

Port Macquarie-Hastings Local Government Area Traffic Study

Plain English Summary Report

Version: October 2019





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1. Introduction

Port Macquarie-Hastings Council, in conjunction with Roads and Maritime Services of NSW (RMS), has undertaken a comprehensive Port Macquarie-Hastings Local Government Area (LGA) Traffic Study. The study used the services of GHD, an international engineering consultancy firm with a local office in Port Macquarie.

The overarching aim of the study was to develop a road and traffic management strategy for the Port Macquarie-Hastings road network for the next 20 years. The study is a component of Council's holistic approach to strategic transport planning which is necessary in:

- improving accessibility, mobility, transport choice and social equity
- supporting economic and regional development
- ensuring that efficient and effective land use decisions are made to shape patterns of development
- improving road safety, social and environmental outcomes

A key component of the traffic study was the development of a sophisticated traffic model that can be used to test future conditions and network improvement options on the basis of land use and population forecasts.

Key project dates were:

December 2015	Consultant appointment
May 2016	Preliminary base model development
August 2016	External audit of base model
March 2017	Finalisation of base model
May 2017	Future base conditions assessment
June 2017	Options identification and assessment
July 2017	Draft final report
June 2018	Final report

This summary report is a plain English version of the GHD project report (June 2018) in a format that is made available to the public via the Council web site.

1.1 What is a Traffic Study?

A traffic study is a detailed examination and analysis of a transportation system by qualified and experienced transportation professionals. They cover a defined study area, involve considerable data collection and detailed analysis.

Traffic studies need to be regularly reviewed and updated to reflect changes in land use, road network, traffic patterns, policies, technology and various other drivers.

Traffic studies are not works programs in themselves but are an essential input into the development of various Council plans and action programs. Traffic studies guide planning and investment decisions by providing important data transparently to the community, Council and other government agencies. They help to determine priorities for future road maintenance, upgrades, operation, safety, traffic and development.

Council regularly undertakes traffic studies across the LGA and key previous studies include:

- The first area wide study was undertaken by GHD in 1985. This study reinforced the need for the provision of critical link roads to service forecast traffic growth associated with planned



urban land releases on the outskirts of Port Macquarie. A primary recommendation was the construction of a link road between Matthew Flinders Drive and Hindman Street, Port Macquarie which was subsequently implemented in stages between 1990 to 2007.

- Connell Wagner updated the GHD study in 1993 and reviewed the major road improvements required to service future traffic demand. Information from this study was also used to support a detailed major roads Section 94 developer contributions plan.
- The first Port Macquarie Town Centre traffic study was undertaken in 1995 and has since been updated by a number of subsequent traffic studies.
- The Wauchope Traffic Study was prepared in 1996 with recommendations for road network improvements within Wauchope, and has since been updated via a number of subsequent traffic studies.
- The Laurieton CBD Traffic Study was prepared in 1998 and led to the implementation of a number of traffic management measures.
- The Hastings Roads and Traffic Study was completed in 2003 by SMEC. For the last decade it has been the primary reference source for traffic forecasts and planning relating to Council's major road network.
- The Port Macquarie Outer Link Roads study in 2008 investigated the provision of new arterial road links between the Oxley Highway and Ocean Drive, and the Oxley Highway and Hastings River Drive.
- Over the last 15 years local area traffic studies have been prepared for Innes Peninsula, Area 13 (Thrumster- Sancrox), Area 14 (Bonny Hills- Lake Cathie) and Area 15 (Camden Haven) growth areas.
- RMS undertook a traffic study for the Oxley Highway between the Pacific Highway and Ocean Drive in 2016. The study investigated potential intersection upgrades along this critical corridor to cope with the significant traffic increase that will occur in the future.
- Council has recently or is currently developing main street plans for towns and villages including Wauchope, Lake Cathie, Laurieton, Kew and Kendall.

1.2 What is the Study Trying to Achieve?

The overarching objective of the study is to develop a road and traffic management strategy for the Port Macquarie-Hastings road network for the next 20 years. This is consistent with two key elements of Council's Operational and Delivery Plans:

- Create and maintain an integrated transport system that eases access between population centres and services
- Ensure transport options are safe, functional and meet access needs across the LGA.

The RMS is a key partner in the study and their charter is to enable safe and efficient journeys by:

- Managing the road network and optimising travel times
- Providing capacity and maintenance solutions for road infrastructure
- Improving road safety.



1.3 Study Methodology

The objectives of the study were achieved by the following specific tasks and key outcomes:

- Evaluate current road network performance based on existing transport demand and travel patterns, including a summary of existing constraints and issues.
- Evaluate the efficiency, performance and safety of the current transport system in relation to on-road public transport, walking and cycling.
- Forecast future travel demands, up to the year 2036, taking into consideration planned future developments, land release areas and committed major road projects.
- Evaluate future road network performance and identify a road hierarchy for future planning.
- Test a range of infrastructure improvements to accommodate existing and forecast future travel demands and develop an implementation strategy for identified road network improvements.
- Develop a traffic model that can be easily updated by Council and/or RMS in the future.
- Provide data that can be used as a key input into the revision of Council's Urban Growth Management Strategy and other relevant council strategies.
- Provide data that can be used as a key input into regional planning documents such as the NSW Long Term Transport Master Plan, NSW Future Transport Strategy 2056, the North Coast Regional Plan and other relevant State strategies.
- Provide data that can be used to develop or update new development contribution plans and voluntary planning agreements.

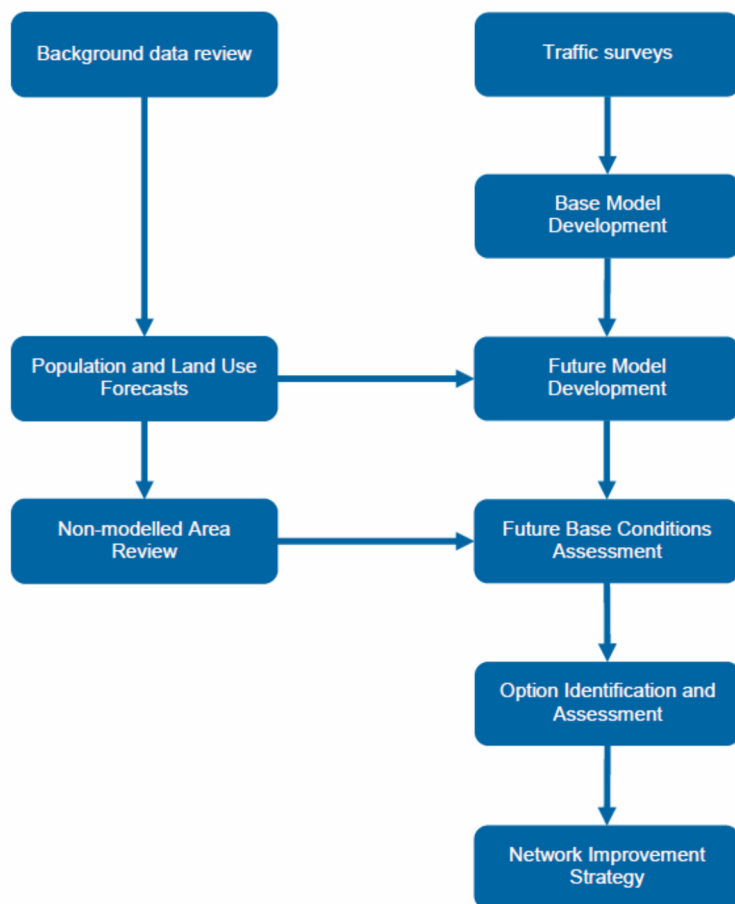




The project was primarily undertaken by GHD with oversight from Council and RMS. It involved the following key steps (refer to Figure 1):

1. Confirmation of the project scope and key parameters
2. Procurement process including engagement of a suitable consultant
3. Background data review
4. Data collection
5. Non-traffic model assessment
6. Traffic model scoping
7. Development of traffic model for the existing road network
8. Development of traffic model for future years
9. Modelling of a select number of road network improvements
10. Evaluation of future traffic conditions
11. Development of a road network improvement strategy
12. Training of Council/RMS staff in the ongoing use of the traffic model
13. Project reporting

Figure 1 Study Methodology



1.4 Glossary

Term	Meaning
AADT	Annual Average Daily Traffic. The total volume of traffic using a section of road in a calendar year, divided by the number of days in that year
Aimsun	Traffic modelling software used for the Port Macquarie-Hastings Traffic Model
AM Peak Hour	The busiest hour in the AM Peak period, nominally 8-9am on a weekday
AM Peak Period	7am-10am, as modelled
Base Case	Conditions without any changes to the existing road network
Level of Service (LOS)	A qualitative description of traffic conditions, which makes reference to quantifiable measures of performance. Scale is from A (free flow conditions) to F (congested conditions)
Model Area	The area covered by the Port Macquarie-Hastings Traffic Model
PM Peak Hour	The busiest hour in the PM Peak Period, nominally 3-4pm on a weekday
PM Peak Period	2pm-6pm, as modelled
Study Area	The Port Macquarie-Hastings Local Government Area
Travel Speed	The average speed achieved by vehicles on a particular road link
Travel Time	The time taken (on average) for a vehicle to travel between two locations on the network
VHT	Vehicle Hours Travelled
VKT	Vehicle Kilometres Travelled
Vehicles per hour (vph)	The number of vehicles using a road in a 60 minute period. Volumes are in one direction only, unless noted otherwise.



2. Existing Transport Conditions

2.1 Road Network

2.1.1 Road Hierarchy

Roads within NSW are categorised in the following two ways:

- by Classification (ownership); and
- by the Function that they perform.

Classification

The NSW Government classifies roads according to the Roads Act 1993 based on their importance to the movement of people and goods. The three main administrative classes of roads are:

- **State Roads** – Major arterial links through NSW and within major urban areas. They are the principle traffic carrying roads and fully controlled and funded by RMS.
- **Regional Roads** – Roads of secondary importance between State Roads and Local Roads which, with State Roads, provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance, though RMS provides some funding assistance. Traffic management on Regional Roads is controlled by councils under delegation.
- **Local Roads** – The remainder of the council controlled roads. Local Roads are the responsibility of councils for maintenance funding. RMS may fund some maintenance and improvements based on specific programs.

State and regional roads within the LGA are presented in Table 1.

Table 1 State and Regional Roads in PMHC

State Roads		Regional Roads
Pacific Highway	Ocean Drive	Comboyne Road
Oxley Highway	Hastings River Drive	Kendall Road
	Gordon Street	River Street (Kendall)
		Nancy Bird Walton Drive

Function

Functional road classification involves a balance of the mobility and access functions. RMS define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These functional groupings are:

- **Arterial Roads** – typically no limit in flow and designed to carry vehicles long distance across metropolitan areas and between regional centres.
- **Sub-Arterial Roads** – their aim is to carry through traffic between specific areas in a sub region, or provide connectivity from arterial road routes (regional links).
- **Collector Roads** – provide connectivity between local roads and the arterial road network.
- **Local Roads** – provide direct access to properties and the collector road system.



Table 2 Arterial and Sub-arterial Roads in PMHC

Arterial		Sub-arterial
Gordon Street	Bago Road	Lord Street
Hastings River Drive	Beechwood Road	Pacific Drive
Ocean Drive	Bold Street	Lake Road
Oxley Highway	Kendall Road	Pembrooke Road
Pacific Highway	Nancy Bird Walton Drive	Comboyne Road
	Kennedy Drive	Stoney Creek Road

2.1.2 Traffic Volumes

The performance of urban road networks is primarily a function of the performance of key intersections. The intersections with the highest traffic volumes (2017 data) are presented in Table 3.

Table 3 Key Intersections

Intersection	Location	Maximum Volume (total vehicles per hour)
Ocean Dr / Lake Rd	Port Macquarie	4160
Oxley Hwy / Lake Rd / Sherwood Rd	Port Macquarie	3890
Oxley Hwy / Pacific Hwy	Thrumster	3660
Oxley Hwy / Hastings River Dr / Ocean Dr / Gordon St	Port Macquarie	3500
Ocean Dr / Koala St	Port Macquarie	3230
Oxley Hwy / Widderson St	Port Macquarie	3030
Oxley Hwy / Clifton Dr / Fernhill Rd	Port Macquarie	2950
Gordon St / Horton St	Port Macquarie	2910
Oxley Hwy / John Oxley Dr / Wrights Rd	Port Macquarie	2800
Lake Rd / Jindalee Rd	Port Macquarie	2680
Lake Rd / Central Rd	Port Macquarie	2620
Gordon St / Hollingworth St	Port Macquarie	2550
Oxley Hwy / John Oxley Dr (west) / Sovereign Dr	Port Macquarie	2400
Lake Rd / Gordon St	Port Macquarie	2370
Hastings River Drive / Clifton Dr	Port Macquarie	2100
Ocean Dr / Crestwood Dr / Dahlsford Dr	Port Macquarie	2020
Ocean Dr / Pacific Dr / Jonas Absalom Dr	Port Macquarie	2020
Hastings River Drive / Newport Island Rd	Port Macquarie	1900
Ocean Dr / Hindman St	Port Macquarie	1880
Oxley Hwy / Cameron St	Wauchope	1720
John Oxley Dr / Major Innes Rd	Port Macquarie	1690
Pacific Hwy / Hastings River Dr	Port Macquarie	1650
Park St / Bay St	Port Macquarie	1630
Lord St / Hill St	Port Macquarie	1620
Gordon St / Lord St	Port Macquarie	1610
Hastings River Drive / Widderson Dr	Port Macquarie	1590
Pacific Hwy / Houston Mitchell Dr	Port Macquarie	1560
Ocean Dr / Mathew Flinders Dr / Emerald Dr	Port Macquarie	1450
William St / Horton St	Port Macquarie	1440
Lake Rd / Hill St	Port Macquarie	1350
Hastings River Dr / Hughes Pl	Port Macquarie	1300



Intersection	Location	Maximum Volume (total vehicles per hour)
Kennedy Dr / Koala St	Port Macquarie	1170
Hastings River Dr / Boundary St	Port Macquarie	1140
Oxley Hwy / Beechwood Rd	Wauchope	1140
Ocean Dr / Houston Mitchell Dr	Lake Cathie	1070
Ocean Dr / Sirius Dr	Lakewood	1050
Koala St / Granite St	Port Macquarie	1050
Ocean Dr / Kew Rd	Laurieton	1000

Outside of urban areas the performance of rural and peri-urban roads is typically a function of the traffic volume of a road as a proportion of the theoretical capacity of the road. The highest traffic roads (2017 data) are presented in Table 4.

Table 4 High Traffic Roads

Road	AADT ¹ (2017)	Location
Oxley Highway	600–26,000	Highest volume is between Wrights Rd & Lake Rd, lowest volume is at Walcha LGA boundary
Ocean Drive	6,000–23,000	Highest volume is between Lake Rd & Koala St, lowest volume is between Bonny Hills & North Haven
Gordon Street	22,000	Highest volume is between Hollingworth St & Horton St
Lake Road	20,000	Highest volume is between Oxley Hwy & Ocean Dr
Pacific Highway	18,000	Highest volume is south of Oxley Hwy
Hastings River Drive	8,000–18,000	Highest volume is near Clifton Drive, lowest volume is at Pacific Hwy
Buller Street	16,000	Port Macquarie
John Oxley Drive	2,000–16,000	Highest volume is near Wrights Rd, lowest volume is in Thrumster
Park Street	14,000	Port Macquarie
Lord Street	14,000	Port Macquarie
Clifton Drive	10,000	Port Macquarie
William Street	10,000	Port Macquarie
Hayward Street	9,500	Port Macquarie
Bay Street	9,000	Port Macquarie
Pacific Drive	7,000	Port Macquarie
Bold Street	7,000	Laurieton
Central Road	6,000	Port Macquarie
Kennedy Drive	6,000	Port Macquarie
Widderson Street	6,000	Port Macquarie
Kew Road	6,000	Laurieton
Cameron Street	6,000	Wauchope
Fernhill Road	6,000	Port Macquarie

¹ Annual Average Daily Traffic

2.2 Public Transport

2.2.1 Bus

The majority of bus services in the study area are operated by Busways, and connect within and between Port Macquarie, Wauchope, the Camden Haven and Kempsey. Key terminus locations include the Port Macquarie CBD, Settlement City, Port Macquarie Base Hospital, Wauchope town centre and Laurieton town centre.

Long distance coach services operate through the study area between Sydney and Brisbane via the Pacific Highway, with scheduled stops at Port Macquarie only.

A trial long distance coach service recently commenced (March 2018) between Port Macquarie and Tamworth.

2.2.2 Rail

NSW TrainLink operates daily return train services between Sydney and each of Brisbane, Grafton and Casino. Each service stops at Kendall and Wauchope (total 3 services per day in each direction). NSW TrainLink also operate a coach connection between Wauchope and Port Macquarie, once per day in each direction.

2.3 Walking and Cycling

Facilities for pedestrians are focussed on the Port Macquarie CBD, and other local commercial / retail centres in the study area. Many residential streets do not have footpaths, even in well-established residential areas. Where a path is provided it is often on one side of the road only, may not have kerb ramps, and may not be continuous or connect to other facilities.

Land use in the study area is relatively dispersed, making walking a less attractive mode of travel than it might otherwise be. Within the inner Port Macquarie area the major arterial roadways, particularly Oxley Highway, Ocean Drive, Hastings River Drive and Lake Road, present significant barriers to pedestrian movement, due to a combination of traffic volume, speed, road width and car-dominated land uses. Opportunities for pedestrians to cross these roads are limited, with many intersections controlled by roundabouts rather than traffic signals which are more pedestrian-friendly.

There are few specific cycling facilities in the study area, limited to on-road bike lanes on parts of Hastings River Drive, Ocean Drive and Park Street.



3. Traffic Modelling

3.1 Introduction

Traffic modelling is a highly specialised field incorporating a range of disciplines including engineering, mathematics, computing and geography. It can be applied at both the macro and micro level. The value of a traffic model is typically a function of the quality and level of the data used to build the model, the model software and the proficiency of the traffic modellers.

A traffic model is a computer based mathematical model of real world traffic, enabling the analysis of an existing road network or theoretical network to estimate performance (e.g. travel times, delays, traffic volumes, impact of new links etc). A model typically covers a defined geographic study area for a specific time period (e.g. AM/PM weekday peak). Future models are developed for specified future years (e.g. Australian Bureau of Statistics Census years).

Traffic models require two areas of input:

- Network – physical characteristics of the road network such as number of lanes, link length, road hierarchy and intersection controls.
- Demand – trip tables showing traffic movement across the network between various land use generators and attractors. Analysis is based on a range of data including journey to work, population, employment data, traffic, travel times, freight and parking.

Typical model outputs include traffic volumes, average vehicle delay, average travel speed, volume over capacity (v/c) ratio and intersection delay.

It is important to recognise, however, that a traffic model is only a tool and one of many elements that contribute to the broader planning, asset management and decision making process for the management of a transportation network.

The selected traffic modelling package for this study was Aimsun (version 8) mesoscopic simulation module. It is one of the leading commercially available traffic modelling software packages and used worldwide. The software choice allows for a strategic level model covering the main urban areas of the LGA with the flexibility to undertake more detailed microscopic simulation modelling within the same model.

Council has an Aimsun licence to enable ongoing use of the traffic model following the completion of the GHD commission.

3.2 Base Model

The first step in the traffic modelling process is the development of a base model which is a mathematical model representing current peak hour traffic conditions. The model, which enables analysis of the existing road network to estimate performance, is required for two key reasons:

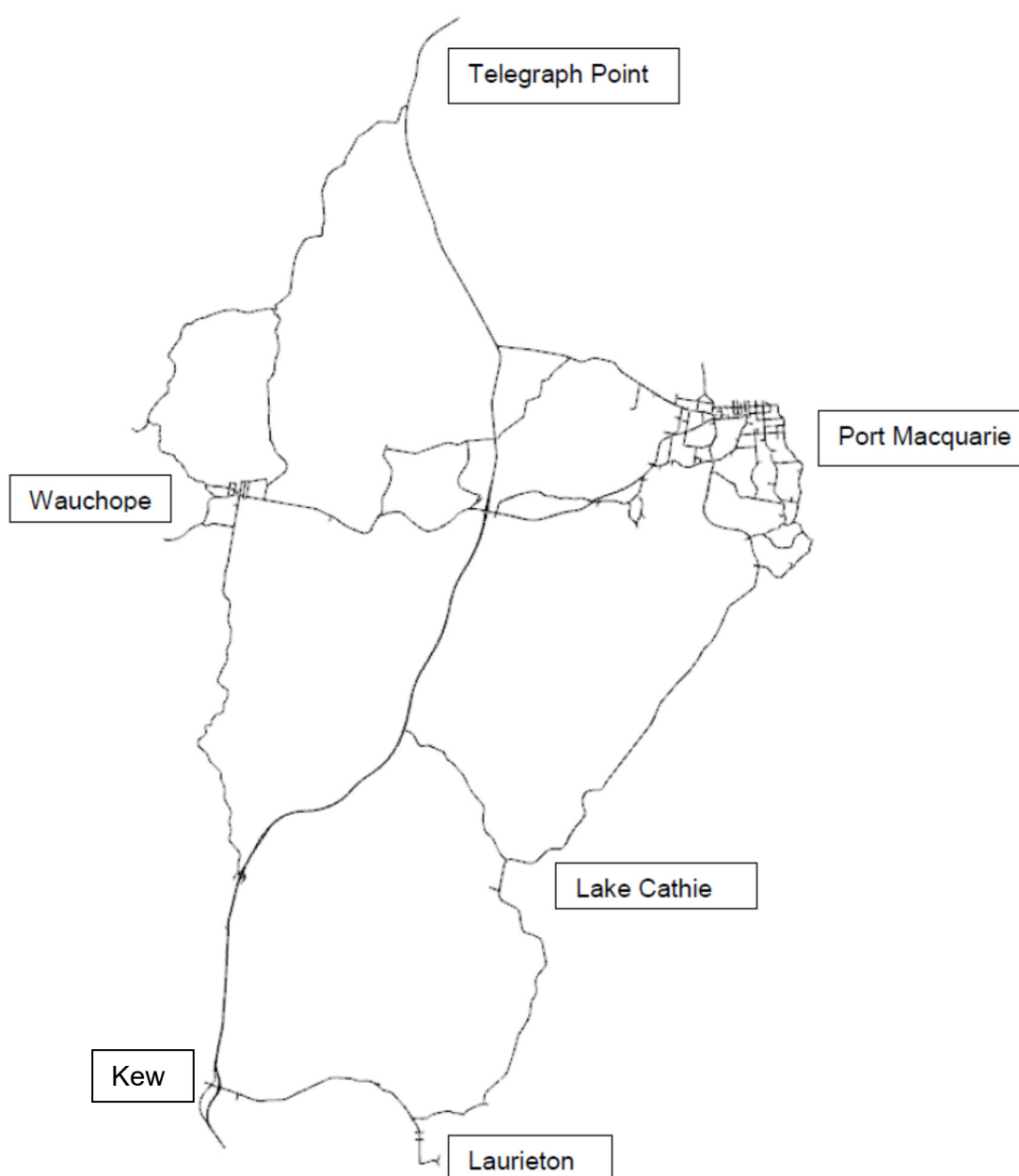
- to enable accurate verification, calibration and validation of model parameters to ensure that the model reflects current traffic conditions and provides accurate forecasts of future performance
- to provide a benchmark against which the effectiveness of the proposed designs can be compared.

The base model for the study was developed after a detailed scoping exercise with respect to key parameters, including geographic extents and timeframe, as summarised in Table 5.

Table 5 Base Model Features

Model Parameter	Description
Model coverage	195 zones ² (see figure below)
Time periods	Weekday 7.00 am – 10.00 am Weekday 2.00 pm – 6.00 pm
Traveller response	Dynamic to reflect changes in route choice, trip generation changes, trip distribution changes etc
Road network	Coding based on recent aerial photography, site observations, GIS data, speed limits, traffic signal layouts, parking etc

Figure 2 Traffic Model Coverage



²The traffic zone is the basic data unit in modelling and represents an area of homogeneous land use that produces and attracts trips.

Traffic models typically only include key roads and amalgamate local roads that do not significantly impact the performance of the overall network.

Model validation is the process whereby the base model is deemed “fit for purpose”. If a model is deemed to be fit for purpose it reflects current traffic conditions thus providing a solid basis for accurate forecasts of future performance.

The base model developed for this study was subject to a rigorous calibration and validation process. This included a peer review by an independent traffic modeller appointed by RMS. The model was found to conform to best practice guidelines and is therefore representative of current traffic conditions.

3.3 Future Year Models

A series of future year models were developed to allow for forecasts of future performance across a range of different road network scenarios. The population and land use forecasts are described in Section 3.3.1. The “Do Minimum” and road network upgrade scenarios are described in Section 3.3.2.

Table 6 Future Year Models

Model	Year	Population and Land Use	Road Network
2021A	2021	Base case forecasts	“Do Minimum”
2021B	2021	Base case forecasts	“Do Minimum” + <ul style="list-style-type: none"> • upgrade of Boundary Street / Hastings River Drive intersection • Lake Road corridor upgrade • Hastings River Drive corridor upgrade • Ocean Drive corridor upgrade • John Oxley Drive corridor upgrade
2026A	2026	Base case forecasts	“Do Minimum”
2026B	2026	Base case forecasts	“Do Minimum” + Scenario 2021B road network upgrades + <ul style="list-style-type: none"> • Orbital Road including John Oxley Drive upgrade • Wauchope inner bypass • Bonny Hills bypass
2036A	2036	Base case forecasts	“Do Minimum”
2036B	2036	Base case forecasts	“Do Minimum” + <ul style="list-style-type: none"> • Scenario 2021B road network upgrades • Scenario 2026B road network upgrades

3.3.1 Population and Land Use Forecasts

The estimation of future traffic considers both:

- population growth (i.e. dwellings) which is generally a generator of trips; and
- changes in industrial, commercial and retail floor space which is generally an attractor of trips.

In established areas traffic generation growth rates are applied on the basis of existing traffic movements and forecast increase in dwellings or floorspace. In greenfield areas traffic

generation is forecast on the basis of the size of the development using typical traffic generation rates for similar developments.

Population and land use forecasts were based on information provided by Council's strategic land use planners. Relevant data includes:

- population and dwelling forecasts by census collection districts for years 2016, 2021, 2026, 2036
- retail forecasts from Port Macquarie-Hastings Retail Strategy Review (2015)
- office and industrial forecasts from Port Macquarie-Hastings Industrial Land Strategy Review (2015) and the current review of the Urban Growth Management Strategy

The LGA's population is forecast to increase from 80,000 in 2016 to 104,000 by the year 2036. A substantial proportion of this growth will occur in Thrumster, Innes Peninsula, Lake Cathie/Bonny Hills and Kew. New district retail centres are planned for Thrumster and Lake Cathie. Significant additional industrial land is planned for Thrumster, Sancrox, the Airport precinct, Wauchope and the Camden Haven. Significant educational and medical development is planned for the Lake Innes area.

3.3.2 Road Network Upgrades

Road authorities need to consider a mix of potential improvement options to plan for the future needs of the road network, including:

- construction of new road links
- upgrades to existing corridors
- improved traffic management measures
- localised works to address specific issues
- non-infrastructure approaches including demand management

The "Do Minimum" road network includes committed road upgrades. These have all been either recently constructed or are currently under construction. This scenario represents a future year benchmark, against which the impacts of a specific project can be isolated and assessed.

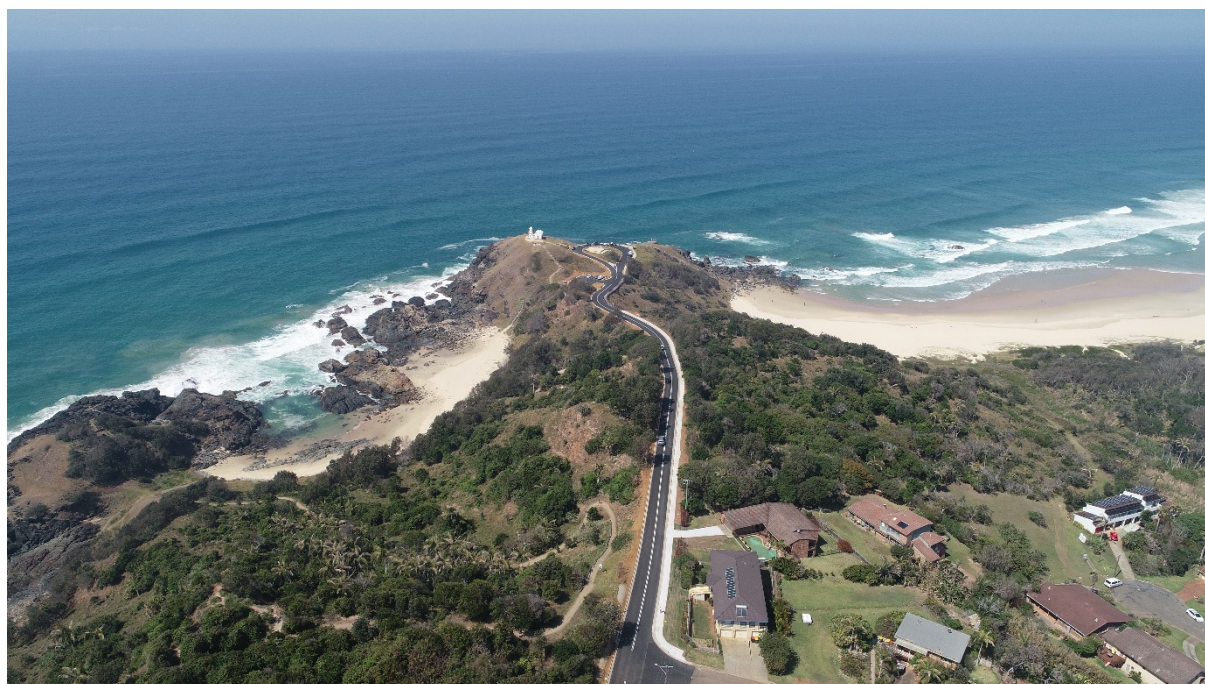
Analysis of the "Do Minimum" network under future traffic conditions highlighted a number of future problems across the network. This led to the selection of a number of future road network scenarios for evaluation. These new road links and corridor upgrades have been modelled as summarised in Table 7. A number of other localised works have not been included in the traffic model but are discussed in the network strategy section.

Table 7 Modelled Road Network Upgrades

Upgrade	Description
Boundary Street / Hastings River Drive intersection	Expanded traffic signal configuration with additional lanes on approaches
Lake Road corridor	Upgrade of key intersections at Fernhill Road, Jindalee Road, Central Road, Barton Crescent and Hill Street. Duplication of Lake Road between Central Road and Ocean Drive.
Ocean Drive corridor	Duplication and intersection upgrades of Ocean Drive between Greenmeadows Drive (south) and Matthew Flinders Drive as per Council's current detailed design. Includes conversion of three roundabouts to traffic signals.



Upgrade	Description
John Oxley Drive corridor	Duplication and intersection upgrades of John Oxley Drive between Wrights Road and The Ruins Way as per Council's current concept design. Includes a continuous central median, new signalised intersection to access the proposed bulky goods site and upgrades to the Kingfisher Road and Major Innes Road intersections.
Orbital Road	Major new arterial road connection linking Oxley Highway to Ocean Drive and Oxley Highway to Boundary Street via the Airport as per current Council study. Also includes a connection from the Airport to the Oxley Highway near Fernhill Road. Could be constructed as a number of separate stages.
Wauchope inner bypass	Road connection from Oxley Highway at railway level crossing to Cameron Street at northern end of Andrews Park as per previous Council investigations.
Bonny Hills bypass	Road connection approximately 3 km in length, as per previous Council studies, to west of Bonny Hills to form a bypass of Ocean Drive through the village.



3.4 Assessment of Road Network Improvement Scenarios

3.4.1 Boundary Street / Hastings River Drive Intersection

The modelling found that a significant upgrade of the Boundary Street / Hastings River Drive intersection would be required if either of the Airport Business Park or Orbital Road was to proceed. The intersection would continue to be controlled by traffic signals but would have additional turn lanes on the approaches.

The upgrade would be consistent with Council's current investigations into improvements on Hastings River Drive and Boundary Street. The Hastings River Drive upgrade involves duplicating the road between Hughes Place and Boundary Street. The Boundary Street upgrade involves widening and raising Boundary Street to the Airport to increase capacity and reduce flooding impacts.

3.4.2 Lake Road Corridor

The modelling found that significant upgrades to key intersections along the Lake Road corridor are already required on the basis of current traffic volumes. The highest priority is the section between and including the Fernhill Road and Jindalee Road intersections. The preferred long term configuration of Lake Road between the Oxley Highway and Ocean Drive is for two lanes in each direction, central median and localised widening at key intersections.

The Orbital Road would only result in a small reduction in traffic on Lake Road, and therefore the improvements are required *now* for both capacity and road safety reasons.

3.4.3 Ocean Drive Corridor (southern Port Macquarie)

The modelling confirmed the benefits of the upgrade of the Ocean Drive corridor in southern Port Macquarie. Significant capacity and safety improvements would arise from the road duplication and conversion of the three roundabouts to traffic signals. In particular traffic signals would better allocate priority to all approaches thus preventing specific movements from dominating. However, delays to Ocean Drive traffic in off-peak periods would increase because of the traffic signals intermittently stopping through traffic.

3.4.4 John Oxley Drive Corridor

The modelling found that the need for upgrades along the John Oxley Drive corridor is largely a function of the future level of local development. The road configuration of the corridor is dependent on future residential, educational, medical and commercial land uses. Council's concept design for the corridor will need to be progressed as the future form of the precinct becomes clearer.

3.4.5 Orbital Road

The Orbital Road project is a proposed major new road link that would have a significant impact on the Port Macquarie Road network. The traffic modelling undertaken to date is preliminary in nature and more comprehensive modelling will be required as investigations progress.

The preliminary modelling found that the Orbital Road would greatly improve the operation of the Port Macquarie road network. It would result in a significant reduction in traffic on parts of the Oxley Highway, Ocean Drive, Hastings River Drive and Clifton Drive but there would also be some road sections where traffic would increase.

The modelling was inconclusive on the merits of a link from the Orbital Road to the Lake Road industrial area such as a Jindalee Road link. More detailed modelling of this connection will be required as part of the ongoing Orbital Road investigations.

Staged construction of the three components should be considered:

- East – West link (3 km)
- North – South link (3 km)
- Airport to Oxley Highway link (1.5 km)

The East – West link is likely to lead to the most significant improvements to the overall efficiency of the network. The attractiveness of the North – South link and Airport to Oxley Highway link significantly increase if a substantial Airport business park was developed.

3.4.6 Wauchope Inner Bypass

The modelling found that the Wauchope inner bypass would only result in a marginal improvement in the operation of the local Wauchope road network. A contributing factor is that the majority of vehicles in the area have an origin/destination within Wauchope or the Beechwood Road corridor rather than further west along the Oxley Highway. The attractiveness of the bypass may increase in the future if delays along High Street through the town centre significantly increase leading to a change in route choice by some motorists.

3.4.7 Bonny Hills Bypass

The modelling found that approximately three-quarters of traffic using Ocean Drive through Bonny Hills would switch to the bypass which currently equates to about 4000 vehicles per day. Travel time savings for through traffic would be relatively insignificant at about 50 seconds. The 3 km bypass cannot be justified on the basis of capacity or road safety and a decision is required about the merits of preserving a corridor for future consideration.

3.4.8 Oxley Highway Corridor

RMS have undertaken traffic modelling, independent of the GHD study, of the Oxley Highway corridor between the Pacific Highway and Port Macquarie. The modelling investigated the need for upgrades at the following key intersections:

- Oxley Highway / John Oxley Drive (west) / Sovereign Drive, e.g. traffic signals
- Oxley Highway / John Oxley Drive (east) / Wrights Road, e.g. traffic signals or grade-separation in the longer term
- Oxley Highway / Lake Road / Sherwood Road, e.g. traffic signals
- Oxley Highway / Clifton Drive / Fernhill Road, e.g. additional approach lanes at roundabout
- Oxley Highway / Widderson Street, e.g. additional approach lanes at roundabout, traffic signals in the longer term
- Oxley Highway / Hastings River Drive / Ocean Drive / Gordon Street, e.g. right turn restrictions

The GHD traffic modelling highlighted that the most critical section of the Oxley Highway is between and including the intersections at Wrights Road and Lake Road.

The need for upgrades at various Oxley Highway locations may change if an Orbital Road was to proceed because such a new road link may increase traffic volumes on some sections of the Oxley Highway and decrease volumes on others.



4. Road Network Strategy

The recommended road network strategy is a combination of new road links, key corridor upgrades, localised works and rural road improvements as described in the following sections.

4.1 New Road Links

Treatment	Description	Action
Orbital Road	Proposed new road link would result in significant benefits to the operation of the region's road network. Has a significant impact on travel patterns, and provides relief to Lake Road and Clifton Drive. Staged introduction may be appropriate, with east-west section the higher priority.	Continue planning for the road link including route selection, concept design, traffic modelling, environmental assessment and staging options
Wauchope Inner Bypass	New road link may not result in a significant benefit in the short term but may become more attractive in the future if delays along High Street through Wauchope town centre increase.	Preserve road corridor as a possible future option





4.2 Corridor Upgrades

Corridor	Description	Action
Hastings River Drive corridor - Boundary Street to Findlay Ave	Duplication of western section of Hastings River Drive between Hughes Place and Boundary Street would result in a consistent corridor road cross-section with increased capacity along the main urban extent of the corridor. Intersection upgrades at Bellbowrie Street, Widderson Street and Aston Street would improve access onto Hastings River Drive and reduce barriers to pedestrian movement.	Continue planning and design for western section of corridor between Boundary Street and Hibbard Drive (east). Commence planning and design for upgrade of Bellbowrie Street and Widderson Street intersections. Aston Street intersection upgrade design has been completed.
John Oxley Drive corridor	Upgrades required to accommodate traffic accessing from new development (residential, educational, medical and commercial), where significant growth is forecast.	Continue planning and design for corridor upgrade between Wrights Road and The Ruins Way. Undertake Thrumster traffic study to determine required network improvements along western section of John Oxley Drive corridor.
Lake Road corridor – Oxley Highway to Ocean Drive	Main benefit of upgrade would be to improve access to and from key side streets, and improve road user safety. Most critical section is between and including the Fernhill Road and Jindalee Road intersections. Lake Road upgrade is required irrespective of the Orbital Road.	Continue development of planning, design and staging options for corridor
Ocean Drive (Port Macquarie) corridor – Greenmeadows Drive (south) to Matthew Flinders Drive	Main benefit of upgrade would be to improve access to and from key side streets, and reduce overall delays in peak periods. Conversion of roundabouts to traffic signals may increase overall delay in non-peak periods.	Continue design and staging options for corridor
Oxley Highway corridor	Corridor upgrades would primarily consist of improvements at key intersections including: John Oxley Drive (west), Wrights Road/John Oxley Drive (east), Lake Road/Sherwood Road, Clifton Drive/Fernhill Road, Widderson Street and Hastings River Drive/Ocean Drive/Gordon Street	Progress designs for upgrades of key intersections (RMS). Undertake further microsimulation modelling of Oxley Highway - Gordon Street corridor
Port Macquarie CBD road network	As a major centre of activity, and the location of the greatest concentration of crashes, it is appropriate to periodically review traffic management in the CBD area, with a focus on safety, accessibility and pedestrian movement.	Continue investigations into improving pedestrian safety within the CBD. Investigate measures to reduce traffic within the CBD particularly through traffic on Buller Street – William Street.

4.3 Localised Urban Works

The traffic modelling undertaken for the project involved testing major road network upgrades. Localised urban improvements such as intersection upgrades are beyond the strategic nature of the model but have been identified through site inspections, review of available data and analysis. Recommended localised works are listed in the following tables.

Table 8 Localised Urban Works – Port Macquarie

Treatment	Description	Action
Bay Street / Bellbowrie Street intersection upgrade (channelisation)	Upgrade would improve safety and efficiency for turning traffic. Roundabout could also be considered to reduce speeds on Bay Street	Undertake concept design
Bay Street / Newport Island Road intersection upgrade (channelisation)	Upgrade would improve safety and efficiency for turning traffic. Roundabout could also be considered to reduce speeds on Newport Island Road	Undertake concept design
Bay Street / Warlters Street / Aston Street intersection upgrade (roundabout)	New intersection would improve access to the Settlement City area	Progress planning for new road connection including property ownership investigation
Buller Street / Hollingworth Street intersection upgrade (traffic signals)	Buller Street - William Street is one of the two east-west connections to the Port Macquarie CBD, resulting in consistent traffic which makes turns from Hollingworth Street difficult. Upgrade to signals would improve accessibility and safety.	Council has prepared concept design for traffic signals and this should be progressed to detailed design.
Central Road / Hindman Street intersection upgrade (roundabout)	Upgrade to roundabout would improve safety and efficiency for turning traffic, and reduce speeds on Hindman Street	Undertake concept design
Gordon Street / Horton Street intersection upgrade (traffic signals)	Busy roundabout on edge of CBD has high turning volumes. Signalisation would increase capacity, and improve safety for pedestrians.	Council is preparing concept design for traffic signals and this should be progressed to detailed design
Kennedy Drive / Koala Street intersection upgrade (roundabout)	Key junction in centre of large urban area with limited sight distances for some approaches. Upgrade to roundabout would improve safety and efficiency for turning traffic, and reduce speeds on Kennedy Drive	Undertake concept design
Koala Street / Granite Street intersection upgrade (roundabout)	Limited sight distances for some approaches. Upgrade to roundabout would improve safety and efficiency for turning traffic, and reduce speeds on Koala Street	Undertake concept design
Lake Road / Hill Street intersection upgrade (roundabout)	Limited sight distances for some approaches. Upgrade to roundabout would improve safety and efficiency for turning traffic, and reduce speeds on Lake Road	Undertake concept design
Pacific Drive / Bangalay Drive intersection upgrade (roundabout)	Limited sight distances for some approaches. Upgrade to roundabout would improve safety and efficiency for turning traffic, and reduce speeds on Pacific Drive	Undertake concept design
Pacific Drive / Hill Street intersection upgrade (channelisation)	Upgrade would improve safety and efficiency for turning traffic, and reduce conflicts with through traffic on Pacific Drive	Undertake concept design



Treatment	Description	Action
Pacific Drive / Lighthouse Road intersection upgrade (roundabout)	Upgrade to roundabout would improve safety and efficiency for turning traffic, and reduce speeds on Pacific Drive	Undertake concept design
William Street / Munster Street intersection upgrade (traffic signals)	Port Macquarie CDB periphery location. Upgrade to signals would improve safety and efficiency for turning traffic, and improve pedestrian safety.	Undertake concept design
William Street / Short Street intersection upgrade (traffic signals)	Signalisation to improve pedestrian safety and access	Council has prepared concept design for traffic signals and this should be progressed to detailed design and construction.

Table 9 Localised Urban Works – Wauchope

Treatment	Description	Action
Beechwood Road / Waugh Street (channelisation)	Upgrade would improve safety and efficiency for turning traffic, and reduce conflicts with through traffic on Beechwood Road	Undertake concept design
Beechwood Road corridor	Localised upgrades at key intersections such as Glenview Drive and Yippin Creek Road. Dependent on level of development in the area.	Council is currently undertaking concept design work for the corridor
Oxley Highway / Blackbutt Drive (channelisation)	Upgrade would improve safety and efficiency for turning traffic, with significant heavy vehicle movements, and reduce conflicts with through traffic on Oxley Highway	Undertake concept design
Oxley Highway / Cameron Street intersection upgrade (signalisation)	Busy intersection in the Wauchope CBD, with high volumes of turning traffic. Traffic signals would improve traffic capacity, and provision for pedestrians.	Consider traffic signals as future option

Table 10 Localised Urban Works – Camden Haven

Location	Treatment	Description	Action
Lake Cathie	Ocean Drive / Evans Street (south) intersection upgrade (roundabout)	Upgrade to roundabout would improve safety and efficiency for turning traffic and reduce speeds on Ocean Drive.	Undertake concept design as part of Lake Cathie Foreshore Masterplan
	Ocean Drive / Abel Tasman Drive intersection upgrade (traffic signals)	Signals would improve safety and efficiency for turning traffic, and access to adjacent subdivision.	Current intersection layout makes provision for traffic signals at some point in the future as local development increases
Bonny Hills	Ocean Drive / McGilvray Road intersection upgrade (roundabout)	Upgrade to roundabout would improve safety and efficiency for turning traffic and reduce speeds on Ocean Drive.	Undertake concept design
North Haven	Ocean Drive / Edith Street intersection upgrade (roundabout)	Upgrade to roundabout would improve safety and efficiency for turning traffic and reduce speeds on Ocean Drive. Gateway treatment to North Haven.	Undertake concept design



Location	Treatment	Description	Action
Laurieton	Ocean Drive / Bold Street intersection upgrade (roundabout)	Upgrade to roundabout would improve safety and efficiency for turning traffic and reduce speeds on Ocean Drive.	Monitor operation of current arrangement
	Ocean Drive / Kew Road intersection upgrade (roundabout)	Major intersection and access point to Laurieton. Current priority disadvantages through traffic on Ocean Drive. Upgrade to roundabout would improve safety and efficiency for turning traffic and reduce speeds.	Undertake concept design
Lakewood	Ocean Drive / Sirius Drive intersection upgrade (traffic signals)	Main access to Lakewood town centre and growth area. Signals would provide for high turning traffic and pedestrian access across Ocean Drive.	Undertake concept design
Kendall	Graham Street / Comboyne Street intersection upgrade (channelisation)	Unusual geometry could be reviewed to improve safety and legibility.	Undertake concept design as per Kendall Main Street Plan

Table 11 Localised Urban Works – Pacific Highway

Treatment	Description	Action
Pacific Highway / Houston Mitchell Drive interchange upgrade (grade separation)	Required as increasing volumes on the highway make turns out of Houston Mitchell Drive harder. Grade separation likely to be the most effective treatment and give the best road safety outcome. In the short term a southbound acceleration lane should be added to the Pacific Highway for the left turn movement from Houston Mitchell Drive.	Undertake concept design as part of Pacific Highway post-duplication project
Pacific Highway / Oxley Highway interchange upgrade (various improvements)	Continued traffic growth will increase pressure on this interchange, which will require various upgrades to accommodate turning traffic and maintain safety. Current roundabout configuration prioritises northbound right turn from Pacific Highway over Oxley Highway eastbound through movement, creating delays for the latter. Metering of the northbound off-ramp approach, and/or the westbound Oxley Highway approach, could be considered to create additional gaps for Oxley Highway eastbound traffic in peak periods.	Further microsimulation traffic modelling. Ongoing liaison with RMS



4.4 Rural Road Corridors

A number of key road corridors lie beyond the coverage of the traffic model. Discussion and recommended actions on these corridors are presented below on the basis of site inspections and review of available data.

Table 12 Rural Road Corridors

Location	Discussion	Actions
Comboyne Road	<p>Comboyne Road (Regional Road 7743) forms part of Tourist Drive 8 connecting Port Macquarie, Wauchope, Byabarra, Comboyne, Wingham and Taree. The distance between Oxley Highway and Comboyne is approximately 26 kilometres.</p> <p>The road is sealed between Wauchope and Comboyne with a pavement width of approximately seven metres. The road has edge and centreline markings with overtaking opportunities on the section between Wauchope and Byabarra.</p> <p>Council has recently replaced a number of timber bridges on Comboyne Road which will lead to a safer road environment.</p> <p>South of Byabarra the road climbs steeply to the Comboyne plateau and follows several kilometres of winding alignment. Chain wire fence along the western verge is poorly maintained and may not effectively restrain errant vehicles.</p> <p>The crash history for 2012-2016 indicates 13 crashes on Comboyne Road, mostly resulting in injury. All crashes except one involved a single vehicle leaving the roadway.</p>	<p>Targeted Comboyne Road shoulder widening would improve clearances in constrained locations resulting in road safety benefits.</p> <p>Improvements to the various sections of chain wire fence and guard rail would also have road safety benefits.</p>
Lorne Road	<p>Lorne Road connects Comboyne to Kendall, a distance of 31 kilometres. The road is sealed between Kendall and Lorne, and unsealed between Lorne and just east of Comboyne Road.</p> <p>The unsealed section, approximately 16 km in length, has a formation width that varies between 5 and 5.5 metres where it passes through heavily wooded terrain. The road follows a curving horizontal and vertical alignment. Safe travel speeds are limited to approximately 50 km/h at many locations due to limited sight distance and surface conditions.</p> <p>Current travel times between Comboyne and Port Macquarie are 10 minutes faster via Comboyne Road than via Lorne Road. Sealing of the unsealed section of Lorne Road would need to significantly increase average speeds between Comboyne and Lorne to make this route faster and significantly affect traffic patterns. Sealing would also have safety benefits particularly if the improved road surface attracted more traffic.</p>	<p>Investigate sealing of unsealed section of Lorne Road</p>



Location	Discussion	Actions
Pappinbarra Road	<p>Pappinbarra Road connects Beechwood to Pappinbarra, a distance of 20 kilometres. Traffic volumes are significant near Beechwood but quickly decrease west of Pipeclay Road.</p> <p>The road is sealed from Beechwood and is constructed and maintained to an acceptable standard for its relatively low traffic volume. However, the crash record for Pappinbarra Road, with eight crashes over five years, is disproportionate to the traffic volume although this has been partially addressed by the recent upgrade between Koree Island Road and Pipeclay Road.</p>	<p>Future upgrades of Pappinbarra Road should be targeted to address specific safety issues</p>
Pembroke Road	<p>Pembroke Road connects Beechwood to Telegraph Point and is a key connection to the Rollands Plains area.</p> <p>The road width is generally appropriate for the function of the road. Council has recently replaced two bridges on Pembroke Road leading to a safer road environment.</p> <p>A hazardous location exists midway along the road. This is caused by the close proximity of the Stoney Creek Road intersection, railway bridge and narrow wooden bridge over Stony Creek. A major upgrade at this location would resolve safety issues and improve access for higher vehicles.</p>	<p>Upgrade road in vicinity of railway bridge and Stony Creek to remove safety hazard</p>
Rollands Plains Road	<p>Rollands Plains Road connects Telegraph Point to Rollands Plains, a distance of 17 kilometres, and continues a further 8 kilometres to the village of Upper Rollands Plains.</p> <p>The road width is generally appropriate for the function of the road. Council has undertaken localised road widening works over the last few years which should lead to road safety improvements.</p>	<p>Future upgrades of Rollands Plains Road should be targeted to address specific safety issues</p>
Stoney Creek Road and Redbank Road	<p>Stoney Creek Road connects Pembroke Road to the Oxley Highway, east of Wauchope.</p> <p>North of Redbank Road, Stoney Creek Road is relatively narrow, with no line marking or shoulders. It is unsealed at its northern end near Pembroke Road. The section between Redbank Road and the Oxley Highway is a higher standard, with a centre line, unsealed shoulders and roadside barriers where required. Redbank Road has similar characteristics.</p> <p>The unsealed section of Stoney Creek Road already carries significant traffic volumes. Sealing of this 1 km section would be a logical network upgrade and safety improvement.</p> <p>The Redbank Road bridge over the railway line is on an oblique alignment and would benefit from a new structure with realigned approaches.</p>	<p>Seal unsealed section of Stoney Creek Road (near Pembroke Road).</p> <p>Replace Redbank Road bridge (railways asset) over the railway line on new alignment.</p>



5. Conclusions and Next Steps

The traffic study recognises that strategies for transport need to be considered within a holistic context where transport is inherently linked to land use, the built form, air quality, health, energy emissions and social equity.

The recommended road network strategy is a combination of new road links, key corridor upgrades, localised works and rural road improvements to manage the Port Macquarie-Hastings road network for the next 20 years. One of the next key steps is to identify and progress the highest priority actions.

The road network strategy will form the basis of a range of different Council action plans. The recommendations were developed to respond to local issues; however responsibility for implementation extends beyond the local jurisdiction and relies on close interaction with state agencies.

Microsimulation traffic models have not been developed as part of the study but would be a beneficial future task for known hotspots such as Port Macquarie town centre, Oxley Highway corridor and Lake Road corridor. Such models are useful in modelling congested or capacity constrained conditions where traffic demand exceeds available capacity and traffic diverts to seek less congested routes.

Regular monitoring of the network strategy will be undertaken and reported to Council. Monitoring will also help to identify new actions or tasks that may be required to respond to land use changes and to ensure ongoing management of the transport network.

