	Forest Way	
West Approach		
Date	12/05/11	
Classification	Light Heavy Bus Cyclist	



VEHICLE MOVEMENT

TIME PERIOD	2 Light	2 Heavy	2 Bus	2 Cyclist	2 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ
7:00 - 7:15	489	21	5	0	515	11	0	0	0	11	0	0	0	0	0
7:15 - 7:30	477	32	9	4	522	7	0	0	0	7	0	0	0	0	0
7:30 - 7:45	496	23	10	1	530	14	0	0	0	14	0	0	0	0	0
7:45 - 8:00	458	23	7	2	490	12	0	0	0	12	3	0	0	0	3
8:00 - 8:15	457	25	11	3	496	6	0	0	0	6	2	0	0	0	2
8:15 - 8:30	433	16	8	1	458	5	2	0	0	7	0	0	0	0	0
8:30 - 8:45	391	14	4	0	409	14	0	0	0	14	2	0	0	0	2
8:45 - 9:00	419	37	5	1	462	12	0	0	1	13	0	1	0	0	1
Σ	3620	191	59	12	3882	81	2	0	1	84	7	1	0	0	8

TIME PERIOD	6 Light	6 Heavy	6 Bus	6 Cyclist	6 Σ	7 Light	7 Heavy	7 Bus	7 Cyclist	7 Σ	8 Light	8 Heavy	8 Bus	8 Cyclist	8 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	25	0	1	0	26	6	0	0	0	6	158	12	2	1	173	689	33	8	1	731
7:15 - 7:30	31	0	0	0	31	10	0	4	0	14	168	22	0	1	191	693	54	13	5	765
7:30 - 7:45	22	0	0	0	22	11	0	2	0	13	210	17	2	1	230	753	40	14	2	809
7:45 - 8:00	24	1	1	0	26	17	0	4	0	21	233	35	5	1	274	747	59	17	3	826
8:00 - 8:15	18	0	0	0	18	9	1	3	0	13	282	29	5	1	317	774	55	19	4	852
8:15 - 8:30	14	0	0	0	14	14	2	4	0	20	262	36	8	0	306	728	56	20	1	805
8:30 - 8:45	19	0	1	0	20	12	0	1	0	13	291	20	3	0	314	729	34	9	0	772
8:45 - 9:00	19	0	0	0	19	22	0	2	0	24	288	23	10	0	321	760	61	17	2	840
Σ	172	1	3	0	176	101	3	20	0	124	1892	194	35	5	2126	5873	392	117	18	6400

VEHICLE MOVEMENT

TIME PERIOD	2 Light	2 Heavy	2 Bus	2 Cyclist	2 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ
16:00 - 16:15	322	21	11	2	356	15	0	0	0	15	1	0	0	0	1
16:15 - 16:30	380	16	5	0	401	16	0	0	0	16	1	0	0	0	1
16:30 - 16:45	381	17	6	0	404	16	0	0	0	16	0	0	0	0	0
16:45 - 17:00	350	7	6	0	363	22	0	0	0	22	2	0	0	0	2
17:00 - 17:15	420	11	7	1	439	22	0	0	0	22	0	0	0	0	0
17:15 - 17:30	403	5	3	0	411	15	0	0	0	15	0	0	0	0	0
17:30 - 17:45	420	11	3	1	435	14	0	0	0	14	4	0	0	0	4
17:45 - 18:00	418	4	2	0	424	15	0	0	0	15	1	0	0	0	1
Σ	3094	92	43	4	3233	135	0	0	0	135	9	0	0	0	9

TIME PERIOD	6 Light	6 Heavy	6 Bus	6 Cyclist	6 Σ	7 Light	7 Heavy	7 Bus	7 Cyclist	7 Σ	8 Light	8 Heavy	8 Bus	8 Cyclist	8 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	19	1	1	0	21	54	1	8	0	63	381	21	7	1	410	792	44	27	3	866
16:15 - 16:30	18	0	0	0	18	45	0	4	0	49	375	17	3	0	395	835	33	12	0	880
16:30 - 16:45	18	0	0	0	18	40	0	3	0	43	387	22	6	0	415	842	39	15	0	896
16:45 - 17:00	21	0	0	0	21	39	0	0	0	39	360	13	3	0	376	794	20	9	0	823
17:00 - 17:15	16	0	0	0	16	47	0	3	0	50	439	15	1	1	456	944	26	11	2	983
17:15 - 17:30	25	0	0	0	25	38	0	1	0	39	458	13	3	0	474	939	18	7	0	964
17:30 - 17:45	19	0	0	0	19	45	0	3	0	48	398	11	4	1	414	900	22	10	2	934
17:45 - 18:00	17	0	0	0	17	39	0	2	0	41	409	9	1	0	419	899	13	5	0	917
Σ	153	1	1	0	155	347	1	24	0	372	3207	121	28	3	3359	6945	215	96	7	7263

HOURLY FLOW

VEHICLE MOVEMENT

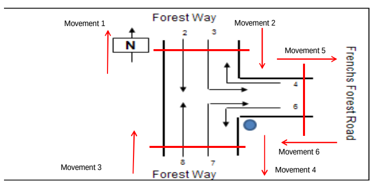
TIME PERIOD	2 Light	2 Heavy	2 Bus	2 Cyclist	2 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ
7:00 - 8:00	1920	99	31	7	2057	44	0	0	0	44	3	0	0	0	3
7:15 - 8:15	1888	103	37	10	2038	39	0	0	0	39	5	0	0	0	5
7:30 - 8:30	**1844**	**87**	**36**	**7**	**1974**	**37**	**2**	**0**	**0**	**39**	**5**	**0**	**0**	**0**	**5**
7:45 - 8:45	1739	78	30	6	1853	37	2	0	0	39	7	0	0	0	7
8:00 - 9:00	1700	92	28	5	1825	37	2	0	1	40	4	1	0	0	5

TIME PERIOD	6 Light	6 Heavy	6 Bus	6 Cyclist	6 Σ	7 Light	7 Heavy	7 Bus	7 Cyclist	7 Σ	8 Light	8 Heavy	8 Bus	8 Cyclist	8 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00	102	1	2	0	105	44	0	10	0	54	769	86	9	4	868	2882	186	52	11	3131	
7:15 - 8:15	95	1	1	0	97	47	1	13	0	61	893	103	12	4	1012	2967	208	63	14	3252	
7:30 - 8:30	**78**	**1**	**1**	**0**	**80**	**51**	**3**	**13**	**0**	**67**	**987**	**117**	**20**	**3**	**1127**	**3002**	**210**	**70**	**10**	**3292**	**Peak**
7:45 - 8:45	75	1	2	0	78	52	3	12	0	67	1068	120	21	2	1211	2978	204	65	8	3255	
8:00 - 9:00	70	0	1	0	71	57	3	10	0	70	1123	108	26	1	1258	2991	206	65	7	3269	

VEHICLE MOVEMENT

TIME PERIOD	2 Light	2 Heavy	2 Bus	2 Cyclist	2 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ
16:00 - 17:00	1433	61	28	2	1524	69	0	0	0	69	4	0	0	0	4
16:15 - 17:15	1531	51	24	1	1607	76	0	0	0	76	3	0	0	0	3
16:30 - 17:30	1554	40	22	1	1617	75	0	0	0	75	2	0	0	0	2
16:45 - 17:45	1593	34	19	2	1648	73	0	0	0	73	6	0	0	0	6
17:00 - 18:00	**1661**	**31**	**15**	**2**	**1709**	**66**	**0**	**0**	**0**	**66**	**5**	**0**	**0**	**0**	**5**

TIME PERIOD	6 Light	6 Heavy	6 Bus	6 Cyclist	6 Σ	7 Light	7 Heavy	7 Bus	7 Cyclist	7 Σ	8 Light	8 Heavy	8 Bus	8 Cyclist	8 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	76	1	1	0	78	178	1	15	0	194	1503	73	19	1	1596	3263	136	63	3	3465	
16:15 - 17:15	73	0	0	0	73	171	0	10	0	181	1561	67	13	1	1642	3415	118	47	2	3582	
16:30 - 17:30	80	0	0	0	80	164	0	7	0	171	1644	63	13	1	1721	3519	103	42	2	3666	
16:45 - 17:45	81	0	0	0	81	169	0	7	0	176	1655	52	11	2	1720	3577	86	37	4	3704	
17:00 - 18:00	**77**	**0**	**0**	**0**	**77**	**169**	**0**	**9**	**0**	**178**	**1704**	**48**	**9**	**2**	**1763**	**3682**	**79**	**33**	**4**	**3798**	**Peak**



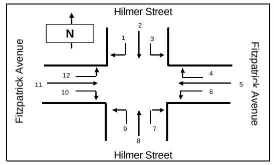
	7-8	8-9	total 2hr
Movement 1	871	1263	2134
Movement 2	2101	1775	3876
Movement 3	922	1328	2250
Movement 4	2162	1896	4058
Movement 5	98	110	208
Movement 6	108	76	184

Intersection of Hilmer Street and Fitzpatrick Avenue

Thursday, 12 May 2011

Austraffic

Survey Start	7:00	AM	16:00	PM
Intersection Type	Cross Junction			
Intersection No.	9			
North Approach	Hilmer Street			
East Approach	Fitzpatrick Avenue			
South Approach	Hilmer Street			
West Approach	Fitzpatrick Avenue			
Date	12/05/11			
Classfication	Light Heavy Bus Cyclist			



VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	5	1	0	0	6	0	0	0	0	0	2	0	0	0	2	5	0	0	1	6	11	2	0	0	13	0	0	0	0	0
7:15 - 7:30	5	1	0	0	6	0	0	0	0	0	4	0	1	0	5	5	0	0	0	5	17	0	0	1	18	0	0	0	0	0
7:30 - 7:45	6	0	0	0	6	0	0	0	0	0	4	0	0	0	4	4	0	0	0	4	17	0	0	1	18	0	0	0	0	0
7:45 - 8:00	8	1	0	0	9	0	0	0	0	0	3	0	0	0	3	5	0	0	0	5	16	0	0	1	17	0	0	0	0	0
8:00 - 8:15	8	0	0	0	8	0	0	0	0	0	3	0	0	0	3	7	0	0	0	7	13	0	0	0	13	0	0	0	0	0
8:15 - 8:30	10	0	0	0	10	1	0	0	0	1	3	0	0	0	3	8	1	0	0	9	13	0	0	0	13	0	0	0	0	0
8:30 - 8:45	11	0	0	0	11	1	0	0	0	1	3	0	0	0	3	6	0	0	0	6	15	0	0	0	15	0	0	0	0	0
8:45 - 9:00	12	1	0	0	13	0	0	0	0	0	3	0	0	0	3	5	0	0	0	5	10	0	0	1	11	0	0	0	0	0
Σ	65	4	0	0	69	2	0	0	0	2	25	0	1	0	26	45	1	0	1	47	112	2	0	4	118	0	0	0	0	0

VEHICLE MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	11	0	0	0	11	36	3	0	1	40
7:15 - 7:30	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	11	0	0	0	11	47	1	1	1	50
7:30 - 7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	16	0	0	1	17	50	0	0	2	52
7:45 - 8:00	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	26	1	0	0	27	63	2	0	1	66
8:00 - 8:15	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	26	0	0	0	26	59	0	0	1	60
8:15 - 8:30	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	1	1	30	0	0	0	30	67	1	0	1	69
8:30 - 8:45	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	28	0	0	0	28	67	0	0	0	67
8:45 - 9:00	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3	35	2	0	0	37	68	4	0	1	73
Σ	2	0	0	0	2	3	0	0	0	3	3	0	0	0	3	1	0	0	0	1	16	1	0	2	19	183	3	0	1	187	457	11	1	8	477

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	14	0	0	0	14	0	0	0	0	0	7	0	0	1	8	19	0	0	0	19	7	0	0	0	7	0	0	0	0	0
16:15 - 16:30	11	0	0	0	11	0	0	0	2	2	4	0	0	0	4	13	0	1	0	14	10	0	0	0	10	0	0	0	0	0
16:30 - 16:45	13	0	0	0	13	3	0	0	0	3	4	1	0	0	5	9	0	0	0	9	15	0	0	1	16	0	0	0	0	0
16:45 - 17:00	10	0	0	0	10	0	0	0	0	0	9	0	0	0	9	12	1	0	0	13	5	0	0	0	5	0	0	0	0	0
17:00 - 17:15	16	0	0	1	17	1	0	0	0	1	5	0	0	0	5	18	0	0	1	19	5	0	0	1	6	0	0	0	0	0
17:15 - 17:30	10	0	0	0	10	0	0	0	0	0	11	0	0	1	12	19	1	0	1	21	14	0	0	0	14	0	0	0	0	0
17:30 - 17:45	18	0	0	0	18	0	0	0	0	0	10	0	0	0	10	17	0	0	0	17	9	0	0	0	9	1	0	0	0	1
17:45 - 18:00	15	0	0	0	15	0	0	0	0	0	10	0	0	0	10	14	0	0	1	15	10	0	0	0	10	0	0	0	0	0
Σ	107	0	0	1	108	4	0	0	2	6	60	1	0	2	63	121	2	1	3	127	75	0	0	2	77	1	0	0	0	1

VEHICLE MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7	25	0	0	0	25	79	0	0	1	80
16:15 - 16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	29	0	0	0	29	72	0	1	2	75
16:30 - 16:45	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	22	69	1	0	1	71
16:45 - 17:00	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	21	0	0	0	21	59	1	0	0	60
17:00 - 17:15	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	22	0	0	0	22	69	0	0	3	72
17:15 - 17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	21	0	0	0	21	76	1	0	2	79
17:30 - 17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	19	0	0	0	19	77	0	0	0	77
17:45 - 18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	24	0	0	0	24	76	0	0	1	77
Σ	0	0	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	21	0	0	0	21	183	0	0	0	183	577	3	1	10	591

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	24	3	0	0	27	0	0	0	0	0	13	0	1	0	14	19	0	0	1	20	61	2	0	3	66	0	0	0	0	0
7:15 - 8:15	27	2	0	0	29	0	0	0	0	0	14	0	1	0	15	21	0	0	0	21	63	0	0	3	66	0	0	0	0	0
7:30 - 8:30	32	1	0	0	33	1	0	0	0	1	13	0	0	0	13	24	1	0	0	25	59	0	0	2	61	0	0	0	0	0
7:45 - 8:45	37	1	0	0	38	2	0	0	0	2	12	0	0	0	12	26	1	0	0	27	57	0	0	1	58	0	0	0	0	0
8:00 - 9:00	**41**	**1**	**0**	**0**	**42**	**2**	**0**	**0**	**0**	**2**	**12**	**0**	**0**	**0**	**12**	**26**	**1**	**0**	**0**	**27**	**51**	**0**	**0**	**1**	**52**	**0**	**0**	**0**	**0**	**0**

E MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	13	0	0	0	13	64	1	0	1	66	196	6	1	5	208
7:15 - 8:15	1	0	0	0	1	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	11	0	0	1	12	79	1	0	1	81	219	3	1	5	228
7:30 - 8:30	1	0	0	0	1	2	0	0	0	2	2	0	0	0	2	0	0	0	0	0	7	0	0	2	9	98	1	0	1	100	239	3	0	5	247
7:45 - 8:45	1	0	0	0	1	2	0	0	0	2	3	0	0	0	3	1	0	0	0	1	5	0	0	2	7	110	1	0	0	111	256	3	0	3	262
8:00 - 9:00	**1**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**2**	**3**	**0**	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**1**	**3**	**1**	**0**	**2**	**6**	**119**	**2**	**0**	**0**	**121**	**261**	**5**	**0**	**3**	**269**

VEHICLE MOVEMENT

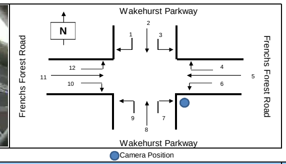
TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	48	0	0	0	48	3	0	0	2	5	24	1	0	1	26	53	1	1	0	55	37	0	0	1	38	0	0	0	0	0
16:15 - 17:15	50	0	0	1	51	4	0	0	2	6	22	1	0	0	23	52	1	1	1	55	35	0	0	2	37	0	0	0	0	0
16:30 - 17:30	49	0	0	1	50	4	0	0	0	4	29	1	0	1	31	58	2	0	2	62	39	0	0	2	41	0	0	0	0	0
16:45 - 17:45	54	0	0	1	55	1	0	0	0	1	35	0	0	1	36	66	2	0	2	70	33	0	0	1	34	1	0	0	0	1
17:00 - 18:00	**59**	**0**	**0**	**1**	**60**	**1**	**0**	**0**	**0**	**1**	**36**	**0**	**0**	**1**	**37**	**68**	**1**	**0**	**3**	**72**	**38**	**0**	**0**	**1**	**39**	**1**	**0**	**0**	**0**	**1**

E MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	0	0	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	13	0	0	0	13	97	0	0	0	97	279	2	1	4	286
16:15 - 17:15	0	0	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7	94	0	0	0	94	269	2	1	6	278
16:30 - 17:30	0	0	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	86	0	0	0	86	273	3	0	6	282
16:45 - 17:45	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	6	0	0	0	6	83	0	0	0	83	281	2	0	5	288
17:00 - 18:00	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**0**	**0**	**8**	**86**	**0**	**0**	**0**	**86**	**298**	**1**	**0**	**6**	**305**

Intersection of	Wakehurst Parkway and Frenchs Forest Road	Thursday, 12 May 2011
		Austraffic

Survey Start	7:00 AM	16:00 PM
Intersection Type	Cross Junction	
Intersection No.	10	
North Approach	Wakehurst Parkway	
East Approach	Frenchs Forest Road	
South Approach	Wakehurst Parkway	
West Approach	Frenchs Forest Road	
Date	12/05/11	
Classification	Light Heavy Bus Cyclist	



VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	0	0	0	0	0	139	7	0	4	150	5	1	0	0	6	7	0	0	1	8	98	1	2	1	102	144	1	5	0	150
7:15 - 7:30	0	0	0	0	0	171	6	0	1	178	5	1	0	0	6	2	1	0	0	3	156	0	1	0	157	120	0	4	0	124
7:30 - 7:45	0	0	0	0	0	209	6	0	2	217	8	0	0	0	8	4	0	0	0	4	109	0	0	1	110	115	1	4	0	120
7:45 - 8:00	0	0	0	0	0	214	4	0	0	218	18	0	0	0	18	8	0	0	0	8	89	0	4	1	94	80	0	6	0	86
8:00 - 8:15	0	0	0	0	0	231	6	2	0	239	27	0	0	0	27	2	0	0	0	2	88	0	3	0	91	96	1	3	0	100
8:15 - 8:30	0	0	0	0	0	205	5	0	1	211	37	1	0	0	38	10	1	0	0	11	108	1	4	0	113	69	3	1	0	73
8:30 - 8:45	0	0	0	0	0	184	4	0	0	188	31	0	0	0	31	7	2	0	0	9	81	1	2	0	84	56	0	1	0	57
8:45 - 9:00	0	0	0	0	0	210	3	3	1	217	27	0	0	0	27	16	1	0	0	17	109	1	0	0	110	60	1	2	0	63
Σ	0	0	0	0	0	1563	41	5	9	1618	158	3	0	0	161	56	5	0	1	62	838	4	16	3	861	740	7	26	0	773

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	13	3	0	0	16	84	3	1	0	88	7	0	0	0	7	7	1	0	0	8	56	0	0	0	56	4	0	0	0	4	564	17	8	6	595
7:15 - 7:30	7	0	1	0	8	87	3	1	0	91	5	0	0	0	5	14	1	0	0	15	126	0	1	0	127	10	0	0	1	11	703	12	8	2	725
7:30 - 7:45	28	2	1	0	31	90	3	0	2	95	7	0	0	0	7	14	0	0	0	14	114	1	2	0	117	20	0	0	0	20	718	13	7	5	743
7:45 - 8:00	35	2	3	0	40	94	11	0	0	105	9	0	0	0	9	9	0	0	0	9	147	0	0	0	147	17	0	0	0	17	720	17	13	1	751
8:00 - 8:15	46	1	4	0	51	121	1	0	0	122	5	0	1	0	6	12	0	0	0	12	131	0	1	0	132	18	0	0	0	18	777	9	14	0	800
8:15 - 8:30	56	0	0	0	56	101	5	0	0	106	7	0	0	0	7	11	0	0	0	11	132	2	4	0	138	6	0	0	0	6	742	18	9	1	770
8:30 - 8:45	35	4	0	0	39	117	1	2	0	120	12	0	0	0	12	21	0	0	0	21	163	0	1	0	164	34	0	0	0	34	741	12	6	0	759
8:45 - 9:00	45	0	0	1	46	108	5	3	0	116	4	0	0	0	4	17	0	0	0	17	130	0	1	0	131	20	0	0	0	20	746	11	9	2	768
Σ	265	12	9	1	287	802	32	7	2	843	56	0	1	0	57	105	2	0	0	107	999	3	10	0	1012	129	0	0	1	130	5711	109	74	17	5911

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	0	0	0	0	0	158	4	3	0	165	20	0	0	0	20	25	1	0	0	26	120	1	4	0	125	58	0	12	0	70
16:15 - 16:30	0	0	0	0	0	128	1	4	0	133	23	0	0	0	23	20	1	0	0	21	110	0	0	0	110	39	0	2	0	41
16:30 - 16:45	0	0	0	0	0	120	5	10	0	135	17	1	0	0	18	27	0	0	0	27	115	1	1	0	117	49	3	3	0	55
16:45 - 17:00	0	0	0	0	0	117	0	5	0	122	19	0	0	0	19	22	0	0	0	22	134	1	1	0	136	35	2	1	0	38
17:00 - 17:15	0	0	0	0	0	145	1	1	0	147	24	0	0	1	25	53	0	0	0	53	142	0	0	0	142	76	1	3	0	80
17:15 - 17:30	0	0	0	0	0	140	0	6	0	146	31	0	0	0	31	37	0	0	0	37	130	0	1	0	131	77	1	3	0	81
17:30 - 17:45	0	0	0	0	0	157	1	3	0	161	24	0	0	0	24	26	0	0	0	26	149	1	0	0	150	96	1	2	0	99
17:45 - 18:00	0	0	0	0	0	119	0	0	0	119	28	0	0	0	28	19	0	0	0	19	118	0	0	0	118	79	0	1	0	80
Σ	0	0	0	0	0	1084	12	32	0	1128	186	1	0	1	188	229	2	0	0	231	1018	4	7	0	1029	509	8	27	0	544

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	39	2	2	0	43	244	5	1	0	250	7	1	0	1	9	13	0	1	0	14	86	0	3	0	89	15	0	0	0	15	785	14	26	1	826
16:15 - 16:30	40	1	2	0	43	248	5	0	1	254	12	0	0	0	12	13	0	1	0	14	120	1	1	0	122	10	0	0	0	10	763	9	10	1	783
16:30 - 16:45	30	0	1	0	31	252	3	0	1	256	4	0	0	0	4	25	0	0	0	25	106	1	0	0	107	7	0	0	0	7	752	14	15	1	782
16:45 - 17:00	30	2	3	0	35	258	3	0	0	261	4	0	0	0	4	14	0	0	0	14	104	0	1	0	105	11	0	0	0	11	748	8	11	0	767
17:00 - 17:15	34	1	0	0	35	279	2	0	0	281	11	0	0	0	11	14	0	0	0	14	121	0	1	1	123	11	0	0	0	11	910	5	5	2	922
17:15 - 17:30	37	0	4	0	41	258	1	0	1	260	13	0	0	0	13	27	0	0	0	27	114	0	1	0	115	19	0	0	0	19	883	2	15	1	901
17:30 - 17:45	35	0	3	0	38	225	2	0	0	227	6	0	0	0	6	7	0	0	0	7	114	0	0	0	114	10	0	0	0	10	849	5	8	0	862
17:45 - 18:00	33	1	2	0	36	247	1	0	0	248	9	0	0	0	9	3	0	0	0	3	86	0	1	0	87	9	0	0	0	9	750	2	4	0	756
Σ	278	7	17	0	302	2011	22	1	3	2037	66	1	0	1	68	116	0	2	0	118	851	2	8	1	862	92	0	0	0	92	6440	59	94	6	6599

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	0	0	0	0	0	733	23	0	7	763	36	2	0	0	38	21	1	0	1	23	452	1	7	3	463	459	2	19	0	480
7:15 - 8:15	0	0	0	0	0	825	22	2	3	852	58	1	0	0	59	16	1	0	0	17	442	0	8	2	452	411	2	17	0	430
7:30 - 8:30	0	0	0	0	0	859	21	2	3	885	90	1	0	0	91	24	1	0	0	25	394	1	11	2	408	360	5	14	0	379
7:45 - 8:45	0	0	0	0	0	834	19	2	1	856	113	1	0	0	114	27	3	0	0	30	366	2	13	1	382	301	4	11	0	316
8:00 - 9:00	**0**	**0**	**0**	**0**	**0**	**830**	**18**	**5**	**2**	**855**	**122**	**1**	**0**	**0**	**123**	**35**	**4**	**0**	**0**	**39**	**386**	**3**	**9**	**0**	**398**	**281**	**5**	**7**	**0**	**293**

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
7:00 - 8:00	83	7	5	0	95	355	20	2	2	379	28	0	0	0	28	44	2	0	0	46	443	1	3	0	447	51	0	0	1	52	2705	59	36	14	2814	
7:15 - 8:15	116	5	9	0	130	392	18	1	2	413	26	0	1	0	27	49	1	0	0	50	518	1	4	0	523	65	0	0	1	66	2918	51	42	8	3019	
7:30 - 8:30	165	5	8	0	178	406	20	0	2	428	28	0	1	0	29	46	0	0	0	46	524	3	7	0	534	61	0	0	0	61	2957	57	43	7	3064	
7:45 - 8:45	172	7	7	0	186	433	18	2	0	453	33	0	1	0	34	53	0	0	0	53	573	2	6	0	581	75	0	0	0	75	2980	56	42	2	3080	
8:00 - 9:00	**182**	**5**	**4**	**1**	**192**	**447**	**12**	**5**	**0**	**464**	**28**	**0**	**1**	**0**	**29**	**61**	**0**	**0**	**0**	**61**	**556**	**2**	**7**	**0**	**565**	**78**	**0**	**0**	**0**	**78**	**3006**	**50**	**38**	**3**	**3097**	**Peak**

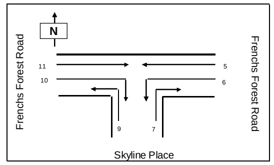
VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	0	0	0	0	0	523	10	22	0	555	79	1	0	0	80	94	2	0	0	96	479	3	6	0	488	181	5	18	0	204
16:15 - 17:15	0	0	0	0	0	510	7	20	0	537	83	1	0	1	85	122	1	0	0	123	501	2	2	0	505	199	6	9	0	214
16:30 - 17:30	0	0	0	0	0	522	6	22	0	550	91	1	0	1	93	139	0	0	0	139	521	2	3	0	526	237	7	10	0	254
16:45 - 17:45	**0**	**0**	**0**	**0**	**0**	**559**	**2**	**15**	**0**	**576**	**98**	**0**	**0**	**1**	**99**	**138**	**0**	**0**	**0**	**138**	**555**	**2**	**2**	**0**	**559**	**284**	**5**	**9**	**0**	**298**
17:00 - 18:00	0	0	0	0	0	561	2	10	0	573	107	0	0	1	108	135	0	0	0	135	539	1	1	0	541	328	3	9	0	340

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL					
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	
16:00 - 17:00	139	5	8	0	152	1002	16	1	2	1021	27	1	0	1	29	65	0	2	0	67	416	2	5	0	423	43	0	0	0	43	3048	45	62	3	3158	
16:15 - 17:15	134	4	6	0	144	1037	13	0	2	1052	31	0	0	0	31	66	0	1	0	67	451	2	3	1	457	39	0	0	0	39	3173	36	41	4	3254	
16:30 - 17:30	131	3	8	0	142	1047	9	0	2	1058	32	0	0	0	32	80	0	0	0	80	445	1	3	1	450	48	0	0	0	48	3293	29	46	4	3372	
16:45 - 17:45	**136**	**3**	**10**	**0**	**149**	**1020**	**8**	**0**	**1**	**1029**	**34**	**0**	**0**	**0**	**34**	**62**	**0**	**0**	**0**	**62**	**453**	**0**	**3**	**1**	**457**	**51**	**0**	**0**	**0**	**51**	**3390**	**20**	**39**	**3**	**3452**	**Peak**
17:00 - 18:00	139	2	9	0	150	1009	6	0	1	1016	39	0	0	0	39	51	0	0	0	51	435	0	3	1	439	49	0	0	0	49	3392	14	32	3	3441	

Intersection of	Frenchs Forest Road and Skyline Place	Thursday, 12 May 2011
		Austraffic

Survey Start	7:00 AM	16:00 PM
Intersection Type	T Junction	
Intersection No.	11	
North Approach		
East Approach	Frenchs Forest Road	
South Approach	Skyline Place	
West Approach	Frenchs Forest Road	
Date	12/05/11	
Classfication	Light Heavy Bus Cyclist	



VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15																					235	0	10	0	245	4	0	0	0	4
7:15 - 7:30																					265	1	5	0	271	6	0	0	0	6
7:30 - 7:45																					210	1	3	0	214	5	0	0	0	5
7:45 - 8:00																					171	0	10	0	181	18	1	0	0	19
8:00 - 8:15																					174	0	6	0	180	21	0	0	0	21
8:15 - 8:30																					189	4	4	0	197	26	1	0	0	27
8:30 - 8:45																					153	2	4	0	159	34	0	0	0	34
8:45 - 9:00																					179	4	1	0	184	15	0	0	0	15
Σ																					1576	12	43	0	1631	129	2	0	0	131

VEHICLE MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	1	0	0	0	1						0	0	0	0	0	1	0	0	0	1	65	1	0	0	66						306	1	10	0	317
7:15 - 7:30	0	0	0	0	0						0	0	0	0	0	6	0	0	0	6	136	2	2	0	140						413	3	7	0	423
7:30 - 7:45	1	0	0	0	1						4	0	0	0	4	14	1	0	0	15	144	1	2	0	147						378	3	5	0	386
7:45 - 8:00	1	0	0	0	1						5	0	0	0	5	21	0	0	0	21	176	1	3	0	180						392	2	13	0	407
8:00 - 8:15	0	0	0	0	0						3	0	0	0	3	21	0	0	0	21	190	0	3	0	193						409	0	9	0	418
8:15 - 8:30	2	0	0	0	2						3	1	0	0	4	32	0	0	0	32	191	1	4	0	196						443	7	8	0	458
8:30 - 8:45	2	1	0	0	3						2	0	0	0	2	39	1	0	0	40	199	3	0	0	202						429	7	4	0	440
8:45 - 9:00	2	0	0	0	2						6	0	0	0	6	30	0	0	0	30	170	0	1	0	171						402	4	2	0	408
Σ	9	1	0	0	10						23	1	0	0	24	164	2	0	0	166	1271	9	15	0	1295						3172	27	58	0	3257

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15																					186	1	15	0	202	4	3	0	0	7
16:15 - 16:30																					160	1	2	0	163	8	0	0	0	8
16:30 - 16:45																					172	4	4	0	180	5	2	0	0	7
16:45 - 17:00																					159	3	2	0	164	1	0	0	0	1
17:00 - 17:15																					216	0	7	0	223	5	0	0	0	5
17:15 - 17:30																					231	1	2	0	234	0	0	0	0	0
17:30 - 17:45																					231	1	5	0	237	2	0	0	0	2
17:45 - 18:00																					180	0	1	0	181	1	0	0	0	1
Σ																					1535	11	38	0	1584	26	5	0	0	31

VEHICLE MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	8	0	0	0	8						11	1	0	0	12	5	1	0	0	6	155	1	5	0	161						369	7	20	0	396
16:15 - 16:30	9	1	0	0	10						10	0	0	0	10	6	0	0	0	6	165	1	4	0	170						358	3	6	0	367
16:30 - 16:45	18	1	0	0	19						14	1	0	0	15	3	0	0	0	3	175	4	1	0	180						387	12	5	0	404
16:45 - 17:00	10	0	0	0	10						31	1	0	0	32	2	0	0	0	2	164	3	4	0	171						367	7	6	0	380
17:00 - 17:15	34	0	0	0	34						52	1	0	0	53	2	0	0	0	2	174	0	1	0	175						483	1	8	0	492
17:15 - 17:30	13	0	0	0	13						11	0	0	0	11	1	0	0	0	1	164	1	5	0	170						420	2	7	0	429
17:30 - 17:45	10	0	0	0	10						37	0	0	0	37	7	0	0	0	7	158	1	3	0	162						445	2	8	0	455
17:45 - 18:00	9	0	0	0	9						27	0	0	0	27	1	0	0	0	1	168	0	3	0	171						386	0	4	0	390
Σ	111	2	0	0	113						193	4	0	0	197	27	1	0	0	28	1323	11	26	0	1360						3215	34	64	0	3313

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00																					881	2	28	0	911	33	1	0	0	34
7:15 - 8:15																					820	2	24	0	846	50	1	0	0	51
7:30 - 8:30																					744	5	23	0	772	70	2	0	0	72
7:45 - 8:45																					687	6	24	0	717	99	2	0	0	101
8:00 - 9:00																					**695**	**10**	**15**	**0**	**720**	**96**	**1**	**0**	**0**	**97**

E MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	3	0	0	0	3						9	0	0	0	9	42	1	0	0	43	521	5	7	0	533						1489	9	35	0	1533
7:15 - 8:15	2	0	0	0	2						12	0	0	0	12	62	1	0	0	63	646	4	10	0	660						1592	8	34	0	1634
7:30 - 8:30	4	0	0	0	4						15	1	0	0	16	88	1	0	0	89	701	3	12	0	716						1622	12	35	0	1669
7:45 - 8:45	5	1	0	0	6						13	1	0	0	14	113	1	0	0	114	756	5	10	0	771						1673	16	34	0	1723
8:00 - 9:00	**6**	**1**	**0**	**0**	**7**						**14**	**1**	**0**	**0**	**15**	**122**	**1**	**0**	**0**	**123**	**750**	**4**	**8**	**0**	**762**						**1683**	**18**	**23**	**0**	**1724**

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00																					677	9	23	0	709	18	5	0	0	23
16:15 - 17:15																					707	8	15	0	730	19	2	0	0	21
16:30 - 17:30																					778	8	15	0	801	11	2	0	0	13
16:45 - 17:45																					837	5	16	0	858	8	0	0	0	8
17:00 - 18:00																					**858**	**2**	**15**	**0**	**875**	**8**	**0**	**0**	**0**	**8**

E MOVEMENT

TIME PERIOD	7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	45	2	0	0	47						66	3	0	0	69	16	1	0	0	17	659	9	14	0	682						1481	29	37	0	1547
16:15 - 17:15	71	2	0	0	73						107	3	0	0	110	13	0	0	0	13	678	8	10	0	696						1595	23	25	0	1643
16:30 - 17:30	75	1	0	0	76						108	3	0	0	111	8	0	0	0	8	677	8	11	0	696						1657	22	26	0	1705
16:45 - 17:45	67	0	0	0	67						131	2	0	0	133	12	0	0	0	12	660	5	13	0	678						1715	12	29	0	1756
17:00 - 18:00	**66**	**0**	**0**	**0**	**66**						**127**	**1**	**0**	**0**	**128**	**11**	**0**	**0**	**0**	**11**	**664**	**2**	**12**	**0**	**678**						**1734**	**5**	**27**	**0**	**1766**

Intersection of Frenchs Forest Road and Parkview Hotel Entrance

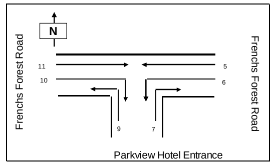
Thursday, 12 May 2011

Austraffic

Survey Start 7:00 AM 16:00 PM
Intersection Type T Junction
Intersection No. 12
North Approach
East Approach Frenchs Forest Road
South Approach Parkview Hotel Entrance
West Approach Frenchs Forest Road

Date 12/05/11

Classfication Light Heavy Bus Cyclist



VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15																					233	0	10	0	243	3	0	0	0	3	2	0	0	0	2						0	0	0	0	0	6	1	0	0	7	56	1	0	0	57						300	2	10	0	312
7:15 - 7:30																					253	1	5	0	259	3	0	0	0	3	2	0	0	0	2						1	2	0	0	3	3	1	0	0	4	133	2	2	0	137						395	6	7	0	408
7:30 - 7:45																					195	1	3	0	199	5	0	0	0	5	3	0	0	0	3						3	1	0	0	4	7	0	0	0	7	128	1	2	1	132						341	3	5	1	350
7:45 - 8:00																					185	0	10	0	195	3	0	0	0	3	1	0	0	0	1						1	0	0	0	1	4	0	0	0	4	172	1	3	0	176						366	1	13	0	380
8:00 - 8:15																					175	1	6	0	182	10	0	0	0	10	0	0	0	0	0						3	0	0	0	3	15	0	0	0	15	174	0	3	0	177						377	1	9	0	387
8:15 - 8:30																					210	4	5	0	219	6	0	0	0	6	1	0	0	0	1						1	0	0	0	1	10	0	0	0	10	186	1	4	1	192						414	5	9	1	429
8:30 - 8:45																					188	1	3	0	192	7	0	0	0	7	0	0	0	0	0						3	1	0	0	4	6	1	0	0	7	194	3	0	0	197						398	6	3	0	407
8:45 - 9:00																					192	4	1	0	197	2	0	0	0	2	0	0	0	0	0						1	0	0	0	1	5	0	0	0	5	155	0	1	0	156						355	4	2	0	361
Σ																					1631	12	43	0	1686	39	0	0	0	39	9	0	0	0	9						13	4	0	0	17	56	3	0	0	59	1198	9	15	2	1224						2946	28	58	2	3034

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15																					171	1	15	0	187	6	0	0	0	6	16	0	0	0	16						6	1	0	0	7	8	1	0	0	9	164	2	5	0	171						371	5	20	0	396
16:15 - 16:30																					160	1	2	0	163	4	0	0	0	4	8	0	0	0	8						10	0	0	0	10	6	1	0	0	7	176	3	4	0	183						364	5	6	0	375
16:30 - 16:45																					170	4	4	0	178	2	1	0	0	3	9	0	0	0	9						9	4	0	0	13	1	1	0	0	2	196	4	1	1	202						387	14	5	1	407
16:45 - 17:00																					154	3	2	0	159	10	0	0	0	10	10	0	0	0	10						8	1	0	0	9	4	1	0	0	5	179	0	4	1	184						365	5	6	1	377
17:00 - 17:15																					214	0	7	0	221	6	0	0	0	6	12	0	0	0	12						4	0	0	0	4	4	0	0	0	4	213	1	1	1	216						453	1	8	1	463
17:15 - 17:30																					199	1	2	0	202	4	2	0	0	6	15	1	0	0	16						15	2	0	0	17	4	0	0	0	4	179	0	6	2	187						416	6	8	2	432
17:30 - 17:45																					233	1	5	0	239	6	1	0	0	7	20	1	0	0	21						6	1	0	0	7	3	0	0	0	3	165	1	4	0	170						433	5	9	0	447
17:45 - 18:00																					169	0	1	0	170	3	0	0	0	3	23	0	0	0	23						15	0	0	0	15	1	1	0	0	2	177	1	3	0	181						388	2	4	0	394
Σ																					1470	11	38	0	1519	41	4	0	0	45	113	2	0	0	115						73	9	0	0	82	31	5	0	0	36	1449	12	28	5	1494						3177	43	66	5	3291

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00																					866	2	28	0	896	14	0	0	0	14	8	0	0	0	8						5	3	0	0	8	20	2	0	0	22	489	5	7	1	502						1402	12	35	1	1450
7:15 - 8:15																					808	3	24	0	835	21	0	0	0	21	6	0	0	0	6						8	3	0	0	11	29	1	0	0	30	607	4	10	1	622						1479	11	34	1	1525
7:30 - 8:30																					765	6	24	0	795	24	0	0	0	24	5	0	0	0	5						8	1	0	0	9	36	0	0	0	36	660	3	12	2	677						1498	10	36	2	1546
7:45 - 8:45																					**758**	**6**	**24**	**0**	**788**	**26**	**0**	**0**	**0**	**26**	**2**	**0**	**0**	**0**	**2**						**8**	**1**	**0**	**0**	**9**	**35**	**1**	**0**	**0**	**36**	**726**	**5**	**10**	**1**	**742**						**1555**	**13**	**34**	**1**	**1603**
8:00 - 9:00																					765	10	15	0	790	25	0	0	0	25	1	0	0	0	1						8	1	0	0	9	36	1	0	0	37	709	4	8	1	722						1544	16	23	1	1584

VEHICLE MOVEMENT

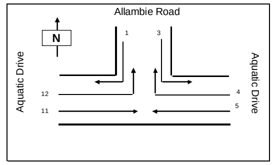
TIME PERIOD	1					2					3					4					5					6					7					8					9					10					11					12					GRAND TOTAL				
	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ	Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00																					655	9	23	0	687	22	1	0	0	23	43	0	0	0	43						33	6	0	0	39	19	4	0	0	23	715	9	14	2	740						1487	29	37	2	1555
16:15 - 17:15																					698	8	15	0	721	22	1	0	0	23	39	0	0	0	39						31	5	0	0	36	15	3	0	0	18	764	8	10	3	785						1569	25	25	3	1622
16:30 - 17:30																					737	8	15	0	760	22	3	0	0	25	46	1	0	0	47						36	7	0	0	43	13	2	0	0	15	767	5	12	5	789						1621	26	27	5	1679
16:45 - 17:45																					800	5	16	0	821	26	3	0	0	29	57	2	0	0	59						33	4	0	0	37	15	1	0	0	16	736	2	15	4	757						1667	17	31	4	1719
17:00 - 18:00																					**815**	**2**	**15**	**0**	**832**	**19**	**3**	**0**	**0**	**22**	**70**	**2**	**0**	**0**	**72**						**40**	**3**	**0**	**0**	**43**	**12**	**1**	**0**	**0**	**13**	**734**	**3**	**14**	**3**	**754**						**1690**	**14**	**29**	**3**	**1736**

Intersection of Allambie Road and Aquatic Drive

Thursday, 12 May 2011

Austraffic

Survey Start	7:00 AM	16:00 PM
Intersection Type	T Junction	
Intersection No.	13	
North Approach	Allambie Road	
East Approach	Aquatic Drive	
South Approach		
West Approach	Aquatic Drive	
Date	12/05/11	
Classfication	Light Heavy Bus Cyclist	



VEHICLE MOVEMENT

TIME PERIOD	1 Light	1 Heavy	1 Bus	1 Cyclist	1 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ	5 Light	5 Heavy	5 Bus	5 Cyclist	5 Σ
7:00 - 7:15	40	3	0	0	43	106	7	2	0	115	87	2	2	0	91	11	0	0	0	11
7:15 - 7:30	53	0	0	0	53	104	4	3	0	111	84	2	1	0	87	17	2	0	0	19
7:30 - 7:45	61	5	0	0	66	141	4	2	0	147	88	4	3	0	95	13	0	0	0	13
7:45 - 8:00	79	0	0	0	79	155	3	2	0	160	91	4	1	0	96	26	0	0	0	26
8:00 - 8:15	96	4	1	0	101	165	3	3	0	171	100	3	1	0	104	35	0	0	0	35
8:15 - 8:30	114	2	0	0	116	183	3	2	0	188	105	0	2	0	107	53	0	0	0	53
8:30 - 8:45	99	0	1	0	100	191	2	1	0	194	104	1	0	0	105	54	0	0	0	54
8:45 - 9:00	100	5	0	0	105	177	2	1	0	180	103	1	0	0	104	39	0	0	0	39
Σ	642	19	2	0	663	1222	28	16	0	1266	762	17	10	0	789	248	2	0	0	250

TIME PERIOD	11 Light	11 Heavy	11 Bus	11 Cyclist	11 Σ	12 Light	12 Heavy	12 Bus	12 Cyclist	12 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ
7:00 - 7:15	8	0	0	0	8	13	2	0	0	15	265	14	4	0	283
7:15 - 7:30	1	1	0	0	2	13	0	0	0	13	272	9	4	0	285
7:30 - 7:45	1	0	0	0	1	17	2	0	0	19	321	15	5	0	341
7:45 - 8:00	0	0	0	0	0	19	4	0	0	23	370	11	3	0	384
8:00 - 8:15	9	0	1	0	10	14	0	0	0	14	419	10	6	0	435
8:15 - 8:30	2	0	0	0	2	18	2	0	0	20	475	7	4	0	486
8:30 - 8:45	15	0	0	0	15	21	2	0	0	23	484	5	2	0	491
8:45 - 9:00	14	0	0	0	14	16	1	0	0	17	449	9	1	0	459
Σ	50	1	1	0	52	131	13	0	0	144	3055	80	29	0	3164

VEHICLE MOVEMENT

TIME PERIOD	1 Light	1 Heavy	1 Bus	1 Cyclist	1 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ	5 Light	5 Heavy	5 Bus	5 Cyclist	5 Σ
16:00 - 16:15	22	2	0	0	24	104	1	0	0	105	89	1	0	0	90	18	0	1	0	19
16:15 - 16:30	57	3	1	0	61	160	4	0	0	164	91	2	2	0	95	23	0	0	0	23
16:30 - 16:45	33	1	0	0	34	133	5	3	0	141	106	3	0	0	109	23	0	1	0	24
16:45 - 17:00	57	0	0	0	57	186	2	0	0	188	103	4	2	0	109	34	0	0	0	34
17:00 - 17:15	33	0	0	0	33	213	2	1	0	216	107	1	1	0	109	11	0	1	0	12
17:15 - 17:30	39	0	1	0	40	215	2	0	0	217	115	0	2	0	117	10	0	0	0	10
17:30 - 17:45	25	0	0	0	25	133	0	1	0	134	83	2	2	0	87	4	0	0	0	4
17:45 - 18:00	20	0	0	0	20	139	1	0	0	140	78	1	1	0	80	7	0	0	0	7
Σ	286	6	2	0	294	1283	17	5	0	1305	772	14	10	0	796	130	0	3	0	133

TIME PERIOD	11 Light	11 Heavy	11 Bus	11 Cyclist	11 Σ	12 Light	12 Heavy	12 Bus	12 Cyclist	12 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ
16:00 - 16:15	36	0	0	0	36	91	1	3	0	95	360	5	4	0	369
16:15 - 16:30	31	0	0	0	31	80	3	1	0	84	442	12	4	0	458
16:30 - 16:45	31	1	0	0	32	86	3	0	0	89	412	13	4	0	429
16:45 - 17:00	27	0	0	0	27	102	1	0	0	103	509	7	2	0	518
17:00 - 17:15	87	1	0	0	88	129	0	1	0	130	580	4	4	0	588
17:15 - 17:30	43	0	0	0	43	87	0	0	0	87	509	2	3	0	514
17:30 - 17:45	34	1	0	0	35	106	0	0	0	106	385	3	3	0	391
17:45 - 18:00	28	0	0	0	28	95	0	0	0	95	367	2	1	0	370
Σ	317	3	0	0	320	776	8	5	0	789	3564	48	25	0	3637

HOURLY FLOW

VEHICLE MOVEMENT

TIME PERIOD	1 Light	1 Heavy	1 Bus	1 Cyclist	1 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ	5 Light	5 Heavy	5 Bus	5 Cyclist	5 Σ
7:00 - 8:00	233	8	0	0	241	506	18	9	0	533	350	12	7	0	369	67	2	0	0	69
7:15 - 8:15	289	9	1	0	299	565	14	10	0	589	363	13	6	0	382	91	2	0	0	93
7:30 - 8:30	350	11	1	0	362	644	13	9	0	666	384	11	7	0	402	127	0	0	0	127
7:45 - 8:45	388	6	2	0	396	694	11	8	0	713	400	8	4	0	412	168	0	0	0	168
8:00 - 9:00	**409**	**11**	**2**	**0**	**422**	**716**	**10**	**7**	**0**	**733**	**412**	**5**	**3**	**0**	**420**	**181**	**0**	**0**	**0**	**181**

TIME PERIOD	11 Light	11 Heavy	11 Bus	11 Cyclist	11 Σ	12 Light	12 Heavy	12 Bus	12 Cyclist	12 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ
7:00 - 8:00	10	1	0	0	11	62	8	0	0	70	1228	49	16	0	1293
7:15 - 8:15	11	1	1	0	13	63	6	0	0	69	1382	45	18	0	1445
7:30 - 8:30	12	0	1	0	13	68	8	0	0	76	1585	43	18	0	1646
7:45 - 8:45	26	0	1	0	27	72	8	0	0	80	1748	33	15	0	1796
8:00 - 9:00	**40**	**0**	**1**	**0**	**41**	**69**	**5**	**0**	**0**	**74**	**1827**	**31**	**13**	**0**	**1871**

VEHICLE MOVEMENT

TIME PERIOD	1 Light	1 Heavy	1 Bus	1 Cyclist	1 Σ	3 Light	3 Heavy	3 Bus	3 Cyclist	3 Σ	4 Light	4 Heavy	4 Bus	4 Cyclist	4 Σ	5 Light	5 Heavy	5 Bus	5 Cyclist	5 Σ
16:00 - 17:00	169	6	1	0	176	583	12	3	0	598	389	10	4	0	403	98	0	2	0	100
16:15 - 17:15	180	4	1	0	185	692	13	4	0	709	407	10	5	0	422	91	0	2	0	93
16:30 - 17:30	**162**	**1**	**1**	**0**	**164**	**747**	**11**	**4**	**0**	**762**	**431**	**8**	**5**	**0**	**444**	**78**	**0**	**2**	**0**	**80**
16:45 - 17:45	154	0	1	0	155	747	6	2	0	755	408	7	7	0	422	59	0	1	0	60
17:00 - 18:00	117	0	1	0	118	700	5	2	0	707	383	4	6	0	393	32	0	1	0	33

TIME PERIOD	11 Light	11 Heavy	11 Bus	11 Cyclist	11 Σ	12 Light	12 Heavy	12 Bus	12 Cyclist	12 Σ	GRAND TOTAL Light	Heavy	Bus	Cyclist	Σ
16:00 - 17:00	125	1	0	0	126	359	8	4	0	371	1723	37	14	0	1774
16:15 - 17:15	176	2	0	0	178	397	7	2	0	406	1943	36	14	0	1993
16:30 - 17:30	**188**	**2**	**0**	**0**	**190**	**404**	**4**	**1**	**0**	**409**	**2010**	**26**	**13**	**0**	**2049**
16:45 - 17:45	191	2	0	0	193	424	1	1	0	426	1983	16	12	0	2011
17:00 - 18:00	192	2	0	0	194	417	0	1	0	418	1841	11	11	0	1863

10.8 Frenchs Forest Transport Studies

(BP REF 65)

/12 **RESOLVED**

Cr Harris / Cr Regan

A. That Council note the contents of the Frenchs Forest Specialised Centre - Strategic Transport Assessment report and the Frenchs Forest Specialised Centre - Local Transport Assessment report, as seen at Attachments 1 and 2.

B. That Council note the infrastructure issues raised by these reports, and these matters, along with the Minister's recent response to Council's draft Housing Strategy be further discussed in a workshop between staff and Councillors at a time to be scheduled forthwith.

C. That Council call on the NSW Government to ensure that the planning and delivery of the Northern Beaches Hospital be a whole of government approach that addresses the issues of health service provision, land uses, sustainability principles as well as traffic and transport.

D. That this Council reiterates the point that no further work on the Housing Strategy will be carried out until Council receives a response from NSW State Government and the response is considered by staff.

CR LAUGESEN LEFT THE CHAMBER AT 6.50PM AND RETURNED AT 6.51PM.

VOTING

For the resolution: Crs De Luca, Falinski, Giltinan, Harris, Kirsch, Regan and Wilkins.

Against the resolution: Crs Laugesen and Sutton.