Upgrading road connectivity between the Illawarra and Greater Sydney

Directed research

Measures to improve reliability and safety of road transport between the Illawarra and Greater Sydney

May 2018

Illawarra Business Chamber

NRMA

vlc Veitch Lister Consulting

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Illawarra Business Chamber/Illawarra First is the Illawarra region's peak business organisation and is dedicated to helping businesses of all sizes maximise their potential.

Through initiatives such as Illawarra First, the Chamber is promoting the economic development of the Illawarra through evidenced-based policy and targeted advocacy.

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Better transport infrastructure has been a core focus of the NRMA since 1920 when our founders lobbied for improvements to the condition of Parramatta Road in Sydney. Independent advocacy was the foundation activity of the organisation and remains critical to who we are as we approach our first centenary.

The NRMA has grown to one of the largest tourism and transport companies in Australia, representing over 2.6 million Australians principally from NSW and the ACT. The NRMA provides motoring, transport and tourism services to our Members and the community.

Today, the NRMA works with policy makers and industry leaders to advocate for transport solutions that help solve key pain points such as congestion, access and affordability and connect people and communities. The NRMA is passionate about facilitating travel across Australia, recognising the vital role tourism plays in supporting regional communities.

By working together with all levels of government to deliver integrated transport and tourism options we can provide for the future growth of our communities and continue to keep people moving for generations to come.

Veitch Lister Consulting

Veitch Lister Consulting Pty Ltd (VLC) is a specialist transport planning and modelling consultancy in Australia. VLC provides the transport planning industry with travel demand forecasting and transport planning advice, based on a solid reputation for providing work of the highest quality, with a focus on solutions that are both practical and technically robust. Its core services comprise multi modal travel demand forecasting and strategic transport planning & policy.

VLC's traffic models are used for strategic planning, toll roads forecasting, outdoor audience measurement and due diligence. VLC has been the consultant of choice to provide demand forecasting for numerous major projects in Victoria and New South Wales as well as assisting the Federal Government with transport advice.

Acknowledgements:
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Foreword

The Illawarra's proximity to Australia's largest city Sydney provides enormous opportunities.

The Illawarra has a skilled and agile workforce, an international-standard port, a world-class university, and a stunning natural environment that make the region an attractive place to live, work and visit.

The road network between the Illawarra and Greater Sydney has not kept pace with the growth in traffic volumes and this is becoming more and more evident. The region is constrained due to the limited number of major roads and a single rail line for freight and passengers. Without intervention, travels times and congestion will steadily increase, resulting in forgone business and employment prospects.

If the region is to leverage the inherent advantages of its location and attributes, efficient and effective transport systems must be at its core. Any constraints on the Illawarra road network are a matter of state significance given it is the third largest economy in NSW.

This study provides a comprehensive analysis of the region's transport connectivity, identifies the challenges facing the Illawarra over the next 20 years, and makes recommendations to ensure the region remains connected to the growing opportunities presented by Greater Sydney, including Western Sydney.

The Illawarra's road network cannot, and should not, be expected to do all the heavy lifting. The expansion and upgrade of the region's road network must also be met with supporting east-west and north-south rail connections and public transport improvements to encourage mode shift and improve connectivity.

Having capable, reliable and safe transport links is the key to our continued economic prosperity.

Adam Zarth
Executive Director
Illawarra Business Chamber

Marisa Mastroianni
NRMA Director
Hoddle Region - South Sydney and the Illawarra

Within the Illawarra, there is currently an over-reliance on one main road and one rail line to the north and one main road to the west.

Contents

Glossary, Modelling Assumptions and Key Terms

GLOSSARY	
AV	Automated vehicles
Appin Road	An 18 km length of arterial road that connects the Princes Highway to Appin with a further 14 kms of road to Campbelltown
BCR	Benefit Cost Ratio
CBD	Central Business District
GDP	Gross Domestic Product
GRP	Gross Regional Product
GSP	Gross State Product
HCV	Heavy Commercial Vehicle
IBC	Illawarra Business Chamber
LCV	Light Commercial Vehicle
LGA	Local Government Area
LoS	Level of Service
Mount Ousley	The escarpment crossing, forming part of the Princes Motorway. The Mount Ousley section of road referred to in the report is the 6 km from the Picton Road intersection to the base of the incline near the University of Wollongong
Mount Ousley Road	A 14 km road incorporating the Princes Motorway from south of Bulli Tops to the base of Mount Ousley (13 kms) and a 1 km section from the Princes Motorway to the Princes Highway at Fairy Meadow
NRMA	National Roads and Motorists' Association
Picton Road	A 37 km road between the Princes Motorway just north of Mount Ousley and Picton (the distance between the Princes Motorway intersection and the Hume Highway intersection is 27 kms and 10 kms through to Picton).
Princes Highway	Arterial road from Victoria to Sydney
Princes Motorway	Freeway standard connection replacing Princes Highway through urban areas. The motorway extends from Waterfall to the north of Albion Park Rail, a distance of around 60 kms
Regional Road	A road that is maintained and administered by the local council and funded with State support
RMS	Roads and Maritime Services
SouthConnex/ F6 Extension	A 30 km freeway connection between the Illawarra and Sydney. Stage 1: 4 km section from Arncliffe to Kogarah, Stage 2: President Ave to Captain Cook Bridge, Stage 3: Captain Cook Bridge to Acacia Road/Loftus Ave, Loftus, Stage 4: Loftus to Waterfall.
State Road	A road that is funded, maintained and administered by the State of NSW
SWIRL	The proposed South West Illawarra Rail Link providing passenger and freight services, incorporating the previous Maldon to Dombarton Rail Line, with connections to the South Coast Line (near Unanderra) and the Main South Line (near Maldon).
TfNSW	Transport for New South Wales
WestConnex	New tolled motorway system comprising upgrades and connecting the M4 and M5

TRANSPORT MODELLING ASSUMPTIONS – BASE CASE	
Rail Services	2021 and 2031 services use current train timetables
Road network Inclusions	2011 as per 2011 road network
2021	WestConnex Stages 1 and 2 operational
	Gerringong to Berry Bypass completed
2031	WestConnex Stage 3 completed
	Albion Park Rail Bypass completed
	Berry to Bomaderry Upgrade completed
Fuel prices	Increase at inflation rate (+1.5%)
Fares	Increase at inflation rate (+1.5%)
Central Area parking charges	Increase at inflation rate (+1.5%)
Value of Time	As per ATAP guidelines. Increases at inflation rate (+1.5%)
Population projections	Department of Planning and Environment 2016 forecasts
Employment projections	From TfNSW Transport Performance and Analytics 2015 Forecasts, 2015

KEY TERMS	
Capacity	The capacity of a road represents the maximum traffic flow possible on a given roadway using all available lanes. The estimated capacity of a road varies depending on the duration of the period for which the capacity is required. Over short periods of up to five minutes, a single uninterrupted lane can carry the equivalent of up to 2,400 vehicles per hour. Over a period of an hour, the capacity would typically be significantly lower, around 2,000 vehicles per hour. The capacity of a road is reduced by the road's grade, the presence of intersections and the number of heavy vehicles that the road carries. The daily capacity of the road is estimated based on the peak capacity of the road and the hourly traffic volumes profile on the road. Generally, the daily capacity is estimated at between 7.5 and 12 times the peak hour capacity. Roads that are busy throughout the day have a higher daily capacity than those that carry only low volumes in off-peak periods. For this study, the daily capacity has been set for individual roads at levels that reflect a point where the delays that would result from volumes over the day approaching the capacity would be unacceptably high.
Crash savings	Average economic costs of crashes of different types are published as well as typical rates of these crashes occurring on different classes of road. These are specified as number of crashes per 100 vehicle kms. For each network scenario, the numbers of crashes of each type on each class of road are estimated by multiplying the volume of vehicles on the road by the length of road. These are then annualised and the result is multiplied by the published rates and costs of crashes and totalled. To get the value of crash savings, we subtract the cost of crashes for the project case from the base case.

KEY TERMS	
Economic benefits	The economic benefits outlined in this report are a combined total of the benefits derived from travel time savings, vehicle operating cost savings and crash savings.
Estimated costs	The estimated costs provided in this report are estimates only based on similar projects, however, are subject to further investigations. The final costs would depend on geology, engineering complexities, requirements for land acquisition and project timeframes.
Economic output	The increase in economic activity that due to an investment (eg. provision of infrastructure).
Travel times	For each of the network scenarios tested, the demand for travel in numbers of trips between origins and destinations are calculated for various market segments: trips to work, shopping, recreation, school, etc as well as business trips and freight trips. The total travel time for each segment is then calculated as the total demand between each origin and destination multiplied by the time the trip takes multiplied by the value of time for that market segment (published by TfNSW in Principles and Guidelines of Transport Infrastructure Assessment). To get the value of travel time savings, we subtract the total travel time value for the project case from the base case.
Vehicle Operating Costs	For each of the network scenarios tested, the demand for road travel is assigned to the road networks. The cost for vehicles travelling along each length of road is then calculated according to average costs for cars, light goods vehicles and heavy goods vehicles per kilometre for the speed at which they travel on the link and the length of the link. The total time for each segment is then calculated as the total volume for each vehicle class on each length of road multiplied by the estimated unit vehicle cost multiplied by the length of road. To get the value of vehicle operating cost savings, the vehicle operating cost for the project case is subtracted from the base case.

1. Executive Summary

The Illawarra Business Chamber (Illawarra First), in collaboration with the National Road and Motorists' Association (NRMA), commissioned Veitch Lister Consulting (VLC) to identify measures to improve road connectivity between the Illawarra and Greater Sydney.

There is an over-reliance on a very limited number of main roads and a constrained rail network. The region's connections are effectively limited to one main road and one rail line to the north and one main road to the west.

The Illawarra is the third largest economy in NSW behind Sydney and Western Sydney, contributing $25.6 billion to the state's economy in 2017. The economy has traditionally been characterised by its strong manufacturing and mining industries, with this focus expected to continue into the future. Manufacturing, construction, mining and logistics account for over a third of the economic output of the Illawarra. As a consequence, the volume and growth of heavy vehicles on the roads are among the highest in NSW.

There will be unprecedented economic activity in Western Sydney supplemented by the new Western Sydney Airport opening in 2026. The opportunities created for the Illawarra by this development underpin the need for additional investment in transport infrastructure.

The **Illawarra** is the third largest economy in NSW behind Sydney and Western Sydney, **contributing $25.6 billion** to the state's economy in 2017.

In addition to population growth, residential and commercial development in the Illawarra and the adjoining regions will have a large impact on transport needs. Residential developments are planned at West Dapto, Shellharbour and Nowra-Bomaderry. To the west, Wilton is a Priority Growth Area located near the Hume Highway and Picton Road junction.

Without intervention, travels times from the Illawarra to Greater Sydney will steadily increase and the **cost of delays** is estimated at **$640 million** per annum by 2031.

There is a high dependence on the road network across the Illawarra. Solutions to improve the Illawarra's transport connectivity require significant investment in road, rail and public transport networks. Without intervention, travels times from the Illawarra to Greater Sydney will steadily increase and the cost of delays is estimated at $640 million per annum by 2031.

In order to address growing congestion and connectivity issues in the region, three priority regional road projects have been identified. These are Mount Ousley Interchange and Widening, Picton Road Upgrade and upgrades to the Princes Motorway at Bulli Tops. These three projects would deliver an estimated total annual benefit of $95 million per year to road users and an additional $125 million in economic output per year to the NSW economy, of which $65 million would be directly attributed to the Illawarra.

Further, major corridor projects including the F6 Extension and the South West Illawarra Rail Link (SWIRL) will greatly improve north and west connectivity.

The NSW Government and Infrastructure Australia have each identified a range of transport projects over the short, medium and long term. There is a large degree of commonality in respect to the projects proposed, however, there are some differences in the timing of individual projects recommended in this study.

Agreement needs to be reached on the timeframes for the three priority regional road projects in order for the appropriate resources to be allocated for planning and construction. It is important the transport connectivity issues identified in this study are not only addressed, but addressed in a timely manner, to ensure the economic growth potential of both the Illawarra and NSW is realised.

2. Introduction

2.1 Study Overview

The Illawarra Business Chamber (IBC) represents businesses in the Illawarra and has instituted a program, called Illawarra First, which aims to advance the economy of the Illawarra region. As part of the program, the IBC has commissioned a series of studies to better understand and communicate the economic opportunities for the region from improved transport connectivity.

The IBC, in collaboration with the NRMA, has undertaken to identify ways to improve the reliability and safety of road transport between the Illawarra and surrounding regions. This study builds on previous work the IBC has commissioned on transport connectivity in the Illawarra, including:

- *Linking the Illawarra*, a report based on work by PwC that made qualitative assessments of transport network deficiencies in terms of services relative to benchmark regions[1].
- *Upgrading Rail Connectivity with Sydney*, a study that developed and assessed measures to improve speed and reliability of rail connectivity between the Illawarra and Sydney, carried out by the SMART Infrastructure Facility, University of Wollongong[2].

Table 2-1 shows diagrammatically how this project fits into the trilogy of studies.

Table 2-1: The place of the project with previous studies

	Rail Connectivity	Road Connectivity
Quantitative studies	Smart Infrastructure Facility (2017) ***Upgrading rail connectivity between Illawarra and Sydney***	Veitch Lister Consulting (2018) ***Upgrading road connectivity between Illawarra and Sydney***
Qualitative study	Road and Rail Connectivity PwC (2014) ***Linking the Illawarra***	

1 Linking the Illawarra: Improving the Region's transport connectivity, 2014
2 Upgrading rail connectivity between the Illawarra and Sydney, August 2017

The aim of this project is to provide a quantitative assessment of road travel demand to better understand road connectivity issues between the Illawarra and Greater Sydney. The main issues addressed include:

- Identification of road and transport related pinch-points, including public transport
- Identification of the impact on productivity, travel patterns and safety in the region
- Identification of projects that have the potential to improve transport connectivity in the short to medium term
- Quantifying the value in improved connectivity with surrounding satellite suburbs and Greater Sydney
- High level assessment of the benefits of these road connectivity improvements for the community and business in the Illawarra and in NSW generally.

PwC's qualitative connectivity study found that the level of road connectivity between the Illawarra and Greater Sydney is materially lower than Australian benchmark regions and their CBDs.

PwC's qualitative connectivity study found that the level of road connectivity between the Illawarra and Greater Sydney is materially lower than Australian benchmark regions and their CBDs. At the same time, there is considerable demand for travel to and from the Illawarra each day. Of particular importance is the demand generated by heavy vehicle movements to and from Port Kembla. Notably, Port Kembla is the main port for the importation of vehicles into Australia and NSW's second largest coal export port. Currently, over 425,000 vehicles are imported annually and this is forecast to grow to as much as 850,000 by 2045. During the week, some 800 heavy vehicles enter and exit the port each day.

2.2 Approach, scope and report structure

This study has used transport modelling to test alternative options for improving road connectivity of the Illawarra. VLC's in-house strategic transport model for Greater Sydney, Zenith (see Appendix B), has been refined for this study to generate demand forecasts under a range of road-connectivity alternatives. The Zenith model covers transport networks and services for the entire Greater Sydney Metropolitan Area, including the regions of the Illawarra, the Central Coast and the Hunter Valley.

A range of potential transport issues have been investigated in this study and although it focuses on roads, the modelling includes public transport. The modelled area encompasses the Greater Metropolitan Area, but the focal point of the study is the Illawarra.

Figure 2-1 shows the location and extent of the study area, which contains the following five Local Government Areas (LGAs):

- Wollongong
- Shellharbour
- Kiama
- Shoalhaven
- Wingecarribee.

In broad terms, the study:

- Shows the Illawarra is an important region in NSW and it is growing steadily
- Shows there are already deficiencies in the road networks and future demand will result in increasing delays
- Considers current and proposed NSW Government projects and their impact on the transport network deficiencies
- Identifies and assesses potential solutions that address the identified deficiencies to evaluate their impact and estimate their benefits
- Develops a recommended program of measures based on the analysis.

The full terms of reference are provided in Appendix A.

Figure 2-1: Location of the Illawarra Study Area

2.3 Key Issues

There is an extensive range of factors that are relevant to the consideration of transport connectivity for the Illawarra as part of this study. These are summarised below:

- The escarpment severely limits transport options for the Illawarra region
- There are only five principal road links in and out of the region: Princes Motorway, Princes Highway, Picton Road, Appin Road and the Illawarra Highway
- The Mount Ousley corridor is the common connector for traffic travelling to the north and west
- The region is serviced by a single passenger rail line, the South Coast Line. The return daily commute to Sydney CBD takes nearly three hours. The travel time to Parramatta and return is around four hours
- Travel times to the Sydney CBD are similar for both road and rail travel. For both modes, travel times over the final third of the journey are considerably slower
- Approximately 17 per cent or 30,600 residents travel to Greater Sydney for work. A further 15,800 travel from outside the region to jobs in the Illawarra. Of the trips between Sydney and the Illawarra, 80 per cent are by road and 20 per cent by rail. For Western Sydney, the corresponding figures are 90 per cent and 10 per cent
- The reliance on road travel demonstrates the limitations of the public transport system
- Travel times along key arterials to Sydney's north and west are expected to increase by around 10 per cent by 2021 and up to a further 15 per cent by 2031 without upgrades to the existing road network
- Over 53,000 vehicles use Mount Ousley and nearly 21,000 use Picton Road each weekday. The percentage of heavy vehicles using these roads is 15 per cent and 25 per cent respectively and is growing at a faster rate than passenger vehicles
- Mount Ousley and Picton Road are forecast to reach capacity in the mid-2020s
- Illawarra's main arterial roads carrying the bulk of traffic are: Princes Highway, Princes Motorway, Memorial Drive and Lawrence Hargrave Drive to the north and Princes Highway, Princes Motorway, Springhill Road, Windang Road, Shellharbour Road, King Street and Five Islands Road to the south
- The main internal roads in the Illawarra generally cope with current traffic volumes although congestion during peak periods is steadily growing across the network. This requires investment in road infrastructure that provides long-term, effective solutions
- The M9 Outer Orbital from the Hume Highway to the Princes Motorway is earmarked for investigation beyond the next 20 years. No new major east-west road link is envisaged before 2040
- Stages 2 and 3 of the F6 Extension (SouthConnex) project from Kogarah to Loftus would provide the greatest benefit for vehicles using the north-south corridor. These stages have been identified for investigation during the next 10 years by the NSW Government
- Infrastructure NSW has noted forecasts that suggest freight movements on the South Coast Line will be displaced entirely by passenger services around 2030. This has significant implications for the road network without an alternative rail link to Greater Sydney.

2.4 Key Findings

The key findings from the study are:

- A number of key road projects need to be delivered within the next 10 years in order to match the expected increase in traffic demand to Greater Sydney
- Transport connectivity is the key to the continuing growth of the Illawarra region as it provides access to the major centres in Greater Sydney and opens up substantial employment and business opportunities
- Increased logistical movements require investment in road infrastructure to accommodate heavy vehicles which support local businesses and industries and key assets such as Port Kembla
- Picton Road is the primary east-west main road from the Illawarra and is expected to reach capacity by the mid-2020s. The Illawarra's economic growth opportunities will be restricted by limited access to the growing areas in Sydney's west and south west. Picton Road should be a high priority for upgrading
- Investment is required to address congestion on the Sydney road network to assist the overall travel times between Illawarra and Sydney. Currently, it takes the same time to travel the final third of the journey to the Sydney CBD as the initial two-thirds
- An alternative major east-west link is required within the next 20 years. Traffic volumes along the east-west corridor are expected to exceed north-south corridor volumes in 2032. An investigation into the feasibility of a new crossing of the Illawarra in escarpment should be undertaken within the next 10 years
- A significant increase in usage of the Illawarra road network is expected due to developments within the Illawarra and surrounding regions. The pressures associated with population growth, residential and commercial developments, increased movements at Port Kembla and the attractiveness of the region as a place to live and visit will directly impact on the road network
- Investment in other transport modes, including rail and public transport options such as Park and Ride facilities will assist with reducing congestion on the roads and encourage mode shift.

Key Findings and Statistics

The return daily commute to Sydney CBD takes nearly

3 hours

Trips between Sydney and the Illawarra

80%

20%

Trips between Sydney and the Western Sydney

90%

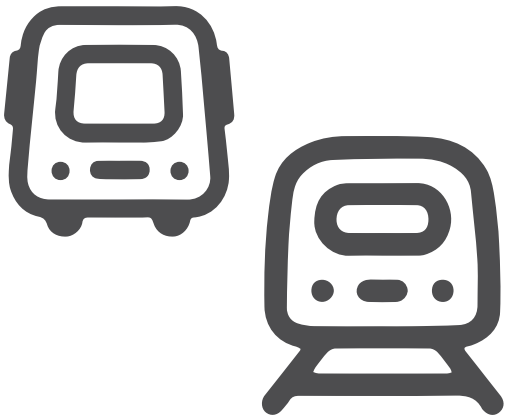
10%

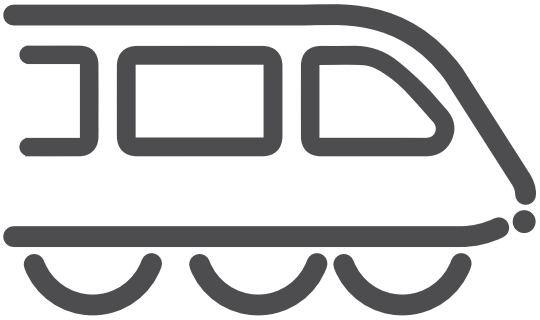
An alternative major east-west link is required within the next

20 years

Traffic volumes along the east-west corridor are expected to exceeed north-south corridor in 2032

Investment in other transport modes, including rail and public transport options such as Park and Ride facilities will assist with reducing congestion on the roads and encourage mode shift





Forecasts suggest that by around

2030

freight movements on the South Coast Line will be displaced entirely by passenger services

Stages 2 and 3 of the F6 Extension (SouthConnex) project from Kogarah to Loftus would provide the greatest benefit for vehicles using the north-south corridor

Mount Ousley and Picton Road are forecast to reach

CAPACITY

mid-2020s

Travel times along key arterials to Sydney's north and west are expected to increase

10% by 2021

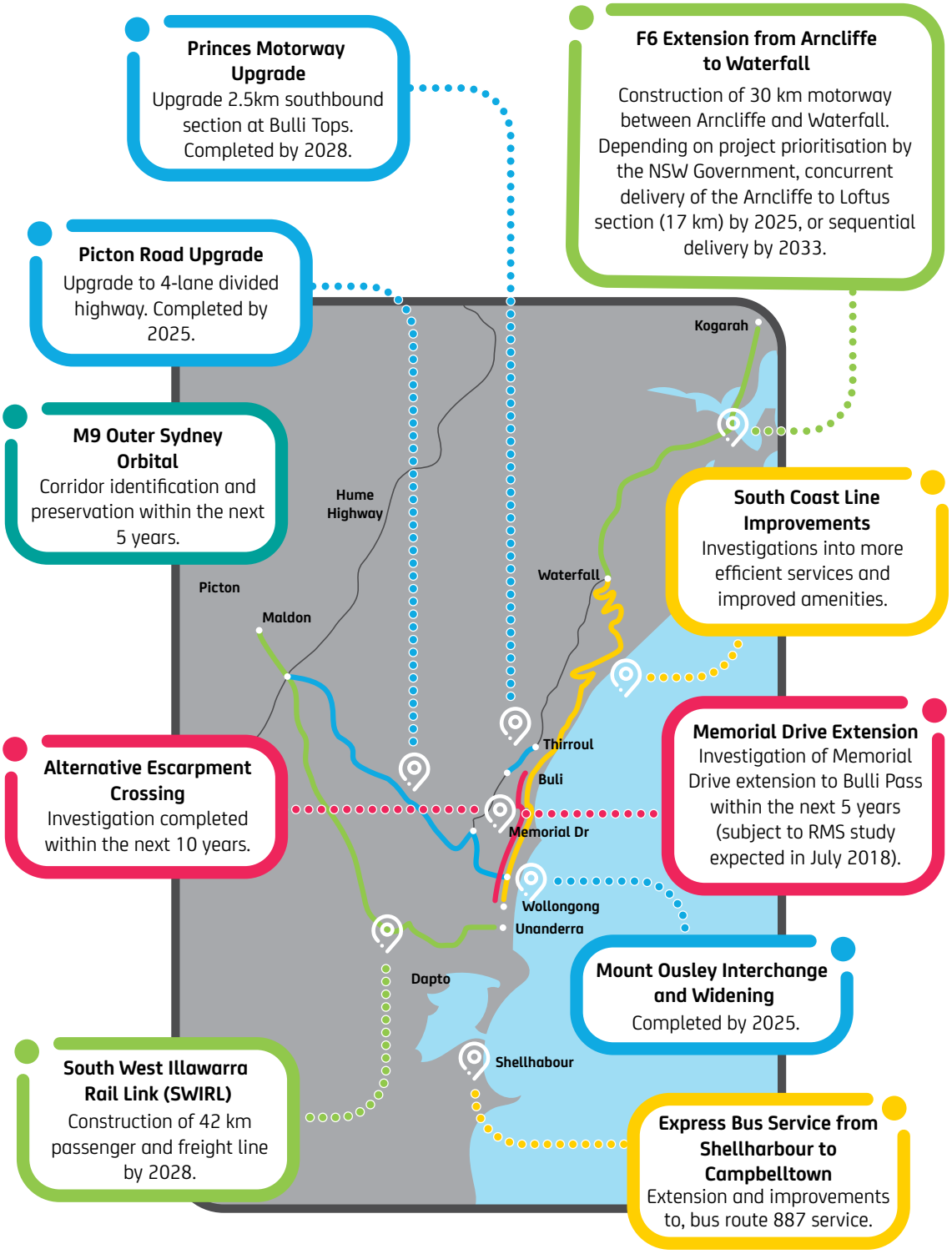
+15% by 2031

2.5 Key Recommendations

This study has identified a range of projects directed at improving the safety, efficiency and reliability of our transport system. While the focus of this study is on the road network which has the biggest impact on the largest number of individual commuters and other travellers, a number of other interrelated public transport projects are highlighted.

The vast majority of projects proposed in this study are the responsibility of the NSW Government. In some cases, joint funding with the Commonwealth Government and/or private sector may be appropriate for the delivery of transport infrastructure. The study draws heavily on the NSW Government's Future Transport Strategy 2056 which reflects the ongoing work of the Roads and Maritime Services' (RMS) investigations, assessments and recommendations about the state of our roads. Further details regarding this Strategy and key projects proposed for the Illawarra are provided in Appendix C. In some instances, this study recommends the earlier commencement of projects based on the relevant findings.

The recommended projects and investigations are outlined in the following diagram. Further details for each of these are provided in Chapter 6.



Park and Ride improvements	Improvements to the commuter parking at Waterfall, Thirroul, Wollongong, Unanderra and Dapto.
Express bus service from Southern Highlands to Campbelltown and Western Sydney	Introduction of new bus services.

Priority Major Coridor Links | **Priority Regional Projects** | **Priority Regional Investigations** | **Key Future Transport Connections** | **Key Public Transport Improvements**

2.5.1 Priority regional road projects

This study has identified three priority regional road projects. The timings for these projects are based on the relevant traffic modelling findings and take into account the capacity of the road, economic benefit, improved connectivity and safety benefits achieved from their completion.

2.5.1.1 Mount Ousley Interchange and Widening

Suggested delivery: Completed by 2025

The interchange component of this project has been committed to by the NSW Government and the preliminary planning phase has commenced. The environmental assessment for the interchange component is now complete and the Submissions Report was published in April 2018. Timing and funding for construction of the interchange upgrade is still to be confirmed. Based on the findings of this study, it is recommended the project be completed by 2025 given this road is expected to reach its estimated peak hour capacity in 2024 and daily capacity in 2026. In conjunction with the upgrade of the intersection at the base of Mount Ousley, the study proposes extending the third lane on the southbound section commencing halfway down Mount Ousley.

In view of the significance of the Mount Ousley corridor for the region's road connectivity, it is recommended that these works be undertaken ahead of the planned upgrade of the Princes Motorway between the Picton Road intersection and Bulli Tops.

Future Transport Strategy 2056 includes the intersection upgrade as a committed initiative in the next 0-10 years.

2.5.1.2 Picton Road Upgrade

Suggested delivery: Completed by 2025

RMS has made improvements to Picton Road in recent years providing much needed safety enhancements with further works planned. However, as the main east-west road corridor to and from the Illawarra, it is critical this road is upgraded to a four-lane divided highway (with provision to include an upgrade to six-lanes). Based on the study findings, it is recommended the project be completed by 2025 given this road will reach its anticipated peak hour capacity in 2022 and daily capacity in 2025.

Future Transport Strategy 2056 includes Picton Road (and Appin Road) improvements as an initiative for investigation in the next 0-10 years.

2.5.1.3 Princes Motorway Upgrade at Bulli Tops

Suggested delivery: Completed by 2028

RMS is planning enhancements to the Princes Motorway between Picton Road and Bulli Tops, aiming to provide a safer and more efficient trip for motorists. The works would reduce the curvature of the bends in the road and widen the road to provide easier passing and less risk of crashes caused by slow moving vehicles. This work is planned over two stages. There is an additional 2.5 kms of road along the southbound carriageway which this study is recommending be considered for upgrading. This is an 80 km/h section on the southbound roadway and has a number of entry and exit points including Appin Road, Princes Highway and Bulli Pass.

This project would also complement any future improvements or upgrades to Appin Road.

Future Transport Strategy 2056 includes upgrading the Princes Motorway between the Picton Road intersection and Bulli Tops (8 km) as a committed initiative in the next 0-10 years.

2.5.2 Priority Regional Investigations

In light of the limitations of the existing escarpment crossings, this study has identified two priority regional investigations intended to identify alternative options to address this issue.

2.5.2.1 Memorial Drive extension to Bulli Pass

Suggested delivery: Investigations within the next five years (subject to RMS study expected in July 2018)

This investigation would assess the feasibility of providing an extension from Memorial Drive to Bulli Pass from its current interchange with the Princes Highway at Bulli. Currently, some 14,000 vehicles use Bulli Pass each day, of which it is estimated more than half of this number also use Memorial Drive.

RMS is preparing the Thirroul to Unanderra Network Strategy which will incorporate the traffic modelling for the Princes Highway through Bulli.

2.5.2.2 Alternative Escarpment Crossing

Suggested delivery: Investigations within the next 10 years

Upgrades proposed in this study for Picton Road and Mount Ousley, as well as improvements to Appin Road, are expected to alleviate traffic congestion until the mid-2030s. Nevertheless, there needs to be an investigation into an alternative crossing of the escarpment to reduce the burden on Mount Ousley in particular. The investigation should consider options that exclude the use of Mount Ousley.

Future Transport Strategy 2056 includes an initiative to investigate an Illawarra escarpment long term solution. This is proposed in the next 20+ years.

2.5.3 Priority Major Corridor Links

The study has identified two priority major corridor links – one road and one rail. These initiatives should be accelerated, as any prolonged consideration will exacerbate congestion and travel times already experienced between the Illawarra and Greater Sydney for passenger and commercial vehicles and result in additional travel time and costs.

2.5.3.1 F6 Extension (SouthConnex)

Suggested delivery: Depending on project prioritisation by the NSW Government, concurrent delivery of the Arncliffe to Loftus section (17 kms) by 2025, or sequential delivery by 2033

This project refers to the 30 km freeway connection between the Illawarra and Sydney.

RMS has commenced planning for Stage 1 (4 km tunnel section from Arncliffe to Kogarah). The greatest benefits for people travelling between Wollongong and Sydney CBD will be realised upon completion of Stage 2 (Kogarah to Taren Point) and Stage 3 (Taren Point to Loftus).

Stage 4 (Loftus to Waterfall) presents challenges due to the de-gazetting of the corridor reservation. The study recommends a number of short-term measures to alleviate congestion on this section of the Princes Highway.

Future Transport Strategy 2056 includes Stage 1 as a committed initiative in the next 10 years. Stages 2 and 3 are included as initiatives for investigation in the next 10 years. Stage 4 is not part of the Future Transport Strategy.

Infrastructure Australia has included the F6 Extension (Connectivity between Wollongong and Sydney CBD) for investigation in the next 5-10 years.

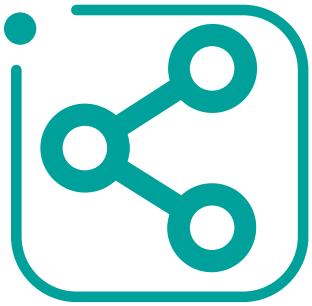
2.5.3.2 South West Illawarra Rail Link (SWIRL)

Suggested delivery: Completed by 2028

Construction of the South West Illawarra Rail Link (SWIRL), as a passenger and freight line, is an important project that will make a substantial contribution to the economic development and prosperity of the region and NSW. In terms of the Illawarra and south west Sydney's overall transport connectivity, it is the missing link. Whereas other large transport projects face huge challenges and costs establishing corridors, the SWIRL incorporates the Maldon-Dombarton rail line corridor. The new rail line should be completed by 2028.

Future Transport Strategy 2056 includes completion of Maldon to Dombarton railway line for investigation in the next 10-20 years.

Infrastructure Australia has included freight rail access to Port Kembla for investigation in the next five years.



2.5.4 Key Future Transport Connection

This study has identified the M9 Outer Sydney Orbital as a key future transport connection

2.5.4.1 M9 Outer Sydney Orbital

Suggested delivery: Investigation leading to the preservation of a corridor within the next five years

The M9 Outer Orbital provides another connection between the Hume Highway and the Illawarra (with direct links to Western Sydney and the Hunter).

The M9 Outer Orbital connection from the Hume Highway to the Princes Motorway is the only major new east–west connection envisaged although it is unlikely to be built before 2040. This timing has major implications for the passenger and freight transport on Mount Ousley, Picton Road and Appin Road over the intervening period.

Early identification of a proposed corridor would greatly assist the future planning and timing of the upgrade of regional roads.

Future Transport Strategy 2056 includes the M9 Outer Sydney Orbital (motorway) from Hume Highway to Illawarra as an initiative for investigation in the next 20+ years.

Infrastructure Australia has included preservation of a corridor for the Outer Sydney Orbital road and rail/M9 for investigation in the next five years.

2.5.5 Key public transport improvements

This study has identified three key public transport improvements.

2.5.5.1 Park and Ride improvements

This study recommends improvements to commuter parking at Waterfall, Thirroul, Wollongong, Unanderra and Dapto as viable short-term measures to encourage greater interchanging and mode shift among commuters and travellers.

2.5.5.2 Express bus service from Shellharbour to Campbelltown via Wollongong

This proposal is aimed at extending this service south to Shellharbour City Centre and reducing the number of stops to provide an express service that would reduce the travel time by 15 minutes.

2.5.5.3 Express bus service from Southern Highlands to Campbelltown and Western Sydney

This proposal is aimed at providing much needed public transport options for the Southern Highlands. This bus service would connect Moss Vale, Bowral and Mittagong with Campbelltown and key locations in Western Sydney. In particular, this will provide greater access to significant employment opportunities in Greater Sydney, noting the high rates of youth unemployment in the Southern Highlands.

2.5.5.4 South Coast Line improvements

Improving operational capacity on the South Coast Line remains challenging. The IBC's Rail Study undertaken by SMART Infrastructure Facility (August 2017) found that substantially reducing travel times on the South Coast Line would involve extensive tunnelling and be expensive.

TfNSW should investigate ways to increase speeds as well as provide capacity and customer service enhancements to the South Coast Line. This should include timetable changes to improve all-station train and bus connections for express services, alongside improvements to station access, shelter and parking, longer trains and localised track improvements. Advanced technologies such as the European Train Control System (ETCS) should also be examined.

3. Profile of the Illawarra's population, growth areas and economy

For the purposes of this study, the Illawarra is defined by the five LGAs of Wollongong, Shellharbour, Kiama, Shoalhaven and Wingecarribee. It is the third largest urban area in NSW totalling 5,620 square kms.

The Illawarra is the third largest economy in NSW and is located just 85 kms from Sydney CBD and 100 kms from Western Sydney (Parramatta), which are Australia's first and third largest economies.

The Illawarra region contributes nearly 4.8 per cent of NSW's economic output, houses 6 per cent of its population and employs around 4 per cent of its workers. As the state's third largest economy, the Illawarra contributed $25.6 billion to the NSW economy in 2017.

As population and employment grows, greater traffic volumes will place additional pressure on the transport network. If not managed appropriately, increased pressure will result in slower travel speeds, unreliable travel times and safety issues, negatively impacting the region's economic performance.

3.1 Population

The Illawarra is the state's third most populous area, being the home to 454,600 people. The region's population is expected to grow to 500,000 by 2050[3]. Based on NSW Department of Planning and Environment forecasts, the population of the Illawarra is projected to grow 0.89 per cent per annum between 2016 and 2021, moderating to 0.81 per cent per annum to 2026.

Approximately half of the Illawarra's population lives in the Wollongong LGA and nearly a quarter in the Shoalhaven LGA. The population density of Wollongong is suburban, whereas the population of Shoalhaven is scattered over a large area. Nowra/Bomaderry is the prominent town centre in Shoalhaven and is home to nearly half of the LGA's population.

The Illawarra region contributes nearly **4.8 per cent** of NSW's economic output, houses **6 per cent** of its population and employs around **4 per cent** of its workers.

3 NSW Department of Planning and Environment, Illawarra-Shoalhaven Regional Plan, 2015 , page 3.

3.2 Growth areas

Transport demand in the Illawarra will be influenced by growth within the Illawarra and the adjoining areas with the closest economic links. Therefore, transport investment will need to keep pace with demand to ensure the Illawarra and nearby regions are able to realise their economic potential.

3.2.1 Growth areas in the Illawarra

The key new growth areas within the Illawarra region are West Dapto, Shellharbour and Nowra-Bomaderry which together have almost 37,600 additional lots expected to be developed over the next 30 to 40 years.

West Dapto is expected to grow through an interconnected series of new settlements that will accommodate nearly 20,000 new dwellings and more than 50,000 people over the next 30 to 40 years. The development is expected to generate more than 8,500 jobs. By 2031, there is the potential for 10,000 new residents.

Shellharbour is expected to grow by more than 300 dwellings per year until 2036. By 2031, it is likely there will be an additional 6,000 dwellings and nearly 15,000 more people will reside in the area.

3.2.2 Growth areas outside the Illawarra

The Illawarra needs to remain connected to growth centres in Greater Sydney and surrounds in order to improve the region's prospects for employment and to enhance its economy.

To the west of the Illawarra, the Wilton Priority Growth Area is located near the junction of the Hume Highway and Picton Road. This development will accommodate up to 50,000 people in around 15,000 dwellings. Development in the area is expected to continue over the next 20 to 30 years. The Bingara Gorge precinct has already been zoned for up to 1,800 homes, with approximately 500 homes delivered so far. By 2031, around 7,000 new dwellings are expected to be located in Wilton.

Planning is underway for the development of land in the corridor between Glenfield and Macarthur. Development will be focused along public transport corridors and add up to 11,000 jobs over the next three decades. Additional land will be released for housing in Menangle Park and Mt Gilead.

There are also several other growth areas identified as part of the Greater Sydney Commission's Western Sydney District Plan[4]. Western Sydney is the fastest growing economy in Australia. It is estimated that an additional 250,000 jobs will be created in this area over the next 20 to 40 years with the potential for more than 100,000 of these new jobs to be available by 2031.

4 Greater Sydney Commission. Our Greater Sydney 2056 Draft Sydney Western District Plan, October 2017

The draft Western Sydney District Plan envisages nearly 200,000 additional dwellings in the District by 2036, housing around 500,000 extra people. The District contains several centres in addition to the Glenfield Macarthur corridor, including:

- Leppington, providing an additional 7,000 to 12,500 jobs
- Campbelltown, providing an additional 10,000 jobs
- Liverpool, providing up to an additional 10,000 jobs
- Greater Penrith, providing around an additional 11,000 jobs
- Western Sydney Airport, which is expected to generate 30,000 new jobs.

Greater Parramatta is the second of the trinity of cities identified by the Greater Sydney Commission and will experience significant growth over the next 20 years. This growth will be guided by the Greater Parramatta Interim Land Use and Infrastructure Implementation Plan[5] (the Interim Plan). The Greater Parramatta area has been identified as a growth area that covers an area of almost 3,500 hectares around the Greater Parramatta area. The Interim Plan provides for more than 72,000 new dwellings and 113,000 additional jobs over the next 20 years. These numbers are likely to increase as infrastructure is delivered and the area develops.

The population of Greater Sydney has grown by 18 per cent between 2006 and 2016, adding an additional 730,000 more people. The population of Greater Sydney was 5 million in 2016 and is expected is expected to grow to 6.2 million by 2031 and 8 million by 2056.

Development in the Sydney CBD[6] is expected to create an additional 250,000 jobs over the next 20 to 40 years with up to 100,000 jobs by 2031.

It is important that Illawarra workers are able to effectively access these growth areas through improved transport connectivity (road and rail) so that they can benefit from these employment and business opportunities.

3.3 Employment

In 2016, Illawarra's population was 454,603 including 177,335 employed residents. Of these:

- 146,748 (82.7 per cent) worked in jobs in the Illawarra
- 30,587 (17.2 per cent) worked in jobs outside the region.

There were a total of 162,519 jobs identified in the Illawarra. Of these:

- 146,748 (or 90.3 per cent) were undertaken by people in the Illawarra
- 15,771 (or 9.7 per cent) were performed by people outside the region.

5 TfNSW, Greater Parramatta Interim Land Use and Infrastructure Implementation Plan, July,2017

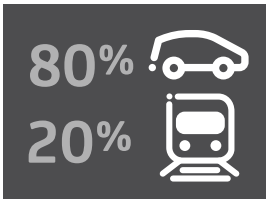
6 Referred to as Eastern Harbour City by the Greater Sydney Commission under the Three Cities concept.

3.4 Travelling to work

In 2016, nearly 30,600 people or 17 per cent of the Illawarra's workforce travelled outside the region for work, with 24,050 of these travelling north and west to Sydney and surrounds. Of these:

In 2016

14,600
travelled north to Sydney CBD and surrounds



9,450
travelled to west and south west Sydney

The major locations for those travelling north includes:

- Sutherland Shire
- St George region
- Sydney Airport, Port Botany and the eastern suburbs of Sydney
- The inner western areas of Marrickville, Ashfield and Leichhardt
- The Sydney CBD and south Sydney.

The major locations for those travelling west includes:

- Appin, Picton, Campbelltown, Minto and Camden
- Liverpool, Parramatta and areas in the M4 corridor to Penrith
- Blacktown and areas in the Windsor Road corridor to Richmond.

For commuters travelling to Greater Sydney, the split is currently 60 per cent north and 40 per cent to the west and south west.

Growth in travel to the west is growing faster than to the north and this is expected to continue with the level of economic activity in Western Sydney.

3.5 The economy

The Illawarra region is the third largest economy in NSW behind Sydney and Western Sydney, contributing $25.6 billion to the State's economy in 2017. Wollongong contributes more than half of the region's GRP, at around $13.4 billion annually. The economy of the Illawarra region has traditionally been characterised by its strong manufacturing and mining industries. Manufacturing, construction, mining and logistics account for over a third (36 per cent) of the economic output of the Illawarra. Transport connectivity is key to these industries and their continuing contribution to the economy of the Illawarra.

However, as these activities have experienced fluctuating demand in recent decades. New economic opportunities have emerged for the region and the economy is in a period of diversification. This change has occurred particularly in businesses such as information and communications technology, high value professional service activities, education and training, health and aged care, transport and logistics, and e-commerce.

The Health Care and Social Assistance sector is the largest employing industry in the region (16 per cent of local jobs), with other major employment industries including retail, education, construction and tourism industries, supporting nearly 45 per cent of local jobs.

The emerging industries are more likely to be generators of light vehicle traffic and more likely to receive freight than generate it. The freight associated with these industries is likely to be less bulky than freight from manufacturers and is more likely to be delivered by smaller commercial vehicles albeit in greater numbers than the heavy vehicle movements that take manufactured goods from factories. The impact of these changes on the Illawarra road network will mean greater volumes of both heavy and smaller commercial vehicles.

A number of other areas are likely to impact traffic flows in/out of the region including:

- Growth in new businesses relocating from expensive land/offices in Sydney
- Growth in tourism - in 2017, the tourism sector supported nearly 10,000 jobs and $1.8 billion annually in output[7]
- Expansion of operations at Port Kembla, which handles significant volumes of the state's steel, grain and coal exports and is the primary import point for Australia's motor vehicles. Currently, 425,000 vehicles are imported into Port Kembla each year and this is forecast to grow to as much as 850,000 by 2045. The port has been identified as NSW's second container terminal for Port Botany
- The growth of the University of Wollongong (UOW) – UOW contributes over $2 billion to the region's output and nearly 8,000 full time equivalent jobs. UOW is in the process of developing a $500 million Health and Wellbeing Precinct
- HMAS Albatross, the naval air station south of Nowra, supports over 2,500 jobs.

425,000

Current number of vehicles imported into Port Kembla each year

850,000

Forecast number of vehicles imported into Port Kembla by 2045

7 2017 estimates, REMPLAN

3.6 The economic benefits of transport connectivity

The Illawarra is poorly connected to other regions, with a single reliable road link (Mount Ousley) and a single passenger rail connection (South Coast Line). Economic growth increases the generation of traffic from both commuter and freight vehicles. The lack of connectivity inhibits the movement of freight into and out of the region and hinders development.

Economic opportunities for the Illawarra region can be enhanced by improved transport connectivity through:

- Greater access to employment opportunities, particularly through assisting residents to work at higher income jobs in Sydney
- Making the Illawarra a more attractive place to live, through better connectivity, which in turn could improve industry opportunities through residential and commercial construction and ongoing service and retail opportunities
- Making the Illawarra a more attractive place to work and do business through improved accessibility to support the location of more business headquarters, government departments and tourism operators and visitors
- Better connections for freight will lower the costs of doing business, particularly for Port Kembla.

The growth of Greater Sydney means the Illawarra is not only a place of residence for those who work in Greater Sydney but also a source of workers, goods and services to support this growth.

A Federal Government's parliamentary inquiry into the role of transport connectivity on stimulating development and economic activity (2016) detailed a large body of research that shows transport accessibility is fundamental to the labour catchment for firms, the retail catchments of stores, the health and well-being of the labour force and community, and the education opportunities provided for young people. Areas rich in transport connectivity, accessibility and mode choice correlate strongly with areas rich in jobs, services and community infrastructure, and that improved transport connectivity provided:

- Access to jobs and services for individuals
- Access to markets, suppliers and workers for business
- Reduced the cost of doing business through travel time savings and reduced vehicle operating costs
- Development of land toward higher value uses, due to improved access to local, intrastate, interstate and international customers and suppliers.

The Inquiry also found that transport infrastructure in regional cities and towns plays a key role for regional centres as service access hubs and nodes in the national transport network. Transport connectivity raises competition in markets which stimulates and shifts economic activity. Improving transport allows regional communities to access new markets, providing the opportunity and the challenge of operating in a more competitive environment.

Based on this report, it is very likely that the low level of accessibility into and out of the Illawarra contributes to the lower level of economic growth of the region.

It is very likely that the low level of accessibility into and out of the Illawarra contributes to the lower level of economic growth of the region.

The Illawarra cannot rely on road connectivity alone to serve a growing population and increased freight movements in and out of the area. The SWIRL, which would service passengers and freight, has been identified as a major corridor link between the Illawarra and south west Sydney and beyond. Modelling on the impact of SWIRL has revealed the project would attract car users and travellers from the South Coast Line. The reduction in car demand would lead to reduced congestion and improved travel times on roads.

In addition, the diversion of freight onto the SWIRL would reduce heavy vehicle movements from the road network, leading to improvements in traffic volumes on the road. Mount Ousley would, in particular, benefit from the volume reductions provided by the SWIRL.

In summary, improvements to the transport connectivity of the Illawarra is needed to:

- Ensure the Illawarra's continuing contribution to the NSW's financial growth as the third largest economy in the state
- Provide the growing population and labour force in the Illawarra with access to a greater variety and number of jobs in regions outside the Illawarra
- Support operations of Port Kembla and the transport of imported and exported goods
- Provide better access for the 30,600 Illawarra residents who work outside the region and contribute to the broader NSW economy
- Provide better access for the 15,800 workers commuting to the Illawarra for work
- Support the development of new commercial and residential opportunities
- Accommodate the changing nature of traffic that results from the diversification of the region's economy
- Encourage further growth of the tourism sector.

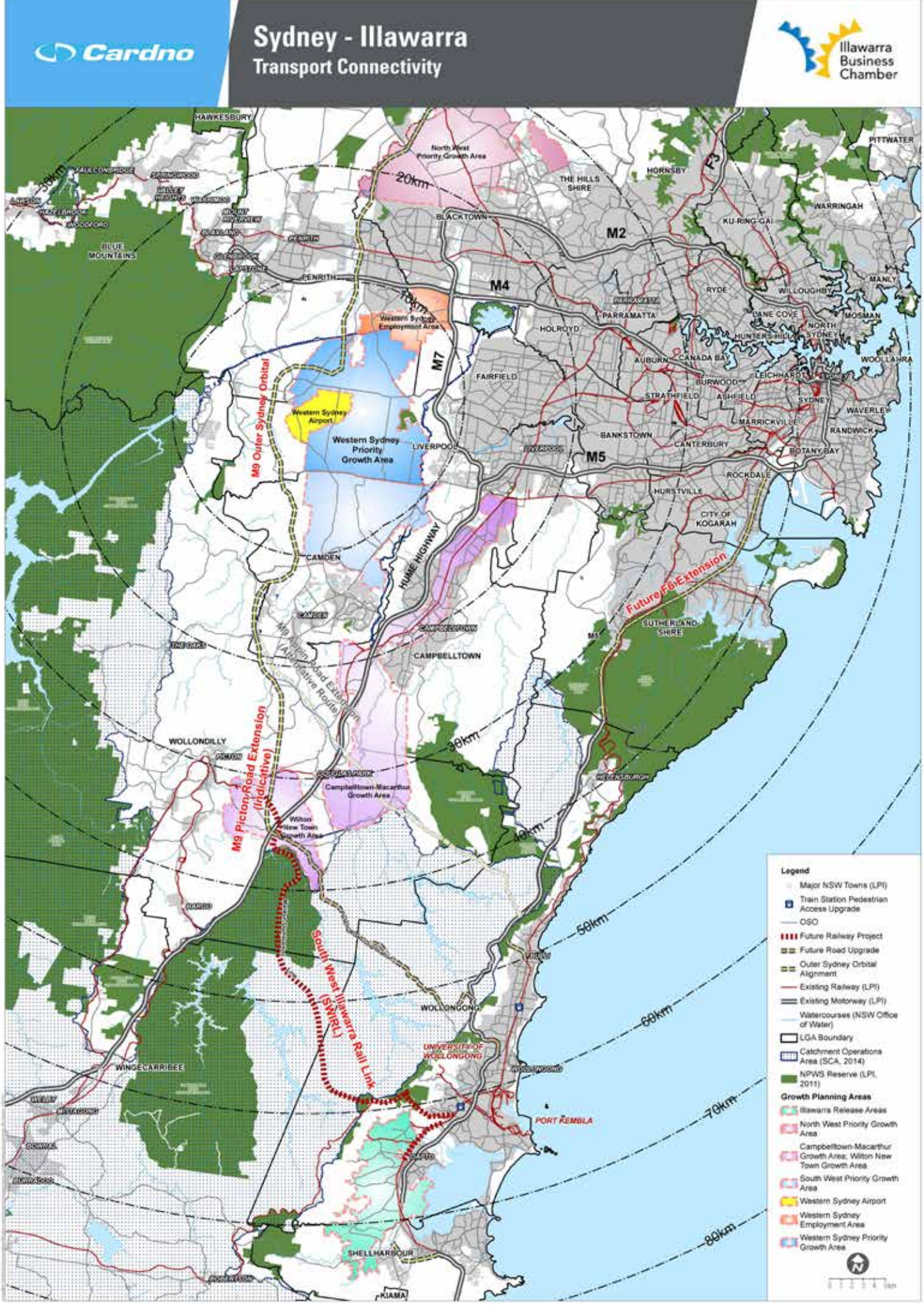


Figure 3-1: Map of major transport links and growth areas in the Illawarra and Greater Sydney

4. Illawarra's Transport Networks

The Illawarra's transport networks are focused in a north-south direction, principally towards the Sydney CBD. This is expected to continue in the foreseeable future, with traffic movements along this corridor in excess of 45,000 on weekdays and expected to grow to 51,400 by 2031. Reflecting the strong growth in Western Sydney, travel volumes in the east-west corridor direction which are currently in excess of 32,000 are forecast to increase to nearly 46,000 by 2031.

The Illawarra's escarpment is the single most prominent feature in the Illawarra region. It varies in height from 400m to 700m. Road transportation dominates most movements in and out of the region. This is partially due to the fact there is only one rail line, the South Coast Line, connecting the Illawarra to the Sydney CBD, with travel times from the region's north not dissimilar to road travel times.

The slopes of the escarpment are steep and unstable and roads across it require regular maintenance, which forces their closure. Landslips have occurred during extended wet periods which have also resulted in the closure of roads in the area, especially Bulli Pass. The escarpment limits the number of crossings and directness of east-west transport connectivity.

All transport links that connect the Illawarra (apart from Wingecarribee) to other regions have to cross the Illawarra escarpment. For Wingecarribee, access to Port Kembla and Wollongong requires crossing the escarpment.

Improvements in bus and Park and Ride facilities will assist in improving transport connectivity and encouraging mode shift. However, the majority of the projects that are likely to provide the greatest benefit to individual users relate to the road network. In the absence of concurrent investment in rail infrastructure and public transport, those benefits will be progressively eroded.

PwC[8], in a qualitative assessment of the transport networks in the Illawarra, identified several significant deficiencies in the existing Illawarra road network. As shown in Table 4-1, these include:

- Road coverage (as defined by PwC) between the Illawarra and western areas (Ingleburn and Bowral)
- Travel speed (as defined by PwC) for cars between the Illawarra and Sydney's western areas
- Travel speed for freight between the Illawarra and Ingleburn
- Travel speeds for cars between the Illawarra and the Sydney CBD.

In this table, road coverage is measured as the percentage of the journey between origin and destination that can be completed by freeway, arterial or other road. A total journey completed by freeway scores 5, a total journey with no freeway or arterial scores 1. The road speed is based on the distance between origin and destination and the time it takes to complete the journey between them. An average speed of 80 km/h or more scores 5, an average speed of less than 50 km/h scores 1.

8 Linking the Illawarra, PwC, 2014

PwC's analysis of the road network identifies the following deficiencies:

- The road network connecting the Illawarra to Ingleburn (Western Sydney) is of an inadequate standard and speeds are unacceptably low
- The road network connecting the Illawarra to Sutherland and the Sydney CBD is adequate in coverage but travel speeds are unacceptably low
- Travel speeds for freight vehicles are unacceptably low.

Table 4-1: Qualitative assessment of transport network connectivity

Connectivity Attribute	External				Internal			Total
Origin - Destination	Wollongong ⇔ Sutherland	Wollongong ⇔ Ingleburn	Wollongong ⇔ Sydney CBD	Shellhabour ⇔ Sydney CBD	Wollongong ⇔ Shellharbour	Wollongong ⇔ Nowra	Wollongong ⇔ Bowral	
Road Coverage	4.1	3.0	4.0	3.9	4.0	3.3	3.8	3.7
Rail Coverage	5.0		5.0	3.0	3.0	1.0	1.0	3.0
Freight Rail Coverage		1.0						1.0
Network Coverage	4.6	2.0	4.5	3.5	3.5	2.2	2.4	2.6
Road Speed (Passenger)	2.0	1.0	1.0	1.0	2.0	3.0	2.0	1.7
Road Speed (Freight)		2.0						2.0
Public Transport Speed	3.0		3.0	2.0	3.0	4.0	2.0	2.8
Public Transport Quality	4.3		4.3	3.0	2.8	2.0	2.5	3.1
Service Quality	3.1	1.5	2.8	2.0	2.6	3.0	2.2	2.2
Weighted Scores	2.9	1.8	2.7	2.1	2.4	2.1	1.8	2.4

Source: Linking Illawarra: Improving the Region's transport connectivity, PwC (2014)

	Drivers travel at desired speed, and manoeuvre freely, experiencing no delay due to other traffic
	Drivers will incur occasional minor delays and restrictions to manoeuvre due to other traffic
	Drivers will experience interrupted travel, with minor delays and stops, but with network operating efficiently providing predictable travel times
	Drivers will experience occasional major delays, with variable travel times due to conflicting traffic and volumes approaching capacity
	Drivers will experience frequent major delays, with volumes at or exceeding capacity for short periods, unpredictable travel times
	Drivers will experience severe congestion and delays, with volumes exceeding capacity for long periods, strong influence on route choice
	This is an additional level of service category, developed in research for planning and long term forecasts of demand and capacity and indicate and area where demand definitely exceeds capacity

4.1 Road Network Assessment

The PwC assessment of the road network coverage was based on the standard of road available to freight and private vehicle users and the extent of this standard between origins and destinations. Assessment of road speed for private vehicle travel was based on road directness and congestion during peak times. Speed of freight travel used non-peak congestion, road grade and directness as the assessment criteria.

The assessment for road network coverage to Sutherland and Sydney CBD was based on the standard of road networks. From the Illawarra to Waterfall, the road is mainly a high standard motorway. From Waterfall to the Sydney CBD, the road network comprises multi-lane arterials, with several route options that cross the Georges River across Alfords Point Bridge, Tom Ugly's Bridge at Sylvania at Taren Point or Captain Cook Bridge. Posted speed limits north of Waterfall range from 60 km/h to 100 km/h with an average limit of 70 km/h for the majority of the journey. Together with congestion, travel speeds to Sydney CBD are severely reduced.

To the west, the PwC assessment of the road coverage was based on the lack of high quality freeway or dual-carriageway road, with Picton Road and Appin Road both being mainly single carriageway rural roads. Speeds are constrained by road geometry and limited overtaking opportunities noting safety and other improvements have occurred in recent years.

Wingecarribee's connectivity to the Sydney CBD or Western Sydney was not separately addressed, but road coverage and speeds would be more highly rated than that of the rest of Illawarra. Wingecarribee is close to the Hume Highway and there are motorway connections via the M5 and other motorways that provide good access to the Sydney CBD and Western Sydney.

4.2 Key roads in the Illawarra

Mount Ousley (as defined in this study) forms part of the Princes Motorway corridor over a distance of 6 kms. It is steep, and rises by nearly 420 m, with an average grade of around 6 per cent. It has a divided carriageway, and for the steepest parts of its length (between Mt Pleasant and top of Mount Ousley 1 km south of the interchange with Picton Road) it has three lanes in each direction. Halfway down Mount Ousley, the southbound carriageway reduces to two lanes. It is the single most important connection to and from the Illawarra because:

- It provides access via the Princes Motorway:
  - to the north (Sutherland and Sydney)
  - to Picton Road and Appin Road to provide access to the west (Hume Highway, Campbelltown and Western Sydney)
- It is the only suitable route for heavy freight vehicles, especially multi-trailer vehicles, across the escarpment
- It functions as a major freight, commuter and tourist route.

The spine of the road network in the Illawarra is the Princes Highway/Motorway, which runs from the Victorian border through the Illawarra and Sutherland, and to Ultimo, south of the Sydney CBD.

Picton Road, and to a lesser extent Appin Road, provide access to the western areas.

Picton Road runs 27 kms from just north of Mount Ousley to the Hume Highway and continues westwards a further 10 kms to Picton. Picton Road provides an important connection to the growth areas in the south west and west of Sydney, including Parramatta, Campbelltown and Badgerys Creek. The majority of the length of Picton Road is single lane, with some 8 kms of passing lanes in both directions at intervals.

Appin Road connects Bulli Tops, around 8 kms north of the Picton Road interchange with the Princes Motorway, to Appin and Campbelltown. Appin Road has a length of 18 kms between Appin and the Princes Motorway at Bulli Tops and includes a further 14 kms to Campbelltown. For the majority of its length, it has a single carriageway in both directions.

Bulli Pass also crosses the escarpment, connecting the Princes Highway at Bulli to Bulli Tops. It is less than 4 kms long and rises 320m in elevation, with an average grade of 8 per cent. The ground through which it runs is highly unstable and Bulli Pass is subject to closure, either due to rock falls or for maintenance. Southbound travel is only a single lane and the climb up Bulli Pass is on a double lane road except for the last kilometre.

The Illawarra Highway runs 60 kms from the Princes Highway at Albion Park Rail to the Hume Highway west of Moss Vale. Its entire length is within the Illawarra, but provides opportunities to connect with areas north and west, especially from the south of the Illawarra. Macquarie Pass has steep sections and small radius curves and is not suitable for articulated heavy vehicles. For nearly its entire length, it is a single road in both directions.

4.3 Current Traffic conditions

Traffic counts, published by RMS, at key locations are shown in Table 4-2. This table shows that the heavy vehicle content of traffic on Mount Ousley and Picton Road is high, at around 15 per cent and 25 per cent respectively. In each of the last two years, heavy vehicle volumes have grown at an average of 6 per cent on Mount Ousley and 7 per cent on Picton Road.

Mount Ousley already operates at capacity for short periods each day and has almost reached its practical daily capacity.

The heavy vehicles on the steep grades of Mount Ousley severely constrain the capacity of the road. Current volumes, at over 53,000 vehicles, indicate Mount Ousley already operates at capacity for short periods each day and has almost reached its practical daily capacity. As a general rule of thumb, a six-lane highway has a practical daily capacity of about 50,000 to 60,000 vehicles per day.

The study could not identify a road similar to Picton Road elsewhere in NSW that carries 20,000 vehicles per day with a heavy vehicle proportion as high as 25 per cent. The Hume Highway near Gundagai carries half the daily volume that Picton Road does with a similar heavy vehicle proportion, but is of freeway standard with two lanes in each direction. The Hunter Expressway near Sawyer's Gully carries a similar daily volume to Picton Road, but only 15 per cent of these are heavy vehicles. The expressway is also a high standard road.

Over the past five years, Picton Road has been improved in certain sections, to address specific traffic and safety issues. Traffic counts are only available from 2015 onwards and the short term counts indicate that daily traffic volumes are increasing at around 7 per cent to 8 per cent per year for total traffic. Present volumes are between 10,200 and 10,600 in each direction. Heavy vehicle volumes are growing at the same rate.

Daily traffic volumes on Appin Road are about half of those along Picton Road and have not increased over the past five years. This appears to indicate Appin Road is not as significant in the east-west connectivity as Picton Road, which connects directly to the Hume Highway.

At the northern end of the Illawarra, at Waterfall, the Princes Motorway carries around 45,000 on a weekday. The four-lane road carries 11,700 vehicles during the 4-hour morning peak. Annual growth of traffic at Waterfall is slow.

An average 800 trucks enter and exit Port Kembla each weekday and this is forecast to progressively increase with the majority of trucks associated with vehicle imports and coal exports. Counts on key roads connecting the Illawarra in Table 4-2 show the traffic volumes, especially heavy vehicle traffic, are growing strongly on roads that are key to the connectivity of the Illawarra.

Table 4-2: Counts on key roads connecting the Illawarra

	Location	Year	North /East Bound	South/ West Bound	North West Bound Heavy Vehicles	South East Bound Heavy Vehicles
Daily	Princes Motorway, Waterfall	2011	21,300	22,100	-	-
		2016	21,400	23,600	-	-
	Mount Ousley	2011	22,300	22,700	14%	15%
		2016	26,700	26,500	16%	17%
	Bulli Pass*	2012	5,900	6,300	5%	5%
		2014	6,300	6,800	5%	5%
	Picton Road	2015	9,200	8,800	25%	25%
		2017	10,600	10,200	25%	25%
	Appin Road	2011	5,400	5,200	-	-
		2016	5,400	4,900	-	-
AM Peak (6am to 10am)	Princes Motorway, Waterfall	2011	7,600	3,900	-	-
		2016	7,500	4,200	-	-
	Mount Ousley	2011	6,300	5,500	14%	16%
		2016	7,700	6,000	16%	19%
	Picton Road	2015	1,700	1,900	38%	33%
		2017	2,500	2,700	40%	32%
	Appin Road	2011	1,300	1,800	-	-
		2016	1,200	1,100	-	-
Average Annual Growth Daily traffic	Princes Motorway, Waterfall		1%	-1%	-	-
	Mount Ousley		4%	3%	-	-
	Bulli Pass		3%	4%	-	-
	Picton Road		7%	8%	-	-
	Appin Road		0%	-1%	-	-
Average Annual Growth Heavy Vehicles	Princes Motorway, Waterfall		-	-	-	-
	Mount Ousley		6%	6%	-	-
	Picton Road		7%	8%	-	-
	Appin Road		-	-	-	-

* Counts on Bulli Pass are unreliable due to uncertainty around closures

Source: RMS Traffic Counts

4.4 Freight

The main industries that generate the need for freight transport are the manufacturing, construction, mining and transportation industries and account for 36 per cent of the region's economic output. Table 4-3 shows the daily heavy vehicle volumes at key locations.

Table 4-3: Daily heavy vehicle volumes on key roads connecting Illawarra

	Location	Year	Weekday Volume
Weekday Daily Volume	Princes Motorway, Waterfall	2011	1,750
		2016	3,630
	Mount Ousley	2011	6,480
		2016	8,500
	Picton Road	2011	2,650
		2016	5,200
	Bulli Pass	2011	700
		2015	800
Average Annual Growth	Princes Motorway, Waterfall		15%
	Mount Ousley		5.5%
	Picton Road		14%
	Bulli Pass		3.5%

Source: RMS Traffic Counts

The principal road freight route for heavy vehicles is along Mount Ousley and Picton Road to the Hume Highway, which then provides access south to Victoria and north to Sydney.

Rail freight services connect to the north (Port Botany and beyond) on the South Coast Line, sharing the track with passenger services. Freight trains are allocated up to 23 services per day and restricted to operating outside peak commuting times which often creates delays.

Freight services also operate on the Unanderra to Moss Vale Line, a dedicated freight track. These services primarily move goods to and from Port Kembla, including coal and grain.

Table 4-4 shows that Greater Sydney is Illawarra's dominant destination and origin for the transport of freight. Queensland is the origin of 8 per cent of heavy vehicle trips that end in Illawarra, while 7 per cent come from the ACT and western NSW. Victoria and Queensland are equivalent in terms of destinations of Illawarra freight trips at 2.5 per cent.

Greater Sydney is Illawarra's dominant destination and origin for the transport of freight.

Table 4-4: Where commercial vehicles come from and go to

	Origins (%)	Destinations (%)
Sydney	85.0	90.0
Victoria	0.0	2.5
Queensland	8.0	2.5
Other	7.0	5.0

Source: ABS 2014 Road Freight Movements Database

4.5 Tourism and weekend travel

Tourism is a vital industry for the Illawarra and drives different demands than everyday traffic. While the modelling and suggested improvements in this report predominately focus on weekday travel patterns during peak commuter period, the tourism industry's needs extend beyond the working weekday. Between March 2012 and March 2016, the number of visitors to the Illawarra increased by around 500,000 per year, representing an annual increase of nearly 4 per cent per year.

Currently, it is estimated that tourism in the Illawarra provides employment for more than 10,000 workers and generates $1.84 billion in output. This amounts to $184,000 per worker in output and places it as one of the more high-yielding industries in the Illawarra. The industry contributes more than four per cent of the Illawarra's total economic output.

The south coast of NSW including Wollongong, Shellharbour, Kiama and Jervis Bay received over 3.8 million domestic overnight visitors for the year to September 2017 – up by 7.7 per cent from the previous year. Visitors spent nearly 11.8 million nights in the region – an increase of 5.9 per cent on the previous year.

By comparison, the region also received 171,900 international overnight visitors - up by 23.2 per cent on year ending September 2016. Visitors spent nearly 2.8 million nights in the region – an increase of 29.8 per cent on the year ending September 2016.

Over nine million trips to the South Coast were made by car in 2016-17, with 98 per cent of these trips being made by domestic overnight or day trip visitors.

Sydney (45.3 per cent) was the largest source of visitors to the region, followed by regional NSW (28.5 per cent) and the ACT (12.4 per cent). Compared to the year ending September 2016, the Sydney source market grew by 17.1 per cent.

'Holiday' (56.4 per cent) was the largest purpose of visit for visitors to the region, followed by 'visiting friends and relatives (VFR)' (33.0 per cent) and 'business' (6.0 per cent). Compared to the year ending September 2016, visitors who travelled for 'holiday' grew by 3.0 per cent and 'VFR' increased by 14.5 per cent while 'business' grew by 20.1 per cent.

The peak demand for non-weekday travel on the road network in the Illawarra predominantly occurs on the Easter weekend, with Easter Monday recording peak volumes. The Easter and Christmas periods and long weekends account for the majority of the 3.8 million visitors to the South Coast of NSW, most of whom either stop or pass through the Illawarra.

While it is uneconomical and impractical to design a road network for a single weekend, the road network needs to accommodate more widespread tourist demands, notably on weekends.

Table 4-5 indicates weekend average daily traffic volumes on key roads connecting the Illawarra which are currently accommodated by the capacity of the road network. Generally, volumes are around 20 per cent to 30 per cent lower than weekday volumes. However, counts for the Princes Highway at Bombo, which is a popular tourist route, indicate that the traffic has grown by an average of 3 per cent per annum over the period between 2011 and 2016.

Weekend traffic volumes are more variable than weekday traffic because most weekend travel is discretionary. Factors such as weather impact weekend traffic more than on weekday, causing more fluctuation.

The daily profile on weekends tends to be more spread across the day than on weekdays, with peak periods occurring between 10 am and 2 pm. The peaks are influenced by shopping and recreational travel and are also highly dependent on special events, like sporting events. Most of the weekend traffic, however, is generated by local households and businesses.

Table 4-5: Weekend average daily traffic volumes on key roads connecting Illawarra

	Location	Year	Volume
Daily	Princes Motorway, Waterfall	2011	41,000
		2016	44,800
	Mount Ousley	2011	40,600
		2016	47,400
	Picton Road	2011	10,800
		2016	16,700
	Princes Highway, Bombo	2011	31,600
		2016	35,900
Average Annual Growth Weekend Traffic	Princes Motorway, Waterfall		1%
	Mount Ousley		3%
	Picton Road		9%
	Princes Highway, Bombo		3%

Source: RMS Traffic Counts

Other roads in the region are also subject to weekend tourist traffic and have implications for the travel by local residents. Traffic along Grand Pacific Drive and Lawrence Hargrave Drive can be significant on weekends. Lawrence Hargrave Drive, a single land road through mainly residential areas, can struggle to handle the extra volumes of traffic. Local traffic congestion at the Seacliff Bridge (Coalcliff and Clifton) and Thirroul is a potential concern. Consideration should be given to appropriate parking arrangements in these areas to facilitate visits by tourists and lessen the impact on local residents.

The Princes Highway at Albion Park Rail is another example of a road that is significantly affected by holiday and tourism travel. With the completion of the Albion Park Rail Bypass by 2022, travel times will be reduced.

4.6 Road Safety

Between 2006 and 2015, there were 121 lives lost on Illawarra roads. While there was a decline in the number of lives lost over the period of nearly 20 per cent[9], the NRMA estimates the cost of this tragic loss of life to the community is nearly $900 million.

Although the numbers of moderate and minor injuries decreased by 8 per cent and 21 per cent respectively, the number of serious injuries increased by nearly 4 per cent. The total cost of crashes between 2011 and 2015 inclusive in the Illawarra has been estimated as nearly $2 billion, an average of around $370 million per year.

$2billion

Estimated total cost of crashes from 2011 to 2015 inc. in the Illawarra

(an average of around $370 million per year.)

Crash rates derived from data provided by RMS show that rates on roads connecting the Illawarra to other regions are not higher than the average for roads in NSW. In Figure 4-1, higher average crash rates are shown in colours other than green. The plot only shows rates for the principal connecting roads in the area and indicates that the highest crash rates on key roads on the network. Table 4-6 provides details for each road for the period 2012 to 2016.

Table 4-6: Crashes on key roads by year

Crashes on Key Roads By Year						
Road	**2012**	**2013**	**2014**	**2015**	**2016**	**Total**
Picton Road	15	15	28	13	19	90
Appin Road	18	13	13	5	7	56
Princes Highway, north of Bulli Tops	8	5	7	5	4	29
Bulli Pass	6	14	9	4	5	38
Mount Ousley	12	24	16	24	16	92
Macquarie Pass	27	35	30	30	13	135

Source: RMS

9 NRMA, The Cost of Crashes, May 2017

A recent study by GIO Insurance based on more than 6,000 Compulsory Third Party (CTP) insurance claims in NSW from September 2016 to October 2017 across Wollongong, Shellharbour and Kiama revealed that Sundays are the worst day of the week for accidents, followed by Wednesdays. The times of accidents were spread throughout the day. Table 4-7 and Table 4-8 below provide a breakdown.

Table 4-7: Accident claims by day

Day	Percentage (%)
Monday	13
Tuesday	8
Wednesday	20
Thursday	9
Friday	18
Saturday	12
Sunday	21

Table 4-8: Accident times of day

Time of Day	Percentage (%)
Early morning	6
Morning peak	22
Morning	21
Afternoon	26
Evening peak	21
Night	4

Figure 4-1: Crash rates between 2012 and 2016

4.7 Public transport and other alternative modes of transport

Encouraging mode shifts and interchanging to take additional pressure off the road network will be essential to accommodate future population growth.

Road and rail are the primary forms of transportation in the Illawarra. However, improvements to the network must also be met with supporting mass transit options to facilitate the movement of a large proportion of both commuters and visitors each day to reduce congestion.

Encouraging mode shifts and interchanging to take additional pressure off the road network will be essential to accommodate future population growth. This will not be possible without significant improvements to rail connectivity, bus services and expanded Park and Ride facilities. These solutions are discussed further in Chapter 6.

The advancement of technology and the search for ways to improve congestion brings the potential of alternative modes of transport. These include both connected and autonomous vehicles (CAVs), ride share and the possibility of flying cars, such as those being investigated by Uber. Further, water connectivity via a ferry service between Wollongong and Sydney is currently being investigated by the NRMA.

4.7.1 New Technology and Innovation

The advent of new technology has the potential to revolutionise travel, transport and tourism. In recent times, the smart phone has given us unprecedented access to information and spurred the sharing environment, allowing the use of new services and options such as ride share and car share. A further progression of this changing mobility model will be the imminent arrival of connected and automated vehicles (CAVs).

CAVs will undoubtedly transform the way we move around. By facilitating the provision of affordable, convenient and synergised mobility solutions to people in urban, regional and rural areas, including those who are less mobile, a safe, sustainable and desirable transport future is possible.

Like Park and Ride, fully automated on-demand cars, taxis and shuttles will help solve the troublesome ‘first-mile last-mile’ transport access dilemma by acting as feeder services, linking people with public mass transport in an efficient and convenient manner.

Consequently, door-to-door transportation solutions will be presented as real alternatives to private car journeys, making individual vehicle ownership far less necessary and desirable.

The benefits of this shared and automated mobility future are immense; improved safety, accessibility and productivity are achievable in conjunction with reduced costs, congestion and emissions.

While private car ownership will continue its dominance in the immediate future, CAV technology will eventually revolutionise transport access, leading to the provision of mobility options that support inclusion and participation. Connecting homes, holiday locations and places of work with buses, trains and ferries will lead to greater efficiencies and encourage economic activity and visitation.

To realise such a mobility system, however, convenient, seamless and integrated connections are critical to encourage mass transport use and integrated mobility networks. Further, encouraging acceptance among the community through trials will be necessary to support this mode shift.

Heavy vehicles will also be affected by the advent of CAV technology, though not in the same way. Non-light passenger vehicles and freight movers will continue to require full access to roadways for the foreseeable future, however greater efficiencies and improved safety are expected through increased automation, integration, platooning, smart highways and drone deliveries.

4.7.2 Ferry services between Wollongong and Sydney

Coastal and harbour waterways offer untapped potential to increase and expand passenger and freight movements beyond the road and rail network. Passenger ferry services, which currently operate on major waterways, including Sydney Harbour and its tributaries, Pittwater, Brisbane Water, Port Hacking, Clarence River, Hawkesbury River and the Hunter, are provided through government and the private sector. In most instances, these services offer safe, convenient and desirable travel, and act as an additional transport option for commuters, visitors and tourists. While some key routes and locations are well serviced, opportunities exist to make better use of prominent waterways.

Establishing a passenger ferry service between the Illawarra and Sydney Harbour would provide a direct and picturesque travel option while alleviating pressure on the road and rail network.

A ferry between Wollongong and Sydney would involve a journey in the open sea of more than 90 kms. From embarkation to disembarkation, the journey is unlikely to take less than two hours.

The provision of such a service, however, presents several potential barriers, including passage along the coast in the open sea and inconsistent swell conditions. Despite this, the NRMA is proposing to undertake analysis to determine the likely viability of such a transport option for the Illawarra. The analysis will include investigation into travel time, capacity, reliability, infrastructure provision, service quality and efficiency.

5. Key issues on the road network

The symptoms of demand stress on the roads can most readily be defined for future years by identifying road sections where demand exceeds the current capacity of the road. Areas that are poorly serviced by transport networks can be identified by analysing travel times to and from their common origins and destinations.

In the following sections, VLC examined the key issues with the road network in the region and the impact on travel times and levels of service as the main indicators of network deficiencies into the future. For this purpose, the Zenith model of Greater Sydney was used to understand the impact of population and employment growth on expected travel demand in 2031.

While the travel time analysis provides an indication of accessibility and connectivity, more detailed analyses of traffic conditions on the road network are used to identify specific issues and their location. In this case, the traffic volumes in 2011 together with forecasts of traffic volumes in 2021 and 2031 were used to estimate how long road lengths could continue to accommodate traffic growth. The capacity of the road is an important feature in this process.

Hourly capacities have been estimated according to Austroads guidelines and VLC Network coding specifications. Based on these, the Zenith model was used to forecast demand for roads in 2021 and 2031 with no upgrades or changes. These demands were compared to 2011 to understand future growth and to the capacity in 2021 and 2031 to identify locations where roads could not accommodate demand.

The results of the analysis can be divided into three categories:

- Internal network issues
- External network issues
- Linking road issues.

Linking road issues are the most relevant to this study, but the others have been examined for completeness.

5.1 Internal road network issues

There are two locations that were highlighted on the do-nothing road network. These are:

- Windang Bridge on Shellharbour-Windang Road (B65)
- Shoalhaven Bridge between Bomaderry and Nowra.

On Windang Bridge, modelling suggests that peak period demand will approach capacity by 2021 and reach capacity before 2031. The bridge will continue to accommodate non-peak daily demand with capacity to spare in 2031. This means that periods of congestion will be limited to short periods in the peaks. In addition, the traffic carried by the bridge is mostly local. On the basis that congestion will be limited to short periods during the peaks and that the traffic on the bridge is local, this bridge is not a significant priority for improving links to other regions.

The bridges across the Shoalhaven River between Bomaderry and Nowra carry 48,000 vehicles per day and the demand is likely to rise to nearly 60,000 vehicles per day around 2030. The capacity of the bridges is estimated to be around 65,000 vehicles per day and, therefore, the current bridges can accommodate demand to beyond 2031. Peak demands are also likely to be lower than capacity except for the main holiday periods. Most of the daily and peak period volumes for light vehicles are made up of shorter trips between Bomaderry and Nowra.

A major restriction to the movement of freight is that Higher Mass Limited (HML) freight vehicles cannot use the older southbound bridge, a two-lane iron truss bridge opened in 1881. This precludes industries south of the river from gaining freight efficiencies through larger capacity heavy vehicle configurations for short and long haul routes. Large manufacturing and logistics industrial base in the Shoalhaven are related to food manufacture, defence support, construction materials, chemicals, regional warehousing and consumer product distribution.

The replacement of the old bridge should be progressed within the next five years along with upgraded traffic flow arrangements both north and south of the bridges.

A further impediment for HML vehicles is the lack of a direct link between Nowra and the Hume Highway. Currently, these vehicles need to travel north from Nowra, up Mount Ousley to Picton Road and then to the Hume Highway to Melbourne and other southern destinations.

5.2 External road network issues

The most significant road bottlenecks are located on roads outside the Illawarra. The most important of these are the bridges across the Georges River

The most significant road bottlenecks are located on roads outside the Illawarra. The most important of these are the bridges across the Georges River:

- Captain Cook Bridge on Taren Point/Rocky Point Road at Taren Point
- Tom Ugly's Bridge on the Princes Highway at Sylvania
- Alfords Point Bridge on Alfords Point Road.

Captain Cook Bridge carries around 62,500 vehicles per day and Tom Ugly's Bridge carries around 92,700 vehicles per day. Daily traffic volumes on these two roads has not changed to a significant degree over the past 10 years. Only traffic volumes on Alfords Point Bridge have grown at a significant annual rate as outlined in Table 5-1 below.

The issues associated with these roads have not been advanced in this study because they are outside of the Illawarra and major projects have been proposed that may address them, including WestConnex and the F6 Extension.

Tom Ugly's Bridge and Captain Cook Bridge are major constraints on growth and are located on routes that link the Illawarra to the Sydney CBD, including the inner western, eastern and northern suburbs of Sydney.

Table 5-1: RMS traffic volumes across the Georges River

	Daily Volumes						Annual Growth (per cent per Year) 2005 to 2015		
	Inbound		Outbound		Total		In-bound	Out-bound	Total
	2005	2015	2005	2015	2005	2015			
Captain Cook	30,200	30,600	31,500	31,900	61,700	62,500	0.1%	0.1%	0.1%
Tom Ugly's	43,100	43,600	49,100	49,100	92,200	92,700	0.1%	0.0%	0.1%
Alfords Point	27,500	31,900	27,500	31,500	55,000	63,400	1.5%	1.4%	1.4%
Total	100,800	106,100	108,100	112,500	208,900	218,600	0.5%	0.4%	0.5%

Source: RMS Traffic Counts

5.3 Linking road issues

Roads linking the Illawarra to other regions include:

- Princes Motorway to Waterfall in the north
- Mount Ousley (Prince Motorway), which is the key critical section in the road network
- Picton Road and Appin Road to the west
- Macquarie Pass, Illawarra Highway to the south west
- Princes Highway to the south at the southern boundary of the Shoalhaven LGA.

Table 5-2 lists the impacts on these roads under a do-nothing scenario into the future.

Table 5-2: Traffic volume forecasts at key locations on connecting roads

Road	Item	Year				
		2011	2021	2031	Year capacity reached (peak hour)	Year Capacity is Reached (daily)
Picton Road	2-way Daily Capacity	25,000	28,000	28,000		
	2-way Daily Volume	12,200	21,800	32,200	2022	2025
Mount Ousley, South of Picton Road	2-way Daily Capacity	55,000	55,000	55,000		
	2-way Daily Volume	45,000	53,200	59,500	2024	2026
Appin Road	2-way Daily Capacity	15,000	15,000	15,000		
	2-way Daily Volume	10,200	11,800	13,700	2031+	2031+
Princes Motorway at Waterfall	2-way Daily Capacity	65,000	65,000	65,000		
	2-way Daily Volume	42,200	45,800	51,400	2031+	2031+

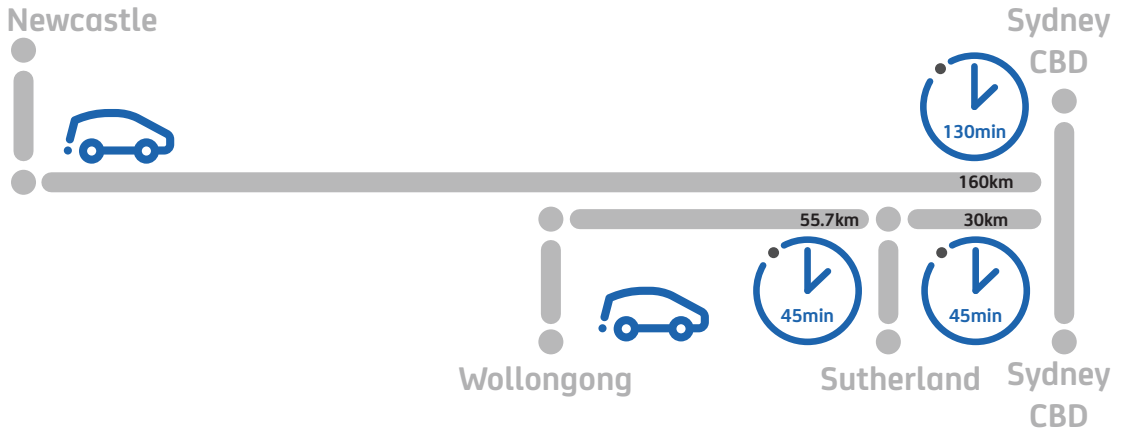
Source: RMS Traffic Counts and VLC modelling

5.4 Travel times

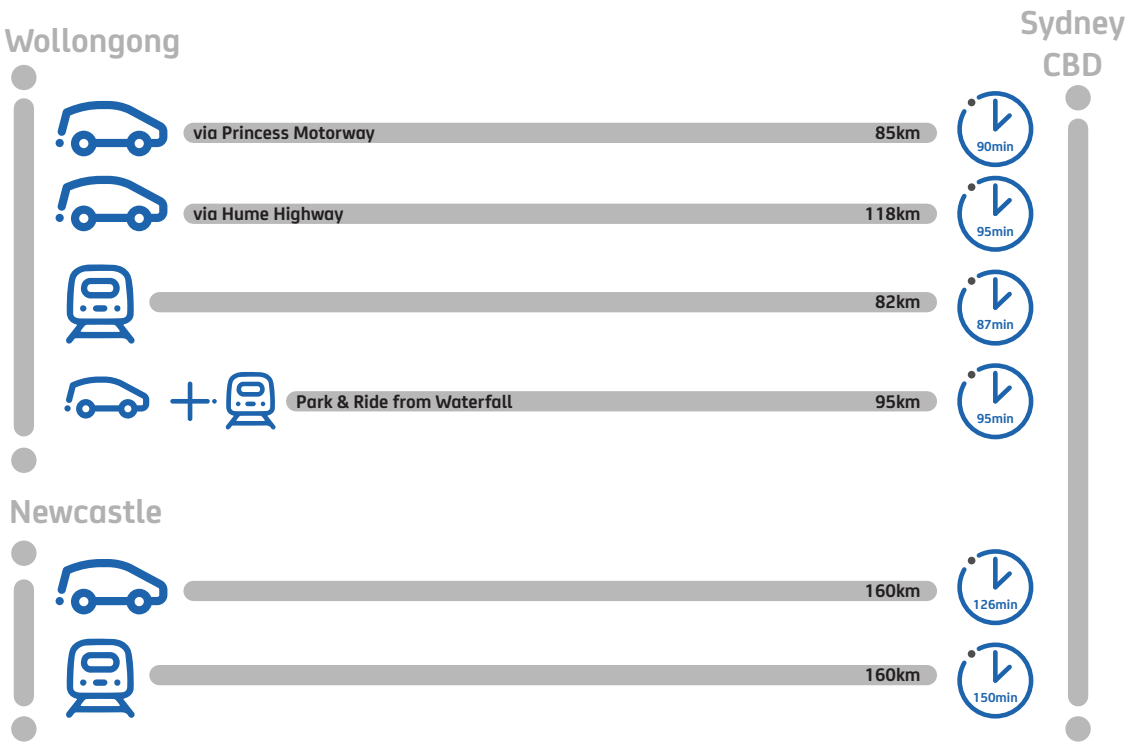
Currently, the travel time from Wollongong to Sutherland, via the Princes Motorway and Princes Highway, is around 45 minutes and through to the Sydney CBD averages around 90 minutes in total. Peak period travel times are highly variable and it may take nearly two hours to drive from Wollongong to the Sydney CBD. By contrast, the driving time from Newcastle to Sydney CBD, a distance of 160 kms, almost double Wollongong's distance from Sydney, takes a little longer than two hours, only around 30 minutes longer than the trip from Wollongong.

Travel to Picton from Wollongong, a distance of 47 kms, takes around 40 minutes.

In essence, it takes the same time to travel the final third of the journey to Sydney CBD as the initial two-thirds. As a consequence of the congestion, alternative routes are used, especially for heavy vehicles. For heavy vehicles traveling to Sydney via the Hume Highway, the extra distance is over 30 kms but it takes on average only six minutes longer.



Travel by the express train (limited stops) from Wollongong to Central Station takes around 87 minutes and is less variable than road traffic travel times. For commuters who use the Waterfall Park and Ride, the car trip to Waterfall from Wollongong would take around 35 minutes, and the train trip to Central Station (which is slower than the direct Wollongong to Central train service) takes around 50 minutes. Including the changeover, the total travel time is similar to driving or taking the train from Wollongong.



Source: VLC 2018

To assess the travel time at a strategic level, VLC analysed the maximum peak travel time[10] from Wollongong to all other travel zones for different horizon years, assuming no new transport infrastructure was provided, beyond those that are already in their delivery phase.

10 Thus, if it took longer to travel in the morning peak, the morning peak travel time was used, and if it took longer to travel during the evening peak the evening peak travel time was used.

Table 5-3 compares travel times from centres in the Illawarra to selected destinations in 2011, 2021 and 2031.

The table shows that towards the north, the travel times to the CBD will increase by around 20 minutes from 2011 to 2031. Within Sydney, the traffic modelling assumes the completion of WestConnex. Travel times from Nowra will increase slightly more because motorists will need to travel along the longest lengths of increasingly congested roads, despite the provision of the upgrades with the Albion Park Rail Bypass and the Princes Highway between Berry and Bomaderry.

Travel times to the west will be similarly affected by increased traffic congestion. Some travel times may increase by more than 30 minutes between 2011 and 2031. With the west's predicted rapid growth, good connections are needed to the Illawarra to allow its workers and businesses to take part in these economic opportunities.

The absence of a direct rail link also contributes to higher levels of traffic. Without intervention, such as infrastructure investment or policies that manage demand, these travel times cannot be maintained or improved.

Table 5-3: Modelled peak period travel times: 2011 to 2031 base case

TO		Wollongong	Shellharbour	Nowra
Sydney CBD	**2011**	90	113	145
	2021	97	121	155
	2031	112	135	168
Wilton	**2011**	35	57	95
	2021	40	63	102
	2031	52	72	113
Parramatta	**2011**	100	110	138
	2021	108	114	140
	2031	121	123	144
Badgerys Creek	**2011**	81	93	130
	2021	85	98	134
	2031	94	105	140

Source: VLC 2018

5.5 The Cost of Delay

By converting travel times to costs using values provided in TfNSW's economic evaluation guidelines[11], the cost of delays have been estimated. Delays were calculated as the difference between the time to travel along a road at the peak traffic speed and the time to travel along the road at free flow speed. Table 5-4 shows the total annual cost of travel to and from the Illawarra in 2011, 2021 and 2031. It shows that the annual cost of delays to the Illawarra community totalled nearly $500 million in 2011. This will increase to $640 million per year by 2031.

In 2011, the annual cost of delays to the Illawarra community totalled nearly **$500 million**

Table 5-4: The annual cost of traffic delay to Illawarra commuters

	2011 $m	2021 $m	2031 $m
Cars	330	365	430
Light Commercial Vehicles	16	19	23
Heavy Commercial Vehicles	150	166	187
Total	496	550	640

Source: VLC 2018

5.6. Shifts in the primary direction of travel

If the current rates of growth of traffic volumes northwards and westwards continue, then the demand for travel to the west is estimated to catch up to demand to the north by 2032 and continue to grow as shown in Table 5-5 below.

Table 5-5: Changes in passenger vehicle traffic volumes

	Traffic volumes to/from the North	Traffic Volumes to/ from the West
2016	45,000	29,700
2021	48,500	36,800
2026	51,000	43,400
2031	53,900	52,500
2032	54,400	55,100
2036	56,100	65,500

Source: VLC 2018

The volumes shown in Table 5-5 do not represent vehicles travelling on the road and are not comparable with traffic volumes on specific roads indicated throughout this report. The focus of Table 5-5 is the start and end points of passenger vehicles travelling to and from the Illawarra to areas in Greater Sydney. The number excludes heavy vehicles as the majority of trucks from the Illawarra travel west but it is not necessarily their final destination and is difficult to model.

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Beyond 2021, the modelling shows there is a diversion of people travelling north to a route towards the Hume Highway and then onto the M5 or M4 depending on their destination. The cause of this diversion is the congestion in the road network in the southern suburbs of Sydney. The result of this is a slowing of the growth of traffic volumes on the Princes Motorway and an acceleration of growth of traffic volumes on Picton Road, Appin Road and the Hume Highway.

In addition, those travelling from areas in Wingecarribee may travel north along the Hume Highway without adding to the traffic volumes on Picton Road or Appin Road, accessing the Hume Highway via other roads in the LGA.

As an example, in 2031, the volumes to and from the north comprise:

- 46,100 vehicles per day travelling on the Princes Motorway and Princes Highway
- 2,900 vehicles diverting from the direct north route to travel via Hume Highway
- 4,900 vehicles from Wingecarribee travelling north along the Hume Highway, which are accessed via roads within the LGA.

Motorists to and from the west include:

- 33,800 vehicles travelling from the Illawarra coastal LGAs to areas in the western areas of the Sydney Metropolitan area via Picton Road and Appin Road
- 2,200 vehicles travelling from the Illawarra coastal LGAs to areas in the western areas of the Sydney Metropolitan area via Princes Highway and Princes Motorway
- 16,500 vehicles from Wingecarribee travelling to areas in the western areas of the Sydney Metropolitan area on other routes.

Road network coverage to the west is sub-standard. Picton Road is of a substantially lower standard than other roads in NSW that carry similar volumes.

5.7 Summary

The road network coverage towards Sydney CBD city is reasonable, with an arterial road (Princes Highway) and a motorway (Princes Motorway). However, speed of travel to the CBD is low. Trips to the city central areas are slowed by traffic congestion north of Sutherland. Substantial road infrastructure investment in the Sydney metropolitan area will be required to improve access to Sydney central areas from the Illawarra.

Road network coverage to the west is sub-standard. Picton Road is of a substantially lower standard than other roads in NSW that carry similar volumes and a similar mix of cars and heavy vehicles.

Appin Road does not connect directly with the Illawarra and is, in part, aligned with Bulli Pass. Travelling from Wollongong to Campbelltown via Appin Road is 11 kms shorter than travelling via Picton Road, but is only three minutes quicker.

6. Proposed projects to unlock the Illawarra's potential

This study has identified a range of projects directed at improving the safety, efficiency and reliability of the transport system in the Illawarra. While the emphasis of this study is on the road network, which impacts the largest number of individual commuters and other travellers, a number of other interrelated projects are highlighted.

The proposed projects have been categorised as follows:

- Priority regional road projects
- Priority regional investigations
- Priority major corridor links
- Key future transport connections
- Public transport improvements.

Details for these projects are provided in this Chapter and include an analysis of the benefits of each project based on:

- Shorter travel times, which result in economic value of travel time savings
- Shorter trip lengths, which provide savings in vehicle operating costs
- Shorter travel and fewer vehicles travelling on dangerous roads
- Crash mitigation through the provision of safer road standards (resulting in economic crash savings).

Prioritisation of these projects was driven by the following objectives:

- Providing additional capacity on the roads between Illawarra, Sydney and Western Sydney
- Improving travel times for passenger vehicles and freight services
- Supporting current plans and strategies of the NSW Government
- Providing material vehicle operating cost savings
- Providing road safety benefits, especially for Mount Ousley, Picton Road and Appin Road
- Relieving the pressure of increasing traffic volumes on Mount Ousley
- Facilitating access to rail transportation.

6.1 Priority Regional Road Projects

These projects relate to key road improvements within the Illawarra region.

6.1.1 Mount Ousley Interchange and Widening

Suggested delivery: Completed by 2025

The interchange component of this project has been committed to by the NSW Government and is in the preliminary planning phase. The environmental assessment for the interchange component is now complete and the Submissions Report was published in April 2018. Timing and funding for construction of the interchange upgrade is still to be confirmed. However, based on the study findings, this report recommends the project be completed by 2025 given that this road is estimated to reach its peak hour capacity in 2024 and daily capacity in 2026.

Mount Ousley is the single crucial road link connecting the Illawarra with regions to the west and the north. The region's reliance on Mount Ousley is a vulnerability. For this reason, this project should proceed ahead of the planned upgrade of the Princes Motorway between the Picton Road intersection and Bulli Tops.

Mount Ousley is the single crucial road link connecting the Illawarra with regions to the west and the north.

The heavy vehicles on the steep grades of Mount Ousley are testing the capacity of the road. In both directions, heavy vehicles travel in the left lane, reducing the capacity of the road for other vehicles to two lanes for much of the road, and a single lane in some sections. During the peak hour, the northbound volume on Mount Ousley is a total of 3,400 vehicles, of which over 500 are heavy vehicles. On the three lane sections, this means that the left lane carries over 500 vehicles per hour, while the two outside lanes carry a total of 2,900 vehicles. An average of 1,500 vehicles per lane per hour on a steep grade represents a traffic flow that is close to capacity.

At the same time, daily traffic volumes on Mount Ousley have been growing at 3-4 per cent per year. Heavy vehicle volumes have grown at an average of 6 per cent per year. As a general rule of thumb, a six-lane highway has a practical daily capacity of about 50,000 to 60,000 vehicles per day. Mount Ousley is fast approaching this capacity and may hinder future economic growth of the Illawarra.

The widening of Mount Ousley would provide some additional capacity and address safety concerns. It is proposed to extend the third lane on the southbound section commencing halfway down Mount Ousley (approximately 2.5 kms).

RMS has indicated that "the third southbound lane is a separate proposal and will not be built through this project, however, the Mount Ousley Interchange has been designed to cater for a third southbound lane in the future[12]."

The costs of the widening, between $220 million and $330 million, could be significantly more depending on geology, engineering complexities and requirements for land acquisition.

The proposal provides some marginal travel time improvements through improved traffic flow and reduced congestion on Mount Ousley. Safety improvements on this section of the motorway would be a major benefit. In view of the number of heavy vehicles using the left hand lane, the exit onto Mount Ousley Road by other vehicles is an increasingly risky manoeuvre. Table 6-1 provides a sample of typical time savings.

It is estimated that in 2031, the Mount Ousley Interchange and Widening would deliver total economic benefits of around $46 million per year, comprising:

- Around $34 million in travel time savings
- Around $9 million in vehicle operating cost savings
- About $3.7 million in crash savings.

Table 6-1 provides a more detailed breakdown of the benefits proved by a widening of Mount Ousley.

Table 6-1: Economic benefits for Mount Ousley Interchange and Widening

Vehicle Type	Travel Time ($m)		Vehicle Operating Cost ($m)		Crashes ($m)	
	2021	2031	2021	2031	2021	2031
Cars	14	18	3	3		
Light Commercial	2	3	1	1		
Heavy Commercial	9	13	3	5		
Total economic benefits	**25**	**34**	**7**	**9**	**2.5**	**3.7**

6.1.2 Picton Road Upgrade

Suggested delivery: Completed by 2025

RMS has made improvements to Picton Road in recent years providing much needed safety enhancements and more of these works are planned. However, as the main east-west road corridor to and from the Illawarra, it is critical this road be upgraded to a four-lane divided highway (with provision to include an upgrade to six-lanes). This study recommends the project be completed by 2025, noting the road is estimated to reach peak hour capacity in 2022 and daily capacity in 2025.

Modelling of future road capacity produces lower volume numbers compared to extrapolating growth rates over the most recent years. If future actual traffic volumes are higher than modelling estimates, then consideration should be given to bringing forward the timing of the upgrade project.

12 RMS Submissions Report, April 2018, page 5 http://www.rms.nsw.gov.au/documents/projects/illawarra/m1-princes-motorway/mount-ousley-interchange-ref-submissions-report-2018-04.pdf

Picton Road is an important connection for regional freight and commuter trips. It is the primary connection from Port Kembla and Wollongong to Western Sydney and the emerging growth areas in the south west of Sydney. It is also the preferred heavy vehicle route from the Illawarra to the Sydney CBD and surrounds. The study could not identify a road similar to Picton Road elsewhere in NSW that carries 20,000 vehicles per day with a heavy vehicle proportion as high as 25 per cent.

The primary aim of this project is to improve the regional connection function of Picton Road by increasing its capacity. This will allow Picton Road to cater for increasing travel demands generated by growth in employment centres in Sydney and freight demand generated in the Illawarra through Port Kembla. It would improve travel speeds through better road alignment and would allow freer traffic flow through continuous passing opportunities.

The improved road will provide better access to Wilton and the Glenfield - Macarthur growth areas. It will also help to improve access from those areas to the Illawarra.

Traffic counts are only available from 2015 onwards and the short term counts indicate that daily traffic volumes are increasing at around 7 per cent to 8 per cent per year for total traffic. Present volumes are between 10,200 and 10,600 in each direction.

To provide greater capacity and a road of an appropriate standard for the volumes it carries, Picton Road should be duplicated between the Princes Motorway and the Hume Motorway, near Wilton. The project location is illustrated in Figure 6-1.

An overall analysis of the travel patterns compared to those of a do-nothing case suggests this option would save more than 3,100 vehicle hours per day, of which savings in heavy vehicle hours would be around 420 hours per day. In addition, there would be a vehicle operating cost saving because of the shorter trips at more efficient speeds. There would also be crash savings as a result of the upgraded road being of a higher standard.

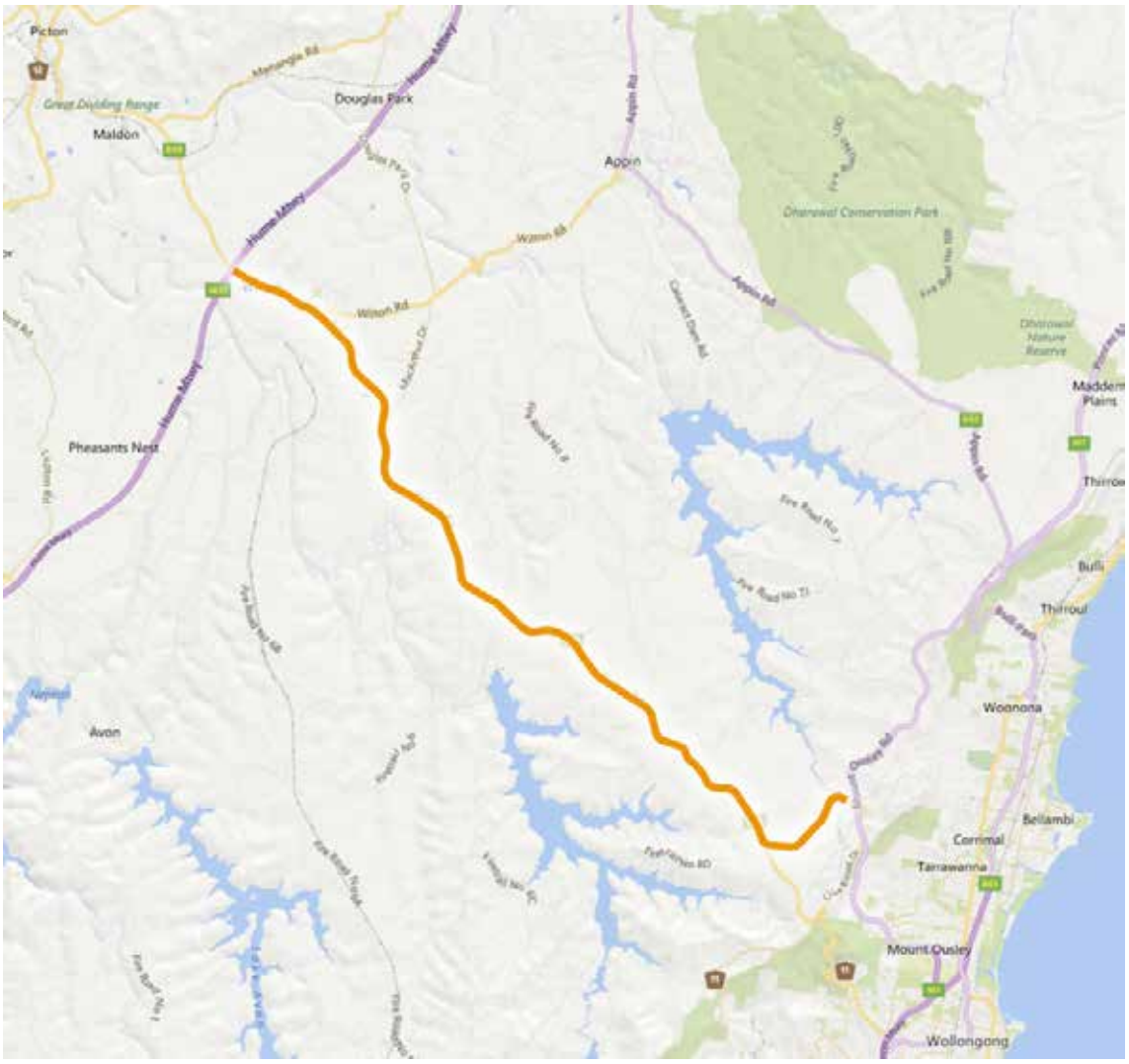


Figure 6-1: Picton Road Upgrade location

The Wilton South East Precinct plan already provides for:

- Duplication of Picton Road between Hume Highway and Almond Street (a length of 3 kms)
- Upgrade of the Picton Road and Hume Highway interchange
- Treatments for intersections of Picton Road with Almond Street and Pembroke Road.

The project would therefore require duplication of Picton Road from Almond Street to Mount Ousley, a length of around 24 kms.

Based on benchmarking values of costs of building roads provided by TfNSW[13] and costs of construction of other roads, the cost of providing a 24 km length of two-lane carriageway would be between $180 million and $220 million.

The Picton Road upgrade would attract some traffic from Appin Road to Picton Road, shortening trip lengths and improving travel times for those trips. Furthermore, trips to Sydney will be attracted to Picton Road from the Princes Motorway route, reducing traffic on the Princes Motorway between Picton Road and Bulli Tops.

13 TfNSW (2016). Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives.

It is estimated that in 2031, the upgrade of Picton Road would deliver total economic benefits of around $42 million per year, comprising:

- Around $32 million in travel time savings
- Around $8 million in vehicle operating cost savings
- Around $1.7 million savings from crash reductions.

A more detailed breakdown of these benefits is presented in Table 6-2.

Table 6-2: Economic benefits for Picton Road Upgrade

	Travel Time ($m)		Vehicle Operating Cost ($m)		Crashes ($m)	
	2021	2031	2021	2031	2021	2031
Cars	14	17	3	3		
Light Commercial	2	2	1	1		
Heavy Commercial	9	13	3	4		
Total economic benefits	25	32	7	8	1.5	1.7

Source: VLC 2018

6.1.3 Princes Motorway Upgrade at Bulli Tops

Suggested delivery: Completed by 2028

RMS is planning enhancements to the northbound carriageway of Mount Ousley between Picton Road and Bulli Tops, providing a safer and more efficient trip for cars. The works would reduce the curvature of the bends in the road and to widen the road to provide easier passing and less risk of crashes caused by slow moving vehicles. This work is planned in two stages. There is an additional 2.5 kms of road along the southbound carriageway that the study recommends upgrading.

The southbound carriageway, between Sublime Point and Bulli Tops, passes through successive interchanges with the Princes Highway, Appin Road and Bulli Pass, as well as adjoining hospitality and tourism facilities. Along the length of this 2.5 km stretch of road, the speed limit is reduced to 80 km/h. There are high instances of merging, particularly at the interchanges with Appin Road and Bulli Pass, where heavy (and slow moving) vehicle volumes are growing, increasing the potential for further crashes.

Where Appin Road joins the Princes Motorway on the west side at Bulli Tops, the Bulli Pass exit is a further 400m on the east side. On the same stretch of road, the left hand lane of the Princes Motorway merges into the right hand lane round 200m before the Bulli Pass exit. This is an inherently dangerous junction.

To mitigate the risk of crashes and to provide consistent speeds on the road, it is suggested the upgrade works planned between Picton Road and Bulli Tops include these additional works. This would provide a separated through carriageway and improved access to and from the connecting roads and facilities. Figure 6-2 shows the location of this project.

The upgrade would cost in the region of $65 million to $80 million, depending on local geological conditions. It would provide only small improvements in time. However, it would provide significant safety benefits in the removal of interactions between an increasing number of fast and slow-moving vehicles. Growth in traffic volumes on Appin Road, which are forecast to increase by a third between 2016 and 2031, provides further justification for these works.

It is estimated the upgrade would provide around $6.5 million in economic benefits, comprising:

- $1.6 million in travel time savings
- $0.3 million in reduction in vehicle operating costs
- $4.6 million in crash savings.

However, these levels of savings are likely to be achieved only in the longer term, beyond ten years into the future.

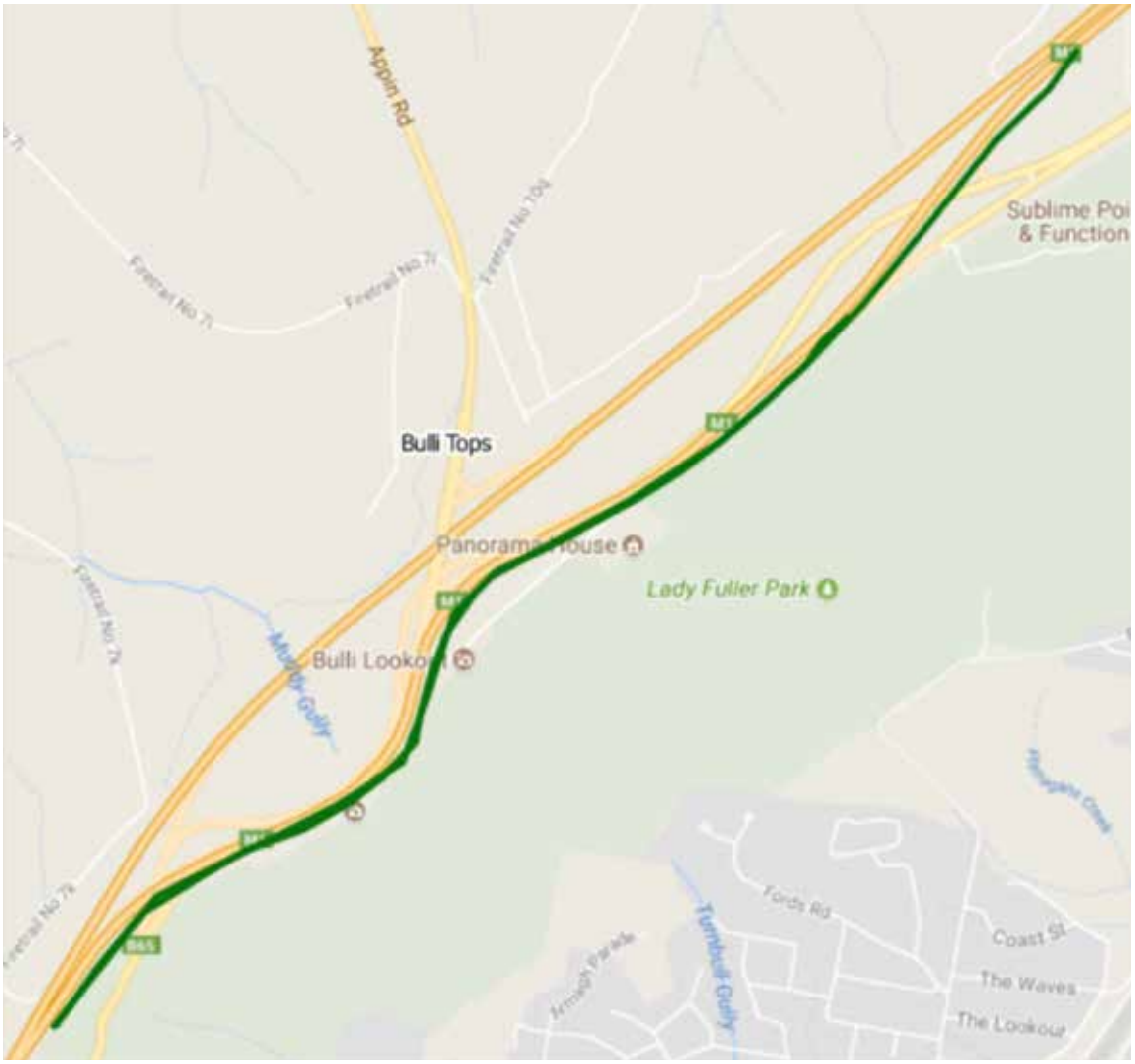


Figure 6-2: Princes Motorway Upgrade at Bulli Tops

6.1.4 Benefits of priority regional road projects

The benefits of the three proposed projects have been compared with the estimated costs of construction, and an estimated benefit cost ratio (BCR) has been produced. Both the Picton Road Upgrade and Mount Ousley Interchange and Widening having a BCR of greater than 1.0 as listed in Table 6-3. The upgrade of the Princes Motorway at Bulli Tops has a BCR below 1.0, noting that this project is essentially addressing safety issues and does not take into account any potential upgrade to Appin Road.

Table 6-4 shows the estimated growth of total annual benefits for the three priority regional projects. These estimates are conservative based on traffic growth of 1 per cent each year when an average is closer to 2 per cent.

Table 6-3: Summary of benefit cost ratios for priority regional projects

OPTION	Total Annual Benefit ($m)	Cost of Construction ($m)	BCR
Mount Ousley Interchange and Widening	46	220 to 330	1.4 to 2.1
Picton Road Upgrade	42	180 to 220	1.8 to 2.6
Princes Motorway Upgrade at Bulli Tops	6.5	65 to 80	0.7 to 0.9

Source: VLC 2018

Table 6-4: Cumulative annual benefit of projects (including inflation)

Year	Project	Total Annual Benefit ($ million)
Mid-2020 - 2025	Mount Ousley Interchange and Widening ($46m) Picton Road Upgrade ($42m)	88
2026		90
2027		92
2028		94
2029		96
2030		98
2031	Princes Motorway Upgrade at Bulli Tops ($6.5m)	107

Source: VLC 2018

Table 6-5 provides a comparison of the traffic volumes at key locations on the road network. This table compares how each of the solutions will impact travel patterns on the road network.

Table 6-5: Forecast traffic volumes at selected locations on the road network for each option

Road	Item	2021	2031	2031	2031
		Do nothing	Do nothing	Picton Road Upgrade	Mount Ousley Widening
Picton Road	Peak Hourly Volume	800	2,100	2,200	2,200
	2-way Daily Volume	21,800	32,200	34,700	34,700
Appin Road	Peak Hourly Volume	700	800	350	700
	2-way Daily Volume	11,800	13,700	11,200	10,900
Mount Ousley, south of Picton Road	Peak Hourly Volume	2,900	3,500	3,300	4,000
	2-way Daily Volume	53,200	58,000	60,500	60,500
Princes Motorway at Waterfall	Peak Hourly Volume	2,700	3,000	2,900	3,300
	2-way Daily Volume	45,800	51,400	51,100	51,100

Source: VLC 2018

6.2 Priority Regional Investigations

6.2.1 Memorial Drive Extension

Suggested delivery: Investigations within the next five years (subject to the RMS study incorporating traffic modelling for the Princes Highway through Bulli – expected July 2018)

This investigation would assess the feasibility of extending Memorial Drive from its current interchange with the Princes Highway in Bulli northwards to Bulli Pass. The length of this extension would be around 2 kms depending on the route chosen.

The Princes Highway through Bulli carries around 25,000 vehicles per day. During the morning peak period, it carries nearly 2,000 vehicles per hour, which is close to the hourly capacity of a road with two lanes in each direction interrupted by traffic lights and other intersections.

By 2031, there are expected to be over 31,000 vehicles passing through Bulli on the Princes Highway. Of these, around 17,000 vehicles are estimated to use Bulli Pass with approximately 11,000 vehicles travelling to and from Memorial Drive. Around 1,000 vehicles would use Bull Pass each day to and from Lawrence Hargrave Drive.

6.2.2 Alternative Escarpment Crossing

Suggested delivery: Investigations within the next 10 years

Upgrades proposed in this study for Picton Road and Mount Ousley should alleviate the traffic congestion over the next 20 years. Nevertheless, there needs to be an investigation into an alternative crossing of the escarpment to reduce the burden on Mount Ousley in particular. The investigation should consider options that exclude the use of Mount Ousley.

Future Transport Strategy 2056 includes an initiative to investigate a long-term solution for the Illawarra escarpment. This is proposed in the 20+ year timeframe.

Over the years, RMS has investigated a range of alternative escarpment crossings. Between 1996 and 2006, RMS studied several options for a road crossing of the Illawarra escarpment, including options to upgrade Bulli Pass (in 1996), with alternative alignments that removed the hairpin bend. However, no alignment could be identified to reduce the grade to less than 10 per cent, which was considered to be too unsafe to be feasible.

In 1998, alternatives at Rixons Pass and to the north of Mt Kembla were examined but found to be less feasible than the Bulli Pass routes studied in 1996.

In 1999, a new alignment at Bulli Pass, called the Brickworks option, was examined. It has less steep grades, included a new interchange with the Princes Motorway and shorter lengths of tunnel. A design report, produced in 2000, reviewed all previous alternatives and identified the Brickworks alternative as the most feasible, but found that its design contained elements that were unacceptably risky. It proposed an alternative called the Colliery West option.

In 2005, a discussion report reviewed previously considered options and found that there were risks in investing in all options due to unstable ground, steep grades, social, environmental and cultural impacts.

Given the examination of Mount Ousley and Picton Road as part of this study, a partial alternative escarpment crossing was also examined, that is, a Mount Ousley to Picton Road Connector. This potential project examined connecting Mount Ousley south of Mt Pleasant to Picton Road in the location of its current intersection with Mt Kembla Road, as shown in Figure 6-3.

A Mount Ousley to Picton Road Connector would provide a safer and more direct link between Wollongong and Picton Road for trips to or from south west Sydney and the Hume Motorway.

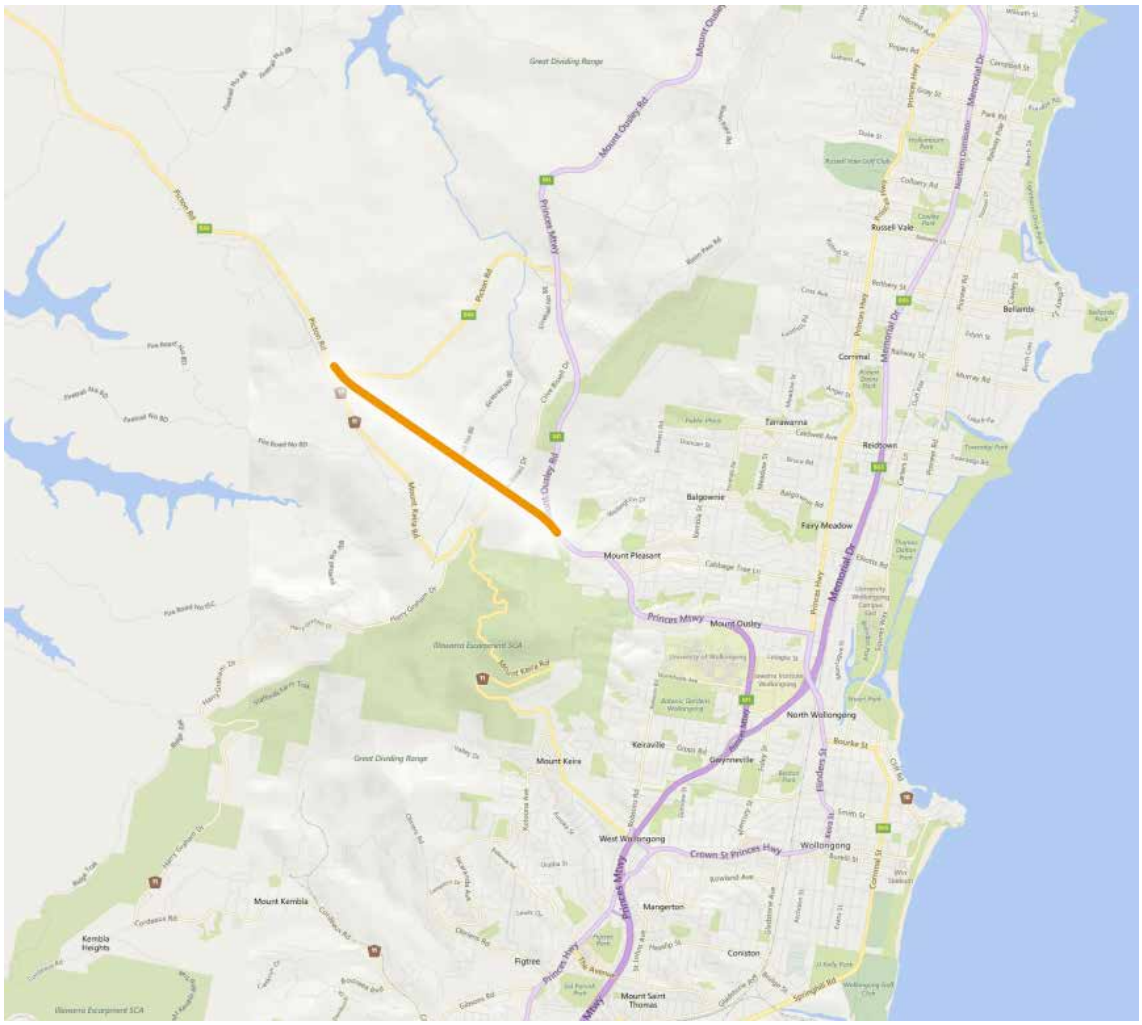


Figure 6-3: Mount Ousley to Picton Rd Connector - conceptual alignment

2031

Mount Ousley - Picton Road Connector

$61million saving*

***Estimated yearly total economic savings in travel time, vehicle operating cost and crash reduction.**

The alignment would have a length of around 3.3 kms with an average grade of 6 per cent. Most of the alignment would need to be in tunnel. The route would be around 4 kms shorter than the current access to Picton Road.

The provision of this link would be provided in conjunction with the upgrade of Picton Road. The connection of the proposed tunnel into Mount Ousley would provide significant engineering challenges and high costs.

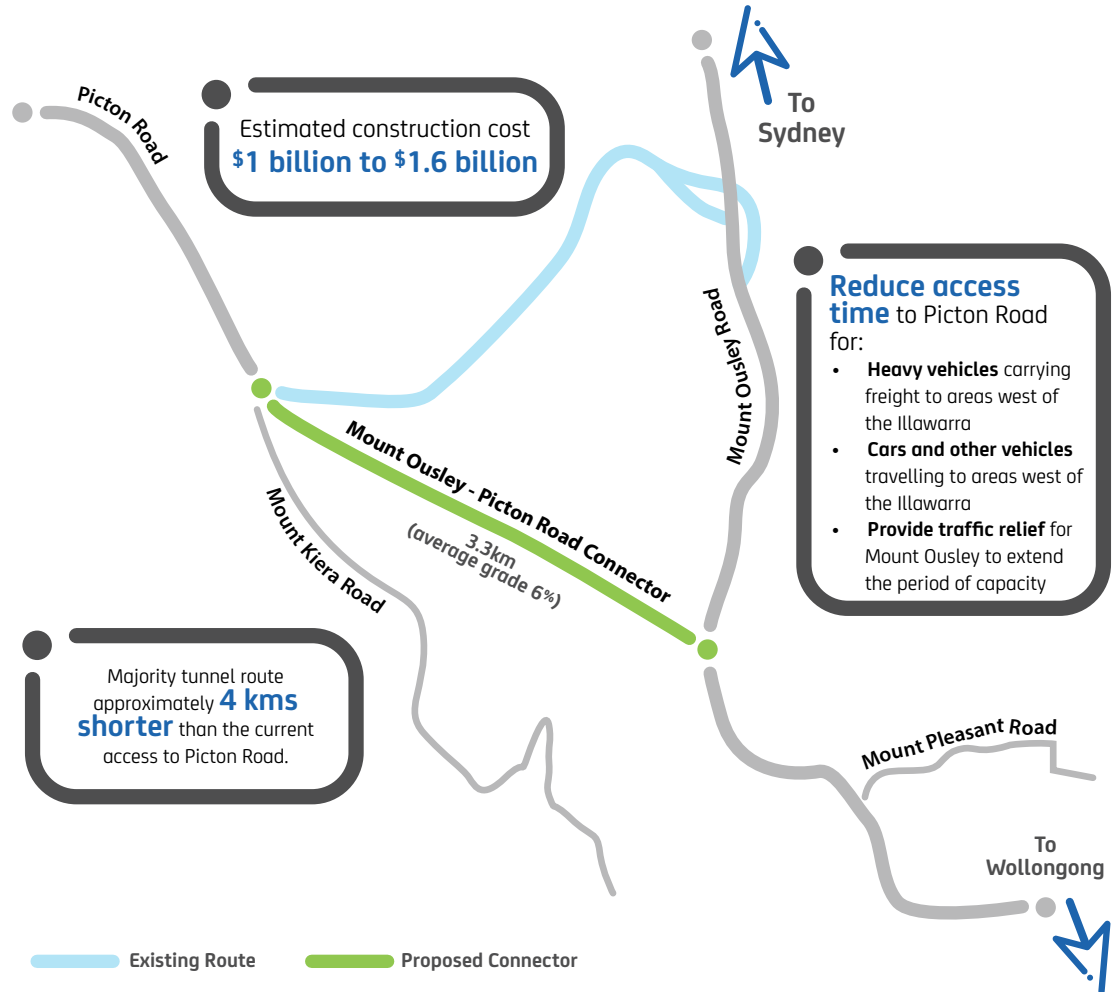
The costs of the road, based on benchmark unit prices and costs of tunnels from other projects has been estimated to be:

- $30 million to $50 million for road construction and intersection treatments
- $1.0 billion to $1.6 billion for tunnelling costs.

The Mount Ousley to Picton Road Connector is a conceptual solution to reduce access time to Picton Road for:

- Heavy vehicles carrying freight to areas west of the Illawarra from the region
- Cars and other vehicles travelling to areas west of the Illawarra from the region
- Provide traffic relief for Mount Ousley to extend the period of capacity.

Mt Ousley - Picton Road Connector (Conceptual Solution)



6.3 Priority Major Corridor Links

6.3.1 F6 Extension (SouthConnex)

Suggested delivery: Depending on project prioritisation by the NSW Government, concurrent delivery of the Arncliffe to Loftus section (17 kms) by 2025, or sequential delivery by 2033

This project refers to the 30 km freeway connection between Wollongong and Sydney. The beginning of the F6 Extension will connect to the new M5 works as part of WestConnex, which are scheduled for completion in early 2020.

RMS has commenced planning for Stage 1 (4 km tunnel section from Arncliffe to Kogarah). Option 1 proposes planning and assessment of Stages 2 and 3 (Kogarah to Loftus) be carried out concurrently and should the project be assigned priority status as a major project by the NSW Government, construction of all three stages should be completed by 2025.

For those people travelling between Wollongong and the Sydney CBD, the full benefit of travel time savings will be realised once Stages 2 and 3 are completed. In the morning peak period, travel time savings are estimated to be 27 minutes.

Whilst it is recognised Stage 4 presents challenges due to the de-gazetting of the corridor reservation, short-term measures should be considered to relieve congestion including targeted intersection treatments at Heathcote Road, the Princes Highway at Engadine and Farrell Avenue and Rawson Avenue near Loftus.

Future Transport Strategy 2056 includes Stage 1 as a committed initiative in the next 10 years. Stages 2 and 3 (Kogarah to Loftus) are included as initiatives for investigation in the next 10 years. Stage 4 (Loftus to Waterfall) is not part of the future transport plan.

Infrastructure Australia has included the F6 Extension (Connectivity between Wollongong and Sydney CBD) for investigation in the 5-10 year period.

The four stages of the F6 are:

- Stage 1 – New M5 in Arncliffe to President Ave Kogarah – 4 kms
- Stage 2 – President Ave to Captain Cook Bridge – 5 kms
- Stage 3 – Captain Cook Bridge to Acacia Road/Loftus Ave, Loftus – 8 kms
- Stage 4 – Loftus to Waterfall – 13 kms.

Stage 1 of the F6 Extension will provide a connection between the new M5 at Arncliffe to President Avenue in Kogarah as shown in Figure 6-4. The proposal comprises a 4 km continuous twin tunnel[14].

14 As highlighted on the RMS website: http://www.rms.nsw.gov.au/projects/sydney-south/f6/index.html

The proposed Stage 2 of the F6 Extension would provide an additional crossing of the Georges River and connect President Avenue to the Princes Highway around Taren Point. It was modelled - on the assumption that it would be completed by 2031 - to assess the impact of the extension on travel from the Illawarra.

The modelling showed that Stage 2 of the F6 Extension would provide considerable time savings to trips from the south to areas north of the Georges River. It also shows that most of the benefits would accrue to trips within the Sydney metropolitan area. The modelling of the various options has assumed tolls will be charged on the initial three stages.

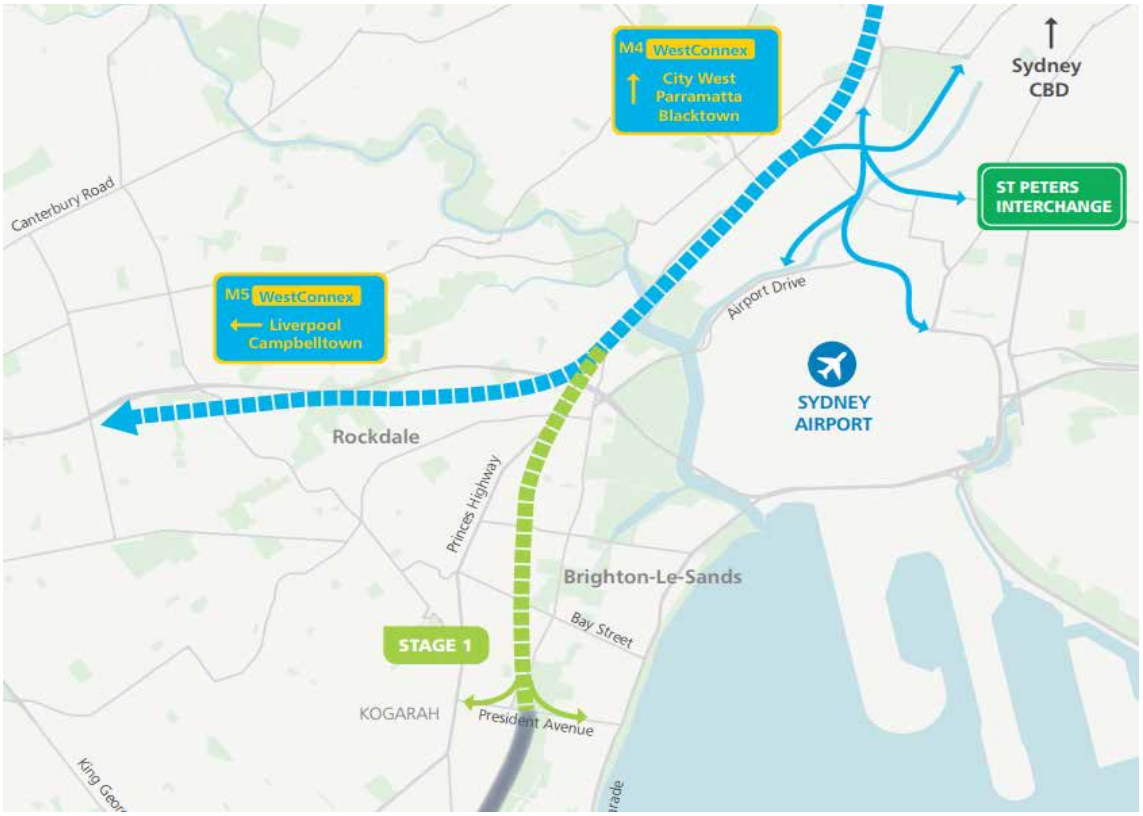


Figure 6-4: Location of Stage 1 of the F6 Extension

Source: RMS: http://www.rms.nsw.gov.au/projects/sydney-south/f6/index.html

Without the F6 Extension, the traffic network in the southern suburbs of Sydney will become much more congested than it is now. The forecast traffic demand for 2031 at selected points around the road network is shown in Table 6-7.

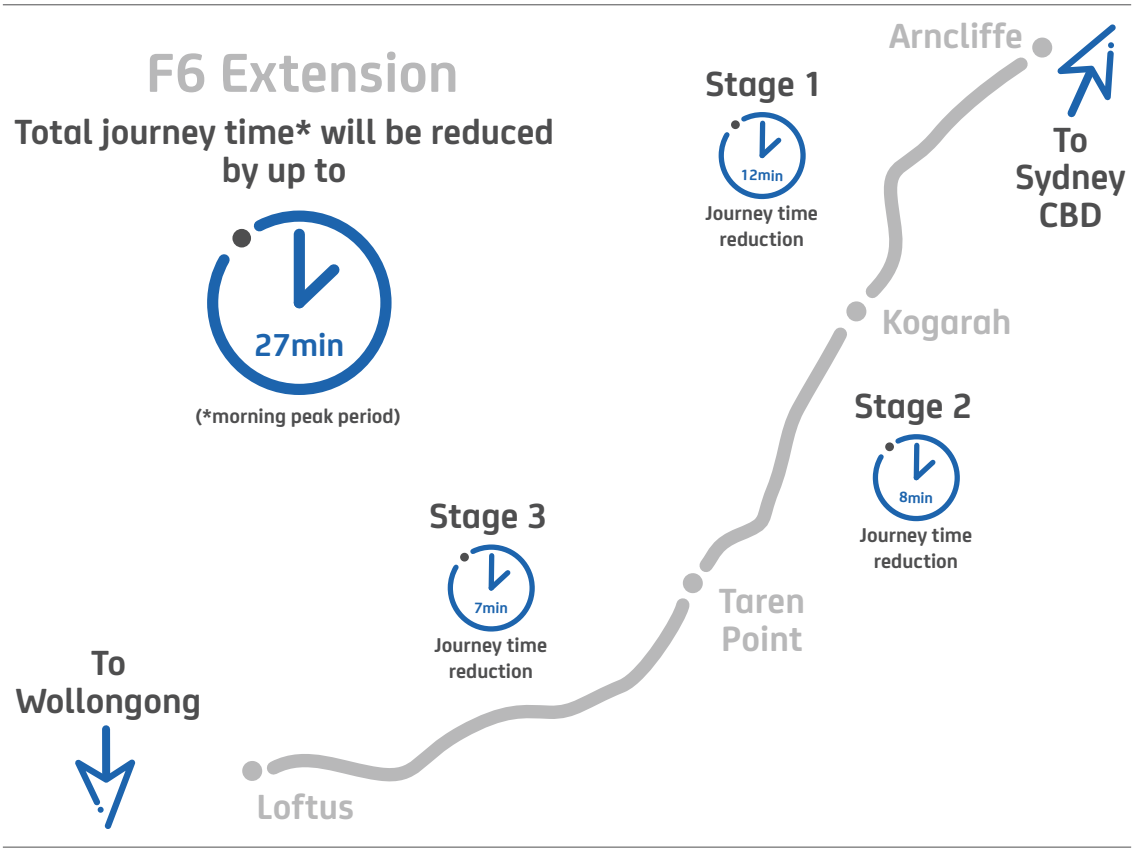
As shown in Table 6-7, the F6 Extension will reduce congestion on the road network and the reduction in traffic demand will develop as the three stages are provided. However, President Avenue in Kogarah can be expected to experience a large increase in traffic volumes and may require further enhancements.

Table 6-7: Impact of traffic demand on major roads following completion of F6 Extension Stages 1-3

	2017 Traffic Demand	2031 Traffic Demand	2031 Indicative Traffic Demand based on 2031 estimated volumes			Change in Volume		
		No F6	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
General Holmes Drive	65,000	75,600	72,000	72,000	71,500	-5%	-5%	-5%
Princes Highway at Rockdale	40,000	52,500	48,000	47,000	46,200	-9%	-10%	-12%
President Ave at Kogarah	24,000	38,000	48,000	50,000	52,000	26%	32%	37%
Captain Cook Bridge	62,500	87,000	88,000	78,000	76,000	1%	-10%	-13%
Tom Ugly's Bridge	92,700	110,000	109,000	96,000	90,500	-1%	-13%	-18%
Alfords Point Bridge	63,400	76,000	76,000	72,000	65,000	0%	-5%	-14%
Heathcote Road, West of Princes Highway	22,500	28,500	28,500	28,500	24,000	0%	0%	-16%
Princes Highway at Kirrawee, north of President Ave	35,500	65,400	65,400	65,400	49,000	0%	0%	-25%
Princes Highway at Loftus	57,500	60,200	60,200	60,200	37,000	0%	0%	-39%

Source: VLC 2018

Currently, 150,000 vehicles use the two key Georges River crossings each day (part of the F6 Extension corridor). By comparison, the Anzac Bridge carries around 130,000 vehicles per day.



The modelled travel times represent a typical weekday during the school term. In reality, the travel times are likely to be highly variable, especially for trips that do not use toll roads. The F6 Extension is likely to reduce the variability of the travel times between the southern locations and Sydney CBD.

In off-peak periods, modelling suggests the journey between Wollongong and the Sydney CBD using the F6 Extension will save around 17 minutes around midday and around 12 minutes in the evening following completion of the first three stages (assuming 2031 traffic volumes).

Table 6-8 shows the estimated difference in time savings in the morning peak period for travel between Wollongong and Sydney CBD (using the F6 Extension) if each stage of the project is delivered sequentially rather than concurrently. The estimated savings for the individual sections would be partially offset by increasing congestion over the period of construction, the effect of the shifts in travel patterns with new roads and the expected impacts associated with the construction of a major road infrastructure project.

Table 6-8: Indicative travel times from Wollongong to Sydney CBD (assuming 2031 traffic volumes)

	No F6	Stage 1	Stage 2	Stage 3
Travel time (minutes) from Wollongong to Sydney CBD	112	106	99	85
Time saving (Sequential delivery)		6	13	27
Time saving (Concurrent delivery)		12	20	27

Source: VLC 2018

The period for planning, assessment and construction of a motorway such as the F6 Extension can vary widely. For the F6 Extension, the extent of tunnelling required will be the main factor. The full length of Stage 1 will be a tunnel whereas Stages 2 and 3 may be a combination of tunnels and surface roads. Stage 2 will also include a bridge over the Georges River. In Sydney, twin tunnels seem to be constructed at a rate of between 1 to 3 kms per year. Assuming a mid-range for a tunnel option, the construction phase for Stage 1 could take 2 to 3 years, for Stage 2 it could take 3 to 4 years and for Stage 3 it could take 3 to 5 years. The construction of surface roads would most likely be much quicker. In broad terms, planning and associated pre-construction activities might be expected to take 2 to 3 years for each stage.

Accordingly, concurrent planning, assessment and construction of Stages 1, 2 and 3 is considered achievable within the next seven years. For sequential delivery of the three stages, completion is considered achievable within the next 15 years. Depending on when the pre-construction activities are undertaken, this timeframe could be reduced. It is assumed construction would not commence until 2020 under either scenario when the WestConnex node link to the F6 Extension is expected to be completed.

An indicative cost estimate for the first three stages of the F6 Extension is between $8.6 billion to $10.4 billion. It should be emphasised that this cost is indicative only and does not involve any input from RMS. This is a complex project and its final cost is dependent on a range of factors, not of least the extent to which tunnelling is required. The assumptions underlying the higher estimate for the project include Stage 1 being a tunnel ($2.9 billion), Stage 2 being a tunnel apart from the bridge over the Georges River ($3.5 billion) and Stage 3 including both surface road and tunnelling ($4 billion).

The **total economic benefits** for the completion of Stages 1, 2 and 3 of the F6 Extension are **$677 million** per year in 2031.

The F6 Extension (Stages 1, 2 and 3) would provide the benefits shown in Table 6-9.

Table 6-9: Economic benefits from F6 Extension (Stages 1, 2 and 3)

Travel time Savings in 2031	$ million per year in 2031
Cars	442
Light Commercial Vehicles	12
Heavy Commercial Vehicles	40
Total	**494**
Vehicle Operating Costs Savings	**$ million per year in 2031**
Cars	81
Light Commercial Vehicles	8
Heavy Commercial Vehicles	92
Total	**181**
Crash Savings	**$ million per year in 2031**
Total	**2.6**
Total Economic Benefits	**677**

Source: VLC 2018

The value of the F6 Extension (Stage 1, 2 and 3 completed) to the **Illawarra** would be around **$67 million** per year from 2031.

This estimate is based on the value of the economic benefits of travel, plus an estimate of the impacts of improved connectivity. The value of the F6 Extension to the rest of NSW (mostly the Greater Metropolitan area) would be nearly $610 million per year in 2031.

6.3.2 South West Illawarra Rail Link (SWIRL)

Suggested delivery: Completed by 2028

A recent report commissioned by the IBC recommended the construction of an additional passenger and freight line between the Illawarra and Sydney, incorporating the previous 35 km Maldon-Dombarton proposal, known as the South West Illawarra Rail Link (SWIRL).

The rail link would connect the Main South Line (at Maldon) and the Moss Vale-Unanderra dedicated freight line at Dombarton. The 7 km rail link from Dombarton along the Moss Vale-Unanderra Line to the junction of the South Coast Line would require electrification. Past proposals for this rail link were intended to service freight trains only. The SWIRL project includes passenger services.

The objective of SWIRL would be to dramatically shorten the travel times to Western Sydney thus attracting some patronage from the South Coast Line and to effect a mode shift from cars. According to the current Sydney Trains timetable, it takes 87 minutes to travel the 82 km line (ie 56 km/h average speed) between Wollongong and Central station in Sydney during the weekday morning peak. To reach Parramatta station at the geographic centre of Sydney, the journey from Wollongong (via Redfern) takes a further 27 minutes at best. On average, the total commute times between Wollongong and stations in south west Sydney, such as Liverpool (125 minutes), Leppington (130 minutes) and Campbelltown (131 minutes), are all over two hours. With the SWIRL, the estimated travel times would be reduced by 35-40 minutes for the journey from Wollongong to Leppington and Liverpool. The proposed freight operation is also likely to attract freight from road transport, thereby reducing the number of heavy commercial vehicles on the road network.

The IBC regards the SWIRL as an essential project for the Illawarra's connectivity. The impact of SWIRL on the roads of the Illawarra was tested by modelling the transport network including SWIRL. The result of this modelling showed that SWIRL would attract trips from car and passengers from the South Coast Line. The reduction in car demand would lead to reduced congestion and improved travel times on the road.

Analysis of the benefits of the model shows that SWIRL may yield benefits of up to **$74 million** per year

The modelling forecasts of patronage are consistent with the SMART's forecast of up to 9,000 passengers per day. Analysis of the benefits of the model shows that SWIRL may yield benefits of up to $74 million per year[15] made up of:

- Vehicle operating costs of $3.5 million per year
- Public transport travel time savings of $27.4 million per year
- Car travel time savings of $36.1 million per year
- LCV travel time savings of $1 million per year
- HCV travel time savings of $4.8 million per year
- Crash savings of $1.2 million per year.

The forecast benefits for SWIRL are consistent, but slightly higher, than those estimated by SMART. A dual passenger and freight line was assessed to have a 1.13 BCR (central case). The assessment was deliberately conservative and did not include, for example, the potential benefits flowing from the construction and operation of Western Sydney Airport and any land value uplift or associated tax revenue derived from subsequent development.

The estimated cost of SWIRL is $1.7 billion (2016-2017 dollars).

6.3.3 Impact of priority regional projects and major corridor links on travel times

The impact of the projects on travel times from Wollongong are shown in Table 6-10.

Table 6-10: The impact of projects on road travel times from Wollongong to Sydney and Parramatta

	Wollongong to Sydney		Wollongong to Parramatta	
	2021	2031	2021	2031
Do nothing	97	112	108	121
Mount Ousley Intersection and Widening (assume completion by 2025)	96	110	103	112
Picton Road Upgrade (assume completion by 2025	95	108	103	112
F6 Extension (Stages 1 and 2) (assume completion by 2031)		95		111

Source: VLC 2018

15 SMART estimated $70.5m per year (Upgrading rail connectivity between the Illawarra and Sydney)

6.4 Key Future Transport Connection

The following project has been examined in relation to the potential long-term benefits to the region.

6.4.1 M9 Outer Orbital

Suggested delivery: Investigation of corridors within the next 10 years.

Initial planning for the M9 Outer Orbital in the Future Transport Strategy 2056 shows that it may join either Appin Road or Picton Road. In a broad long-term forecast beyond 2031, traffic volumes at key locations on the road network connecting to the Illawarra are shown in Table 6-11. For this forecast, it has been assumed that all of the projects recommended in this study are implemented. Table 6-11 shows that by 2046, Picton Road will be carrying a large daily total volume, close to that carried by Mount Ousley.

Table 6-11: Forecast daily traffic volumes without any connection of the M9

Road	2021	2031	2046
Hume Highway at Picton Road	62,200	73,700	95,100
Appin Road	10,100	11,200	13,100
Picton Road	23,500	34,700	62,300
Princes Motorway north of Appin Road	21,900	14,700	17,000
Mount Ousley north of Picton Road	32,000	25,900	30,100
Mount Ousley south of Picton Road	55,500	60,600	69,100

Source: VLC 2018

Table 6-12 contains a forecast of the traffic if the M9 is connected to Appin Road at the Hume Highway. This table shows that the impact of this would be to reduce the traffic demand on the Hume Highway by around 8 per cent, and would halve the traffic volumes on Picton Road. Traffic on Appin Road would increase by more than 300 per cent. It means that Appin Road would need to be upgraded to a dual carriageway, four-lane highway. It would also need to be extended to the Hume Highway west of Appin, with a new interchange put in place at the Hume Highway.

Table 6-12: Forecast daily traffic volumes with a connection of the M9 to Appin Road

Road	2021	2031	2046
Hume Highway at Picton Road	62,200	73,700	85,700
Appin Road	10,100	11,200	45,100
Picton Road	23,500	34,700	31,100
Princes Motorway north of Appin Road	21,900	14,700	17,000
Mount Ousley north of Picton Road	32,000	25,900	62,100
Mount Ousley south of Picton Road	55,500	60,600	70,000

Source: VLC 2018

Table 6-13 shows a forecast of the traffic if the M9 is connected to Picton Road at the Hume Highway. This table shows that the impact of this connection would be minimal compared to the forecasts in Table 6-11.

Table 6-13: Forecast daily traffic volumes with a connection of the M9 to Picton Road

Road	2021	2031	2046
Hume Highway at Picton Road	62,200	73,700	95,100
Appin Road	10,100	11,200	11,790
Picton Road	23,500	34,700	60,990
Princes Motorway north of Appin Road	21,900	14,700	19,620
Mount Ousley north of Picton Road	32,000	25,900	31,410
Mount Ousley south of Picton Road	55,500	60,600	70,000

Source: VLC 2018

Consequently, in comparing Picton Road and Appin Road options against the traffic modelling in Table 6-11, it is highly recommended that future planning consider the advantages of connecting the M9 to the Picton Road corridor.

6.5 Key Public Transport Projects

Three potential improvements to public transport services are recommended:

- Expanded Park and Ride facilities at Waterfall, Thirroul and Wollongong stations
- Improved bus services between the Illawarra and south west Sydney
- South Coast Line improvements.

6.5.1 Park and Ride expansion: Linking modes

Park and rides spaces are provided at most stations on the South Coast Line, but only four have more than 100 spaces, including:

- Wollongong, 400 (361 spaces on the western side of the station and 39 spaces on the eastern side)
- Oak Flats, 380 spaces
- Waterfall, 208 spaces
- Thirroul, 150 spaces.

At Waterfall, Park and Ride commuters connect with slower suburban trains because the South Coast Line express trains (limited stops) do not stop at Waterfall.

The Waterfall Park and Ride facility does not meet demand, with parking for the station extending outside of the formal car park for more than 500m on surrounding roads.

The Waterfall Park and Ride facility does not meet demand. Parking for the station, extends outside the formal car park for more than 500m on the surrounding roads. The southbound ramp onto the Princes Highway appears to be a favourite parking place for commuters.

Modelling and analysis of Journey to Work data for the Illawarra in the 2011 and 2016 censuses for the Greater Metropolitan Area of Sydney indicates that only a small percentage (around 5 per cent) of work trips include Park and Ride[16]. The Wollongong Park and Ride services workers mostly from south of Wollongong, while the Waterfall Park and Ride is used mostly by travellers from the north of Wollongong, including Bulli, Thirroul, Austinmer and other locations to the north.

Thirroul Park and Ride provides 150 spaces. It is the main station north of Wollongong serviced by the express train to Sydney. It is a convenient station for commuters and residents in the inner northern suburbs. However, the current parking facilities are limited and need to be expanded.

Commuters south of Wollongong in areas like Windang could access expanded park and ride facilities on the east or west of Wollongong station.

These are viable short-term options that should be examined in detail as they encourage greater interchanging and mode shifts among commuters and travellers.

At most of the smaller stations, demand exceeds the number of spaces provided early on weekday mornings, resulting in the surrounding streets being used by commuters for overflow parking. The stations at Unanderra and Dapto should also be examined as part of the master planning process for station precincts. These stations service large surrounding populations. Issues such as commuter parking, kiss and ride access and public transport interchanges need to be resolved.

However, demand for Park and Ride at Oak Flats, one of the major Park and Ride sites, is currently less than the number of parking spaces provided. The growth of Shellharbour, though, suggests that demand will rise rapidly over the next 5 to 10 years.

The study recommends a doubling of parking spaces at Waterfall (ie. additional 200 spaces) and an additional 100 spaces at Wollongong by 2021. Further investigations will need to occur for Thirroul, particularly in regard to the location of the Park and Ride facility in order to increase the number of places.

16 Based on the category: "*Two Methods, Train and Car as driver*"

6.5.2 Express bus service from Shellharbour to Campbelltown via Wollongong

Route 887 bus service currently operates hourly services between Wollongong station and Campbelltown station. The bus journey takes 70 minutes and there are 42 stops along its length. More recently, additional services have been introduced. During peak periods, this service could be improved by extending the route southwards to Shellharbour City Centre and reducing the number of stops to four for specific express services:

- Shellharbour City
- Wollongong Station
- Appin
- Campbelltown Station.

Timetabling and reducing the number of empty return trips also needs to be a consideration.

This would reduce the travel time between Wollongong and Campbelltown by 15 minutes to 55 minutes and would provide a travel time from Shellharbour of less than 90 minutes.

The services on this bus route have been well patronised by university students, and recently the service has been significantly improved by providing more services during the day and during periods of peak demand. While these improvements appear to have been aimed at accommodating demand for transport to and from the University of Wollongong, commuter demand between the Illawarra and the Outer South West area of Sydney (from Journey to Work data) is around 4,000 trips to work per day.

Shorter times between services and the reduced journey time (by 20 per cent) would attract between 6 per cent and 10 per cent of commuter demand and would increase the patronage of the services in peak times by between 240 and 400 passengers. A new market of Shellharbour may increase this by a further 10 per cent to between 250 and 450 passengers.

The extension of the route between Shellharbour and Wollongong would also function as an express shuttle between Shellharbour and Wollongong.

6.5.3 Express bus service from Southern Highlands to Campbelltown and Western Sydney

This proposal is aimed at providing much needed public transport options for the Southern Highlands. This bus service would connect Moss Vale, Bowral and Mittagong with Campbelltown and key locations in Western Sydney.

It is proposed that express bus services be introduced from the Southern Highlands, especially during the peak morning and evening periods. The frequency of the service would be tailored to meet the demand. A service to Campbelltown would allow for more convenient access to the Sydney Trains Network.

The Southern Highlands is an area of high youth unemployment. Enhanced public transport would provide significant employment opportunities across the Sydney region.

6.5.4 South Coast Line Improvements

The region is serviced by rail with connections to Sydney on both the Illawarra and South Coast lines. The South Coast Line provides electrified train services from Kiama to Central Station. The journey time from Kiama is over two hours and from Wollongong is almost 90 minutes. During the morning peak (6-9am) there are two express trains per hour between Wollongong and Central Station. During the non-peak periods, there is one express train per hour.

In addition, suburban services operate on the Illawarra Line between Waterfall and Sydney City stations. Trains depart Waterfall every 20 minutes during the morning peak period and every 30 minutes during the remainder of the working day.

A diesel shuttle service operates between Nowra/Bomaderry and Kiama, connecting with the service to Sydney. Shuttles leave Nowra/Bomaderry at two hourly intervals throughout the day. During the morning peak, two services operate to Kiama. Future Transport Strategy 2056 includes an initiative to investigate the electrification of the South Coast Line from Kiama to Bomaderry in the next 10-20 years.

There are 78 services per day on the South Coast Line. This includes 28 services from Wollongong to Central Station, 27 from Central to Wollongong Station and 23 freight services. Train services during the peak hours are crowded with additional pressures on the southbound journey from the CBD due to passengers travelling to Hurstville and Sutherland stations.

Improving travel times on the South Coast Line remains challenging. The line has a speed limited track, with relatively low travel speeds because of the terrain along the coast and through the escarpment as well as congestion on the Sydney Trains Network. There is also a single section of track at the Coalcliff tunnel (1 km).

The rail connectivity study undertaken by SMART Infrastructure for Illawarra First determined that achieving substantial travel time savings on the South Coast Line between Waterfall and Wollongong would involve extensive tunnelling and would be expensive.

Notwithstanding, TfNSW should investigate ways to provide incremental improvements to the South Coast Line including:

- Timetables – better connectivity between all station services and buses
- Station improvements – including accessibility improvements and shelter
- Local track enhancements to allow the removal of speed restrictions on certain track sections
- Exploration of the use of additional 8-car sets to provide immediate additional capacity
- Consideration of the potential to extend the capacity of the line to 10-car sets longer term with appropriate station platform upgrades to accommodate additional patronage
- Improving rail crossing safety
- Technology improvements such as the ETCS.

The average speed from Wollongong to Central Station is 56 km/h for the 82 km journey. However, over the two sections of the journey, the average speed from Wollongong to Waterfall is 64 km/h and from Waterfall (which is start of the Sydney Trains Network) to Central Station is 49 km/h. By way of example, achieving an average speed for the entire journey of 70 km/h would reduce the average travel time from 87 minutes to 70 minutes. At an average speed of 65 km/h, the average travel time would be reduced to 76 minutes.

7. Benefits to NSW

The travel benefits outlined in this Chapter represent benefits to the Illawarra community. However, investment in roads results in additional benefits, namely:

- **Agglomeration economies** that result from improved productivity of businesses and being located in larger markets that are only available to industries working close to each other. Improved access allows businesses to benefit from:
  - larger product, input and labour markets
  - face to face contact
  - information exchange and networking
  - knowledge and technology spillovers
- **Reduction in transport costs** to business passengers or freight transport that allows businesses to profitably increase the outputs of the goods or services that use transport in their production
- **Improved accessibility** affects individuals' decisions about when, where and how far they are prepared to commute, providing access to better paid jobs that may be further away in distance but not in travel time. Commuters may gain benefits in terms of their disposable incomes
- Value capture represents the **increases in land values** that result from improved accessibility provided by transport infrastructure investment.

These benefits are available for the wider Sydney and NSW communities, because they impact on all areas that gain from the increased accessibility provided by new roads. Studies in Europe and USA show that a government's investment in roads results in increased economic output and growth of the Gross State Product (GSP) as a result of the benefits that are not directly related to travel. On the basis of these studies, broadly speaking every $10 million invested in roads adds:

- Around 20 ongoing jobs to the economy of the state generally
- $2.25 million to the overall output per year
- $11.5 million to the GSP per year.

The proposed program of the three priority regional road projects has a value of around $550 million (total of the mid-point for estimated cost of construction). As a result, it is estimated that the investment in roads will:

- Allow growth of employment by an additional 1,100 jobs
- Provide potential for an increase in output of around $125 million per year
- Contribute an increase of around $630 million per year to the NSW GSP.

These estimated economic outcomes represent the final value to which they will grow over the period of the impact of the roads, a period which will depend on the performance of regional and state economies in the future.

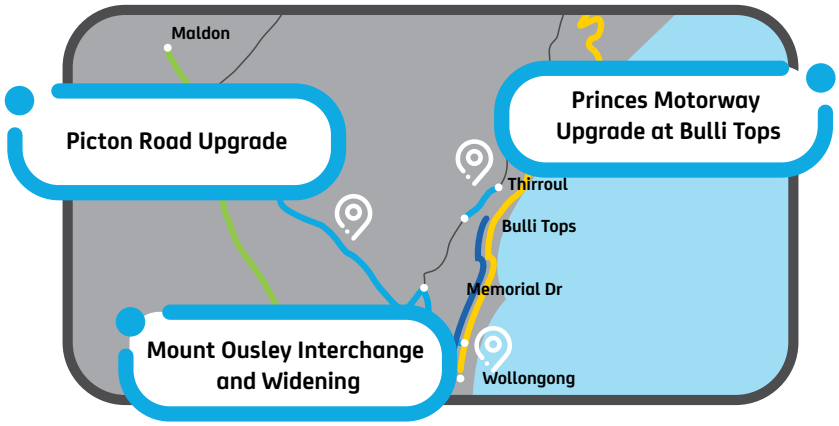
The above economic outcomes will be shared between the Illawarra, Greater Sydney and wider NSW regions. It is estimated that the increase in output of $125 million per year, will be shared between these areas as follows:

- $65 million to the Illawarra
- $10 million to the wider NSW regions
- $45 million to Greater Sydney.

In addition to these overall economic outcomes, these three projects would deliver an estimated total annual benefit of $95 million per year to road users through travel time savings, vehicle operating cost savings and crash savings.

$550 million

total projects value mid-point
(for estimated cost of construction).



1,100
additional jobs

$125 million
potential increase in output per year

$630 million
increased contribution per year to the NSW GSP.

$95 million
estimated total annual benefit per year to road users

These estimated economic outcomes represent the final value to which they will grow over the period of the impact of the roads, a period which will depend on the performance of regional and state economies in the future.

$125 million

increase in shared output

$65 million
to the Illawarra

$10 million
to the wider NSW regions

$45 million
to Greater Sydney

8. Conclusion and Recommendations

The pressures associated with population growth, residential and commercial developments, planned growth at Port Kembla, and lifestyle advantages of the Illawarra directly impact road infrastructure and transport connectivity in the region. Investment in infrastructure must match demand to avoid increasing congestion. In this context, the following projects and investigations are recommended:

Within the next five years:

- Mount Ousley Interchange and Widening (commence construction)
- Upgrade to Picton Road (commence construction)
- Investigation into feasibility of extending Memorial Drive to Bulli Pass
- F6 Extension (commence construction)
- South Coast Line improvements (ongoing)
- Investigation to identify and preserve the corridor for the M9 Outer Orbital
- Expansion of existing Park and Ride facilities at Wollongong, Thirroul, Waterfall, Unanderra and Dapto
- Express bus service from Shellharbour to Campbelltown
- Express bus service from Sothern Highlands to Campbelltown and Western Sydney.

Within the next 5-10 years:

- Princes Motorway Upgrade at Bulli Tops
- Investigation of an alternative escarpment crossing
- South West Illawarra Rail Link (commence construction with completion by 2028).

Any consideration of the priority projects for approval would require more detailed investigations than has been undertaken as part of this study. However, the analysis above shows there are significant benefits that could be achieved for freight and private vehicle users of the Illawarra road network.

Investigations would involve detailed engineering and environmental assessments to develop an appropriate project case for consideration. With more developed project definitions, strategic cost estimates could be developed. Whilst the BCR approach is supported, there is a conservatism applied by these assessments in the regional context, particularly due to scale and population issues which often discount the benefits and importance of regional investment. Regional infrastructure is an important policy lever for promoting regional development and a formal cost benefit analysis should not ignore the broader benefits to the community.

Appendix A: Study Terms of Reference

The Brief

The Illawarra Region is located immediately to the south of Sydney stretching southwards along the coast to just north of Shoalhaven. The major centre for this region is Wollongong, with other towns being Shellharbour, Kiama, Appin and Picton.

In their report "*Linking the Illawarra: Improving the regions transport connectivity*" (2014), PwC found that the level of connectivity between the Illawarra and Sydney is materially lower than the Australian benchmark regions and their CBDs.

Approximately 15 per cent of the Illawarra's working population commute outside of the region for work purposes, while approximately 10,000 workers travel from outside the region to jobs in the Illawarra. This highlights the interdependency between the Illawarra, Greater Sydney and its neighbouring regions.

Mount Ousley currently provides the only suitable access route for Higher Mass Limit (HML) vehicles into the Illawarra and it forms the main freight, commuter and tourist route. The route is affected by the steep and geologically unstable Illawarra escarpment. The grades along some parts of this road corridor have a significant negative impact on travel speeds and heavy vehicle operations.

Assessments of both Picton Road and Appin Road also identify significant bottlenecks that impose major impediments on safe and reliable transport.

Anticipated increases in vehicle movements due to population and economic growth will place further constraints on existing road infrastructure that are likely to manifest in longer delays and reduced safety.

The Illawarra Business Chamber (the Chamber) is aims to provide an evidence-based assessment of the primary benefits of the construction of SouthConnex and other improvements in road connectivity between the Illawarra and Greater Sydney, including the economic, productivity and safety benefits.

Specifically, the assessment will address the following:

- Identification of:
  - road-related pinch points and their impact on productivity, travel patterns and safety in the region
  - the demand of road access to rail stations (Park and Ride and Kiss and Ride) in the study area
- Determination of:
  - a priority list of road project needs in the short term (5 years) to improve road freight and commuter movements between the Illawarra and Greater Sydney
  - motivation for the selection of these projects
  - a high level strategic plan for the delivery of the projects including information on the current commitments, total costs, timing and delivery method
- Identification of:
  - value in improved connectivity with surrounding satellite suburbs and Sydney CBD
  - the potential value to the NSW economy and relevant sectors (e.g. tourism, advanced manufacturing, education and health).

Methodology

Project has two stages, as follows:

Stage 1 - Model preparation and validation

As the Zenith model for Greater Sydney is current and includes the latest land use and demographic data, there should be no need to implement major updates to this data, nor the road network and public transport networks.

However, the model inputs should be reviewed and incorporate most recent traffic volume data provided by RMS. With this traffic volume data, along with data currently held by VLC, there will be a brief (two week) validation exercise in the project study area. The modelled traffic volume results will be compared to observed traffic survey counts, presented to demonstrate the accuracy of the model for use in the project area and material weaknesses or limitations will be identified

The NRMA has contributed funding and in-kind support for this study and has indicated that it could supply VLC with a range of data such as the cost of crashes in the region and trends in whether this is improving/worsening; travel times to/from the region; business and general commuter sentiment with regards to travel times and analysis of transport mode trends. This data will be incorporated into the study where it supports the scope of works.

Stage 2 - Demand forecasting and economic modelling

Once validated, the focus will initially be on understanding the current conditions on the road network connecting the Illawarra with Greater Sydney (CBD and Western Sydney) and the impact thereof on productivity in the region. The analysis will focus on the following:

- Expected traffic volumes along the main routes connecting the Illawarra and Greater Sydney
- The level of service with the peak period, which would impact safety
- Expected delays in the peak periods thus impacting productivity.

VLC should request accident records from RMS and assess the current impact of crash rates.

Forecasts

For this project, it is proposed to run two horizon years, namely 2021 and the 2031.

In order to determine a priority list of road project needs in the short term, we would propose to initially focus on the 2021 model results.

Subsequently, the results of the 2021 and 2031 horizon years for the economic assessment would be incorporated.

Agree assumptions

For each of these alternative horizon years, the main assumptions that need to be agreed on are as follows:

- Future demographics
- Future transport networks
- Special generators, e.g. Port Kembla.

VLC will provide a recommendation for each of these assumptions for each scenario and seek agreement with Illawarra First and its stakeholders.

Build future year scenarios and run models

Once agreement is reached on the assumptions to be used, VLC will build the future year scenarios and run the core model runs. For the economic analysis, VLC will further run the economic module for the 2021 and 2031 horizon years.

Analysis of the model results

- Once completed, the model results will be analysed and outputs prepared as agreed with the Chamber. These outputs will be automated in order to maintain consistency between model runs
- It is envisaged the initial outputs would be limited to providing plots of 24-hour and peak period volumes and level of service for an average weekday during school term for private vehicles, light commercial vehicles and heavy commercial vehicles.

For the economic analysis, we will prepare outputs indicating the benefits produce meaningful plots which really highlight who's benefiting/disbenefiting from the proposed infrastructure improvements. Some examples of these plots are shown overleaf. The economic analysis will highlight travel time and cost benefits for passengers and freight.

VLC should assess safety based on change in vehicle kilometres travelled on each road link in the model.

In assessing the freight benefits, account will be taken of the need for intra-modal and inter-modal transfers.

Literature review

Further to the modelling assessment, there will be a literature review of relevant documentation to inform the high level strategic plan for the delivery of the projects including information on the current commitments, total costs, timing and delivery method.

The review will also input into the determination of the potential value to the NSW economy and relevant sectors (e.g. tourism, advanced manufacturing, education and health).

VLC will also undertake a high-level assessment of the journey to work data from the 2016 Australian Census, once available, and discuss the changes and trends since 2011.

VLC will produce a short technical report, outlining the level of validation in the model study area, model assumptions and the analysis of the modelling results.

Appendix B: VLC and the Zenith Travel Model

Veitch Lister Consulting Pty Ltd (VLC) is one of the largest specialist transport planning consultancies in Australia. VLC has provided the transport planning industry with travel demand forecasting and transport infrastructure planning for over 30 years.

VLC is a pioneer in the art of travel modelling, having developed its first large scale traffic model in 1988, and its first regional multi-modal model in 1996.

The Zenith model, created by VLC, is a classical four step model, the four steps being:

- **Trip Generation** (how often to travel and for what purpose)
- **Destination Choice** (where to travel to)
- **Mode Choice** (what transport mode to use)
- **Trip Assignment** (what route to take).

The main inputs to the Zenith model are:

- A digital representation of the transportation network, including all freeway, arterial and collector roads, all public transport routes and stops, and in some cases, walking and cycling paths
- Demographic and land use data, describing in a high level of detail the locations of households, firms and other trip generators (e.g. schools, universities, airports, ports, etc.)
- Policy variables including fuel prices, parking costs, toll prices and public transport fares
- Model parameters which specify the travel behaviour of the local market.

Separate sets of inputs are maintained by VLC for various forecasting horizons (typically 2021, 2026, 2031, etc).

The overall architecture of the Zenith model is shown in Figure B-1 below.

The parameters used in the Zenith model of Victoria are primarily based on household travel surveys conducted in Victoria between 2007 and 2010 (the VISTA survey). Those parameters are documented in technical papers that are available on VLC's website.

For more information on the general methodology used by the Zenith model, see http://www.veitchlister.com.au/zenith/documentation.

For specific information about the Victorian implementation of the Zenith model (including the parameters used), see http://www.veitchlister.com.au/zenith/documentation/victoria.

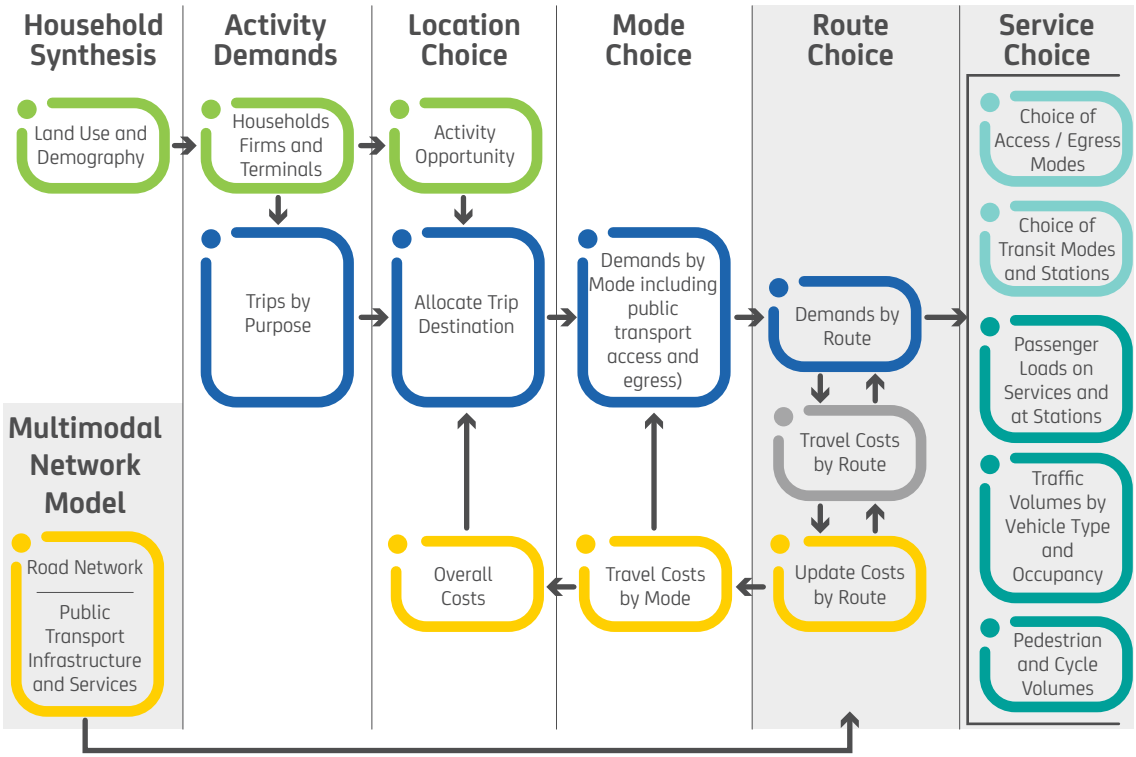


Figure B-1: Key Stages of the Zenith Models

Appendix C: NSW Government Future Transport Strategy 2056, other studies and planned projects

Transport for NSW (TfNSW) released the final version of its Future Transport Strategy 2056 in March 2018. In addition, RMS has completed several investigations into potential improvements of the road network throughout the Illawarra. RMS has also investigated and begun implementation of some projects to relieve congestion. These are mentioned below.

Future Transport Strategy 2056

The Future Transport Strategy 2056 is the update of the NSW Long Term Transport Master Plan and is a 40-year vision for mobility in NSW. The Strategy sets out a vision, strategic directions and customer outcomes, with infrastructure and services plans for Greater Sydney and Regional NSW. It also sets out a series of issue-specific and place-based plans that focus on more integrated solutions than previously was the case.

The Strategy has specific goals of improved connectivity for regional centres, to provide better access to jobs and to better support the regional economy. It has a strong focus on the role of technology, with visions for developing Mobility as a Service, strengthening the digital network and envisioning the impact of automated vehicles.

Proposed short-term infrastructure improvements for the Illawarra included in the Strategy that have been committed to by the NSW Government during the next 10 years include:

- Princes Highway Upgrade between Berry and Bomaderry (10.5 km road, planned completion 2021)
- Albion Park Rail Bypass (9.8 km road, planned completion 2022)
- Princes Motorway Interchange at the base of Mount Ousley
- Picton Road and Appin Road: capacity improvements to support the growth in freight, public transport and private vehicle journeys.
- Princes Motorway: upgrading including additional lanes from the Picton Road intersection to Bulli Tops (8 kms of road, delivered in two stages)
- Nowra Bridge over Shoalhaven River subject to business case and Federal funding.

In the medium term (10 to 20 years), the strategy includes the following proposals, subject to a business case assessment:

- Completion of Maldon to Dombarton railway line
- Electrification of the intercity line from Kiama to Bomaderry/Nowra
- Illawarra Highway/Macquarie Pass improvements.

The Strategy includes assessment in the 10 to 20 year period of the Maldon to Dombarton rail line for servicing freight only. However, the IBC commissioned a study of rail transport connectivity between Illawarra and Western Sydney which identified the value of using the rail link (SWIRL) for passenger services as well[17].

In the long term (20+ year period), the strategy includes assessment of the M9 Outer Sydney Orbital from the Hume Motorway to the Illawarra. The actual corridor has yet to be determined.

Other RMS Road Studies

Macquarie Pass

The Illawarra Highway is a designated State Highway, 62 kms in length, connecting the Hume Highway at Sutton Forest to the Princes Highway at Albion Park Rail. It provides access to Moss Vale and Robertson in Wingecarribee from the coastal plain of Illawarra. For most of its length it is an undivided, two-lane road, with passing lanes at infrequent intervals. It crosses the escarpment at Macquarie Pass, a steep, highly curved road, with several sharp bends.

In 2017, a traffic count on Macquarie pass showed that the road currently carries around 3,600 vehicles per weekday. Over the past 12 years, the traffic volume has grown by an average of 2 per cent per year. Table C-1 provides the 12-year history of traffic volumes on Macquarie Pass.

Table C-1: Traffic volumes on Macquarie Pass on weekdays from 2006 to 2017

	Eastbound	Westbound	Total	Growth
2006	1444	1419	2863	
2007	1493	1458	2951	3.1%
2008	1458	1449	2907	-1.5%
2009	1518	1512	3030	4.2%
2010	1586	1574	3160	4.3%
2011	1626	1606	3232	2.3%
2012	1655	1648	3303	2.2%
2013	1705	1683	3388	2.6%
2014	1664	1619	3283	-3.1%
2015	1714	1596	3310	0.8%
2016	1744	1679	3423	3.4%
2017	1876	1783	3659	6.9%

Source: RMS

17 Upgrading rail connectivity between Illawarra and Sydney, SMART, August 2017

The count at Macquarie Pass is not classified, so the number of heavy vehicles using the pass is not directly known. An older count taken between Moss Vale and Robertson suggests that the heavy vehicle content on Macquarie Pass is around 10 per cent. The number of heavy vehicles using Macquarie Pass on a weekday can therefore be estimated at between 350 and 400 per day. With growing constraints on Mount Ousley and Picton Roads, freight movements are already being forced onto less appropriate minor roads.

During the five years ending 2016, there were 125 crashes on Macquarie Pass. Table C-2 summarises the five-year crash occurrences.

Table C-2: Crashes on Macquarie Pass 2012 to 2016

Year	Number of Crashes
2012	27
2013	35
2014	30
2015	20
2016	13

Source: RMS

There are no plans to improve the alignment of Macquarie Pass or to provide an alternative route across the escarpment. The location of Macquarie Pass in a National Park, the complex geology and topography and the relatively low level of demand for the road are all negative influences for the need to improve the road.

Travel time between Wollongong and Moss Vale (connection to Hume Highway) is around 70 minutes. This is approximately the same in terms of travel time for the journey from Wollongong to Moss Vale via Picton Road and the Hume Highway.

Reductions of speed on the Illawarra Highway are not associated with congestion. Rather the geometry of the road (both speed and curves) slows traffic. Given the geometry and location of the road, improvement to the alignment of Macquarie Pass would be very costly.

Other alternative corridors as part of F6 Extension investigations

As part of investigations into the F6 Extension (SouthConnex), RMS has looked at the A6 corridor option which is broadly aligned with Heathcote Road, New Illawarra Road, Alfords Point Road, Davies Road and Fairford Road. The upgrade of the A6 as an alternative to the F6 Extension (SouthConnex) has previously been examined and was found to be a costly option that is unlikely to provide significant relief of volumes across the Captain Cook and Tom Ugly's Bridges.

Heathcote Road connects the Princes Highway at Heathcote to Newbridge Road (A34) near Moorebank. It is, for most of its length, a two lane road with passing lanes provided, and has a 100km/h speed limit. It has some steep grades, especially southwest of Lucas Heights. It connects to the New Illawarra Highway at Lucas Heights, which leads to one of the crossings of Georges River (Alfords Point Bridge). Its location is shown in the following diagram:

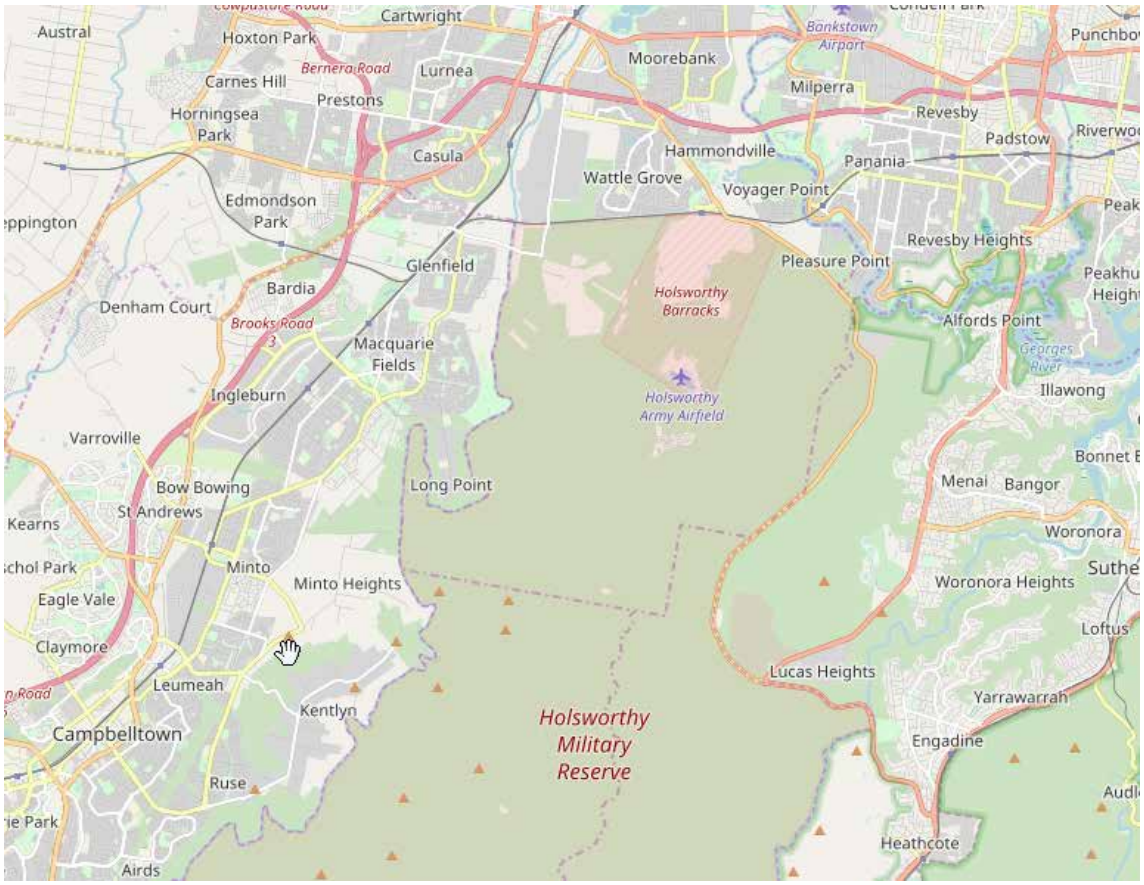


Figure C-1: Other alternative corridors as part of F6 Extension investigations

South of Lucas Heights, its carries a total of around 22,000 vehicles per day in both directions. Its traffic is growing at around 2 per cent per year. North of its intersection with New Illawarra Highway, it carries less than 10,000 vehicles per day.

Heathcote Road is superficially attractive for upgrading, to improve connectivity from the south to western Sydney and for improved connectivity to New Illawarra Road. However, upgrading the road would be complex and expensive because of:

- the topography through which is passes, especially in in the south
- its location along the border of the Holsworthy Military Reserve

Its principal market would be vehicles travelling from south of Heathcote to the area around Liverpool. However, the route it provides for cars is relatively uncompetitive with the route along Picton Road and the Hume Highway. Even though it connects to a rapidly growing areas, its attraction would be relatively low. In addition, it would provide minimal relief for the routes across the Georges River, which is the main priority for the road network in the south of Sydney's metropolitan area.

Appendix D: Road classifications and levels of service

Road classifications

To manage the network of roads for which councils are responsible under the Roads Act 1993, RMS and local government authorities established an administrative framework of State, Regional, and Local Road categories:

- State roads are managed and financed by RMS
- Regional roads are managed and financed by councils; however, because of their significance in the road network, RMS provides financial contributions to assist council in their administration of the roads
- Local roads are unclassified roads that are maintained and funded by councils.

The Princes Motorway is classified a state road, together with stretches of the Princes Highway where it does not duplicate the Princes Motorway. Picton Road and Appin Road are also classified state roads.

The vast majority of road said addressed in this study are the responsibility of the NSW Government. In some cases, this may involve joint funding with the Commonwealth Government and/or private sources.

Level of Service		Volume/ Capacity Ratio		
		Motorway	Arterial	Local
A	Drivers travel at desired speed, and manoeuvre freely, experiencing no delay due to other traffic	<0.50	<0.40	<0.35
B	Drivers will incur occasional minor delays and restrictions to manoeuvre due to other traffic	0.50	0.40	0.35
C	Drivers will experience interrupted travel, with minor delays and stops, but with network operating efficiently providing predictable travel times	0.65	0.60	0.50
D	Drivers will experience occasional major delays, with variable travel times due to conflicting traffic and volumes approaching capacity	0.85	0.75	0.65
E	Drivers will experience frequent major delays, with volumes at or exceeding capacity for short periods, unpredictable travel times	1.00	0.90	0.80
F	Drivers will experience severe congestion and delays, with volumes exceeding capacity for long periods, strong influence on route choice	1.15	1.05	0.95
F*	*This is an additional level of service category, developed in research for planning and long term forecasts of demand and capacity and indicate and area where demand definitely exceeds capacity*	1.30	1.20	1.10

Source: Veitch Lister research with DoIRD

Figure D-1: Level of Service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Member
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Business
Chamber

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